KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

1. Refer to Kentucky American's response to the Attorney General's First Request for Information ("Attorney General's First Request"), Item 1(a). Explain what each number in parentheses is indicative of, which are contained under certain position titles.

Response:

The number in parentheses noted in the organizational chart reflects the number of employees that ultimately report up to that position.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

2. Refer to Kentucky American's response to the Attorney General's First Request, Item 2(b). Provide Kentucky American's actual number of customers from 2013 – September 2023, using the most updated data.

Response:

Please see below for the actual number of KYAW water customers from 2013 through August 2023. Customer count information for September 2023 is not available at this time.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	121,888	122,034	122,212	122,401	124,401	124,466	124,527	125,311	125,494	125,348	125,291	125,396
2014	125,438	125,396	125,159	125,169	125,143	125,253	125,184	125,950	126,075	126,153	126,074	126,211
2015	126,323	126,457	126,716	126,874	126,905	127,286	127,478	127,680	127,868	127,886	127,943	127,952
2016	127,930	128,072	128,235	128,465	128,709	128,836	128,791	129,068	129,188	129,282	129,208	129,250
2017	129,214	129,249	129,725	130,126	130,335	130,476	130,464	130,641	130,704	130,730	130,671	130,667
2018	130,776	131,281	131,391	131,598	131,677	131,744	131,755	131,942	131,881	131,880	131,883	131,763
2019	132,005	132,302	132,256	132,857	133,020	132,939	133,305	133,492	133,603	133,765	133,652	133,578
2020	133,639	133,704	133,963	134,159	134,369	134,527	134,681	134,862	134,941	134,766	134,961	134,974
2021	134,886	134,768	134,927	135,216	135,540	135,700	135,831	136,138	136,246	136,221	136,212	136,167
2022	136,231	136,293	136,458	136,628	136,831	136,868	136,822	137,101	137,147	137,123	137,100	137,065
2023	137,216	137,309	137,488	137,591	137,817	137,979	137,979	138,331				

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

3. Refer to Kentucky American's response to the Attorney General's First Request, Item 2(d). Provide Kentucky American's total annual water sales for the years 2013 – September 2023, using the most updated data.

Response:

Please see below for the actual KYAW total billed water sales from 2013 through August 2023. Water sales information for September 2023 is not available at this time.

	Water Sales in 000 Gallons											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2013	871,531	878,725	823,480	847,249	869,888	1,117,429	1,026,797	1,104,987	1,071,791	1,024,380	902,775	855,639
2014	1,014,618	907,902	884,784	883,890	893,278	1,070,314	1,152,099	1,085,762	1,094,607	1,104,137	849,046	859,480
2015	945,540	813,036	910,337	957,253	931,132	1,147,238	1,107,417	1,103,570	1,205,151	1,165,993	941,681	892,071
2016	892,895	860,360	874,412	948,821	910,208	1,089,874	1,177,678	1,196,843	1,255,024	1,176,425	1,052,800	964,010
2017	837,851	920,537	813,895	875,560	952,160	1,116,191	1,158,075	1,146,263	1,193,399	1,020,471	958,704	862,330
2018	977,593	862,321	828,984	875,568	921,216	1,139,437	1,099,790	1,123,125	1,148,582	1,033,932	899,950	847,340
2019	894,804	881,852	862,428	732,614	984,519	1,077,805	1,018,052	1,220,664	1,179,594	1,310,216	957,490	880,269
2020	951,796	725,561	879,621	854,561	806,565	932,366	1,250,281	1,223,700	1,168,946	1,034,364	879,749	795,232
2021	934,558	789,727	827,929	899,965	945,965	1,013,959	1,156,956	1,131,012	1,146,704	1,004,756	938,366	876,173
2022	955,380	846,470	821,924	871,864	975,682	1,010,671	1,213,755	1,238,885	1,067,736	1,296,143	916,197	909,921
2023	997,539	899,815	902,039	808,392	967,150	1,219,003	1,068,538	1,250,494				

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

4. Refer to Kentucky American's response to the Attorney General's First Request, Item 3(h).

   a. Confirm that according to the most recent data from the Bureau of Labor Statistics, the average share of premiums paid by the employer for single coverage in private industry is 78%.[1]

   b. Provide the percentage of premiums that Kentucky American pays toward single coverage health insurance for it exempt employees.

   c. Confirm that according to the most recent data from the Bureau of Labor Statistics, the average share of premiums paid by the employer for family coverage in private industry is 67%.[2]

   d. Provide the percentage of premiums that Kentucky American pays toward family coverage health insurance for it exempt employees.

Response:

   a. Per the BLS website[1], the employer share of the premium for the private industry is 78%. It should be noted that the same table shows the employer share of premium for the state and local government employees is 86%. It should also be noted that not all employers are in a union environment in which bargaining plays a critical role in plan design and cost sharing, but American Water is in a union environment. American Water benchmarks against other key segments of the market utilizing Mercer and their survey data. One key subset of data that the company reviews annually is how American Water compares against employers with 500+ employees with at least 65% of their employees in a union. The data for employers share of premium with 500+ employees with at least 65% union is 83%. The BLS data for employer with all union employees and employer with 500+ employees are 81% and 80%, respectively.

   b. Kentucky American currently pays 84% of premiums toward single coverage health insurance for its employees.

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[1] https://www.bls.gov/news.release/archives/ebs2_09222022.htm, Table 3.
[2] https://www.bls.gov/news.release/archives/ebs2_09222022.htm, Table 4.

c. Per the BLS website[2], the employer share of the premium for the private industry is 67%. It should be noted that the same table shows the employer share of premium for the state and local government employees is 71%. It should also be noted that not all employers are in a union environment in which bargaining plays a critical role in plan design and cost sharing, but American Water is in a union environment. American Water benchmarks against other key segments of the market utilizing Mercer and their survey data. One key subset of data that the company reviews annually is how American Water compares against employers with 500+ employees with at least 65% of their employees in a union. The data for employers share of premium with 500+ employees with at least 65% union is 81-82%. The BLS data for employer with all union employees and employer with 500+ employees are 80% and 74%, respectively.

d. Kentucky American currently pays 84% of premiums toward family coverage health insurance for its employees.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

5. Refer to Kentucky American's response to the Attorney General's First Request, Item 4(h).

   a. Provide the percentage of premiums that Kentucky American pays toward single coverage health insurance for it non-union employees.

   b. Provide the percentage of premiums that Kentucky American pays toward family coverage health insurance for it non-union employees.

Response:

Kentucky American currently pays 84% of premiums toward both single and family health insurance for its employees.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

6. Refer to Kentucky American's response to the Attorney General's First Request, Item 5(h).

   a. Provide the percentage of premiums that Kentucky American pays toward single coverage health insurance for it hourly employees.

   b. Provide the percentage of premiums that Kentucky American pays toward family coverage health insurance for it hourly employees.

Response:

Kentucky American currently pays 84% of premiums toward both single and family health insurance for its employees.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

7. Refer to Kentucky American's response to the Attorney General's First Request, Items 6(a), (b), and (c).

   a. Explain how many External Directors are on the Board of Directors. In the response to (a) it states there is one External Director, but in the response to (c) Kentucky American states that it plans on reducing the number of External Directors to two.

   b. Explain whether the Internal Directors also receive an Annual Retainer and a Per Meeting Fee. If not, explain why the Board of Directors' fees for the forecasted test period is $99,023.

   c. Based upon the planned updates to the Annual Retainer and Per Meeting Fee, as well as the removal of the inflationary adjustment, confirm that Kentucky-American's Board of Director forecasted fees should be reduced from $99,023 to $25,000. If not confirmed, explain why not in detail.

   d. Explain in detail the process of how Kentucky American employees are chosen as Internal Directors on the Board of Directors, and if there is a specific time limit on the appointment. Provide a copy of all pertinent documentation.

   e. Explain in detail the process of how an individual is chosen to be an External Director on the Board of Directors, and if there is a specific time limit on the appointment. Provide a copy of all pertinent documentation.

   f. Provide the names/positions/resumes of each current Internal and External Director, along with the date of appointment and the date that the appointment ends.

Response:

   a. When Kentucky American filed its responses to AG's first set of data requests the Company only had one external director on its Board of Directors. In the last six months, the Company reduced the number of external directors from four to two and for a short period had only one of those two external positions filled. Currently, the Company has two external directors that serve on the Kentucky-American Water's Board of Directors.

b. Internal Directors do not receive an Annual Retainer or a per meeting fee. The Board of Directors fee for the forecasted test period was $99,023, because the Company had not approved to decrease the fees of the external directors at the time of filing or to decrease the number of external directors.

c. As stated in the response to AG 1-6(c), the updated forecasted test year total will be $25,000.

d. The Internal Directors on the Board of Directors do not have a specific time limit on their appointment. They are elected and will remain in that position until they resign, are removed, or decease, as per the Company's Articles of Incorporation. Internal Directors are members of Kentucky American's Executive Leadership team, including the President, Vice President of Operations, Director of Finance, Director of Engineering and Director of External Communications.

e. External Directors are chosen based on their ability to fulfill the governance duties of the Board of Directors for Kentucky American Water. When an opening occurs or is anticipated, the Company compiles a list of possible candidates for these positions based on consultation with internal and external advisors, such as existing Board members, and reviews talents and interest in service. The Company extends the invitation and if accepted, the current directors on the board will then vote to approve the election of the new director. Each director has an annual agreement that is reviewed and can be renewed for the next year.

f. External Directors:
Dave Adkisson: Retired as the chief operating officer of the Kentucky Chamber of Commerce, Frankfort, KY – appointed May 23, 2019
Warren Rogers: Retired as the chief operating officer of W. Rogers Co., Lexington, KY – appointed September 6, 2023

Internal Directors:
Kathryn Nash, President of Kentucky-American Water – appointed May 17, 2022
William Andy Lewis, Vice President of Operation – appointed November 22, 2022
Shelley Porter, Director of Engineering – appointed September 6, 2023
Rebecca Broaddus, Director of Finance – appointed June 26, 2022
Susan Lancho, Sr. Manager of External Affairs and Government Affairs – appointed September 6, 2023

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

8. Refer to Kentucky American's response to the Attorney General's First Request, Item 7. The Company asserts that there is no Supplemental Executive Retirement Plan ("SERP") costs included in the test year operating and maintenance ("O&M") expenses.

   a. Explain in detail whether SERP is provided to Kentucky American employees, or any employees whose costs are allocated to the Company. If so, provide a detailed explanation of the offered SERP benefits. Provide all pertinent documentation.

   b. Explain in detail whether SERP is provided to any employees whose costs are allocated to the Company. If so, provide a detailed explanation of the offered SERP benefits. Provide all pertinent documentation.

Response:

Objection. As stated in response to AG 1-7, there are no SERP costs included in the test year in this case. This means that cost recovery of those expenses is not being requested. Therefore, this request seeks information not relevant to this proceeding.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Robert Mustich

9. Refer to Kentucky American's response to the Attorney General's First Request, Item 8. Confirm that no formal study was conducted to specifically compare Kentucky American's wage and benefit information to the local wage and benefit information, including non-utility companies, for the geographic area in which Kentucky American operates.

Response:

Willis Towers Watson performed a comprehensive total remuneration study (compensation and benefits). Both utility and general industry data was referenced on a Midwest regional level, which includes Kentucky and provides a robust analysis of the competitive market for talent. The regional data analysis included Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Missouri, Nebraska, Ohio, Oklahoma, Tennessee, Wisconsin, and West Virginia. The outcome of this comprehensive study showed that Kentucky American's total remuneration was 11% below the competitive market median of this regional perspective. When looking at cost of labor differentials, Kentucky has a similar cost of labor to the overall regional average. Using a broader dataset gave WTW the ability to capture over 60% of Kentucky American's employee population. I also comment on the national perspective in my testimony to recognize senior level and hard to fill roles can also be recruited on a national basis. Kentucky American was below the median competitive market range from both perspectives.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

10. Refer to Kentucky American's response to the Attorney General's First Request, Item 10. If a position becomes vacant throughout the pendency of this case, consider this an ongoing request.

Response:

Please see confidential attachment for Kentucky American's current vacant positions as of 9/21/2023. The Company will provide an update, if there is one, when rebuttal testimony is due on November 8, 2023.

Kentucky-American Water
AGDR2_NUM010

Position	Salaries & Wages	Labor Related	Date Created	Date Vacated	Necessity	Estimated Hiring Timeline
Crew Leader	[redacted]		3/2/2022	6/22/2023	To meet regulatory requirements and meet customer needs	Plan to promote existing Utility from Field Ops into crew leader position.
Maint Service Specialist			6/17/2019	3/19/2023	To meet regulatory requirements and meet customer needs	Q4 – position to be posted
Maintenance Technician II			6/17/2019	7/24/2023	To meet regulatory requirements and meet customer needs	Q4 – position to be posted
Treatment Plt. Operator			1/24/2021	8/21/2023	To meet regulatory requirements and meet customer needs	Q4 – position to be posted
Sr Mgr Business Dev			7/28/2022	9/2/2023	Expansion of customer base to leverage economies of scale and provide water and wastewater solution options to communities in Kentucky.	Q4 – position to be posted
Operations Specialist			6/17/2019	7/1/2023	Position is under review	Position is under review
GIS Analyst			12/2/2022	7/29/2023	To meet regulatory requirements and meet customer needs	Position is under review

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

11. Refer to Kentucky American's response to the Attorney General's First Request, Item 13. As originally requested, provide copies of the J.D. Power Customer Satisfaction Study for 2022 and 2023, which includes either American Water Works Company, Inc. ("American Water") and/or Kentucky American.

Response:

Please see KAW_R_AGDR2_NUM011_092123_Attachment.

J.D. POWER

Press Release

Inflation Turns Water into Whine: Customer Satisfaction with Water Utilities Plunges as Rates Surge, J.D. Power Finds

Average Monthly Bill Rises $5.73 during Past Two Years

TROY, Mich.: 4 May 2022 — The six-year streak of improving or flat customer satisfaction with residential water utilities has come to an end. According to the J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study,[SM] released today, the past several years of goodwill earned through investment in water quality, proactive customer communications and digital customer service channels have been washed away by a significant increase in monthly bills.

"The timing couldn't be worse," said **Andrew Heath, senior director of utilities intelligence at J.D. Power**. "The rate relief efforts put in place during the pandemic have come to an end just as the forces of inflation have driven a significant increase in the monthly bills of residential customers. Customer satisfaction has declined in every factor of the study, as the average monthly water utility bill in the U.S. is now up $5.73 from 2020—without a corresponding increase in consumption. Utilities looking to combat this negative sentiment really need to get serious about proactive customer communications and customer service."

Following are key findings of the 2022 study:

- **Customer satisfaction goes down the drain as prices rise:** Overall customer satisfaction with residential water utilities is 731 (on a 1,000-point scale), down 6 points from last year's study and ending six consecutive years of improving or flat satisfaction levels. The decline coincides with a $5.73 increase in the average monthly bill amount vs. 2020. Importantly, that cost increase does not correspond with a significant increase in water usage that was seen in 2021 when a largely home-bound customer population was consuming more water than ever.

- **Declines observed in every factor:** While customer satisfaction scores decline in every factor of the study this year, the declines are most pronounced in the areas of communications and price. Notably, among those customers who receive a bill, 35% say they recall hearing about a rate increase by their water utility.

- **Digital communications and customer service more important than ever:** Overall satisfaction scores are highest (794) when customers recall receiving a proactive electronic communication from their water utility. Likewise, the number of customers using digital channels to access customer service increases 43% from 2019 and customer satisfaction is highest when interacting with customer service digitally.

Study Rankings

The study measures customer satisfaction with water utilities in eight geographic regions. Highest-ranked utilities and scores, by region, are as follows:

- Midwest Large: **Illinois American Water** (773) (for a third consecutive year)
- Midwest Midsize: **Aqua** (758)
- Northeast Large: **NYC Environmental Protection** (763)
- Northeast Midsize: **Boston Water and Sewer Commission** (762)

- South Large: **Miami-Dade County** (766)
- South Midsize: **Orange County Utilities** (794)
- West Large: **Seattle Public Utilities** (766) (for a third consecutive year)
- West Midsize: **Irvine Ranch Water District** (771)

The U.S. Water Utility Residential Customer Satisfaction Study, now in its seventh year, measures satisfaction among residential customers of 90 water utilities that deliver water to at least 400,000 customers and is reported in four geographic regions and two size categories: Midwest Large, Midwest Midsize, Northeast Large, Northeast Midsize, South Large, South Midsize, West Large and West Midsize. Overall satisfaction is measured by examining 33 attributes in six factors (listed in order of importance): quality and reliability; price; conservation; billing and payment; communications; and customer service. The study is based on the responses of 33,054 residential water utility customers and was conducted in four waves from June 2021 through March 2022.

For more information about the U.S. Water Utility Residential Customer Satisfaction Study, visit https://www.jdpower.com/business/utilities/water-utility-residential-customer-satisfaction-study.

See the online press release at http://www.jdpower.com/pr-id/2022050.

About J.D. Power
J.D. Power is a global leader in consumer insights, advisory services and data and analytics. A pioneer in the use of big data, artificial intelligence (AI) and algorithmic modeling capabilities to understand consumer behavior, J.D. Power has been delivering incisive industry intelligence on customer interactions with brands and products for more than 50 years. The world's leading businesses across major industries rely on J.D. Power to guide their customer-facing strategies.

J.D. Power has offices in North America, Europe and Asia Pacific. To learn more about the company's business offerings, visit JDPower.com/business. The J.D. Power auto shopping tool can be found at JDPower.com.

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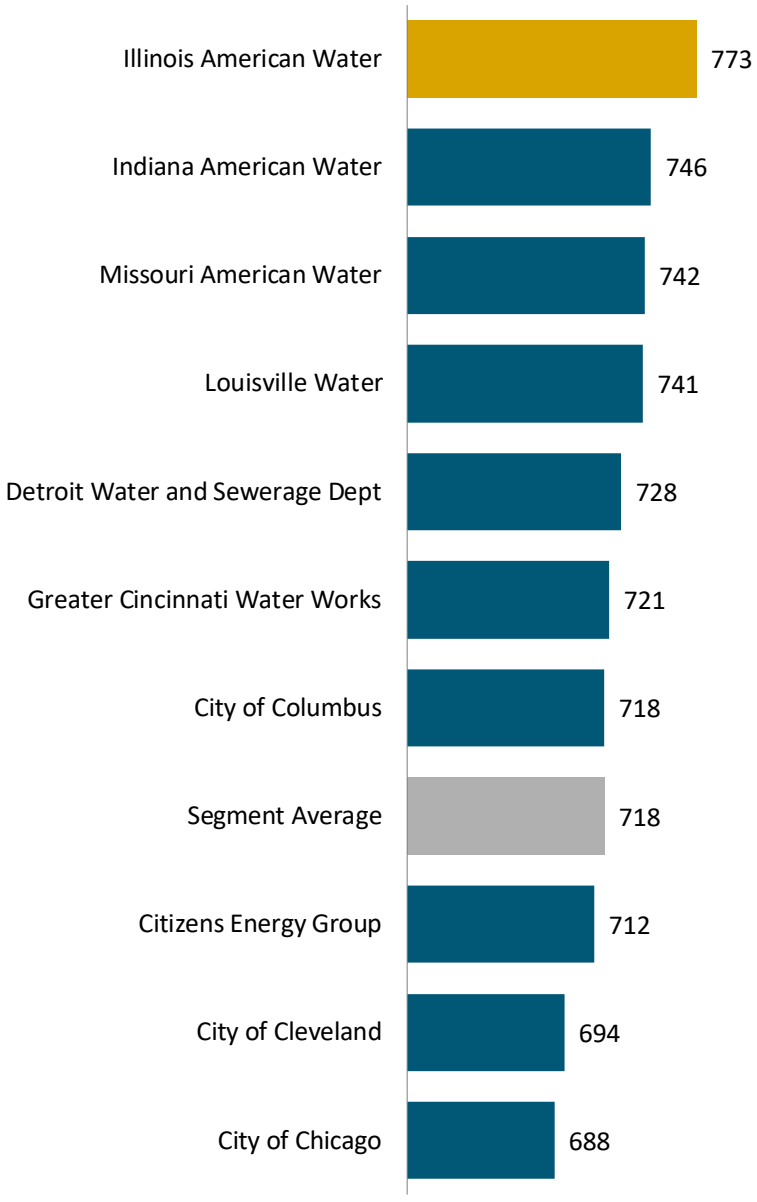
# # #
NOTE: Eight charts follow.

J.D. Power
2022 U.S. Water Utility Residential Customer Satisfaction Study[SM]

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

Midwest — Large



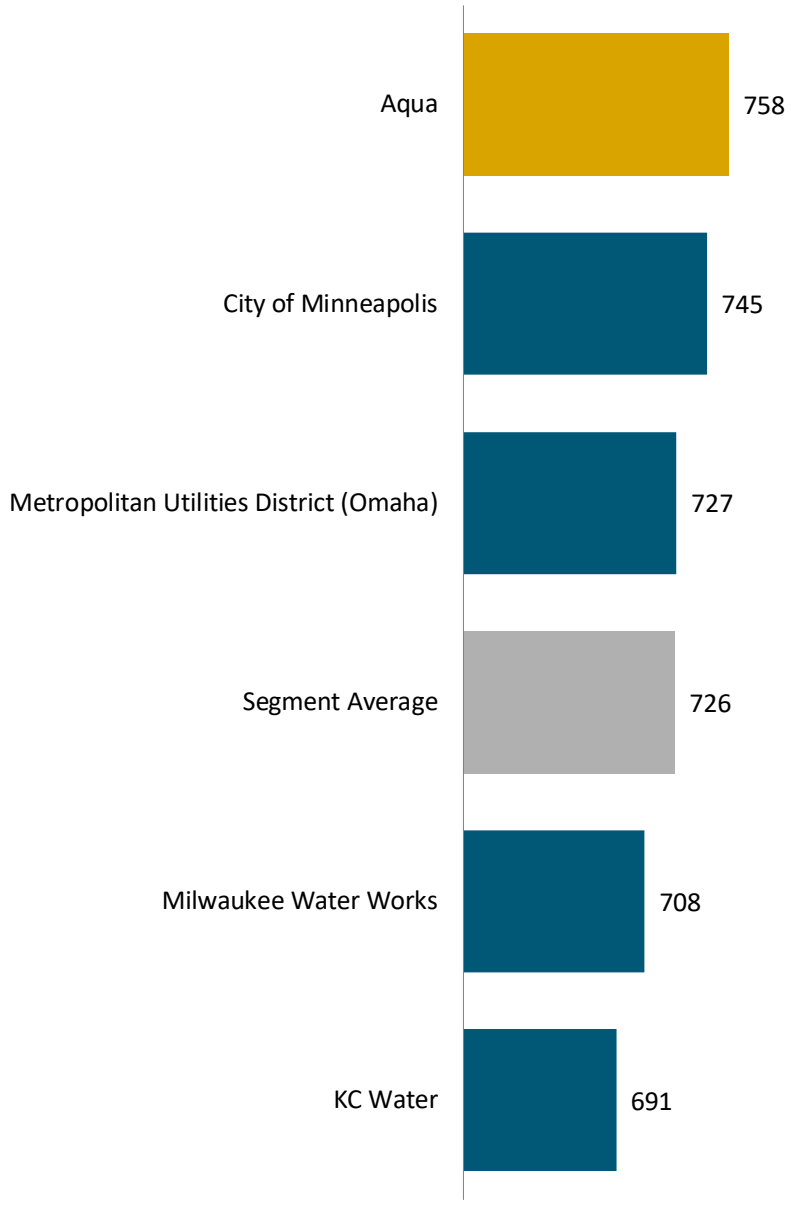
Source: J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study[SM]

J.D. Power
2022 U.S. Water Utility Residential Customer Satisfaction Study[SM]

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

Midwest — Midsize



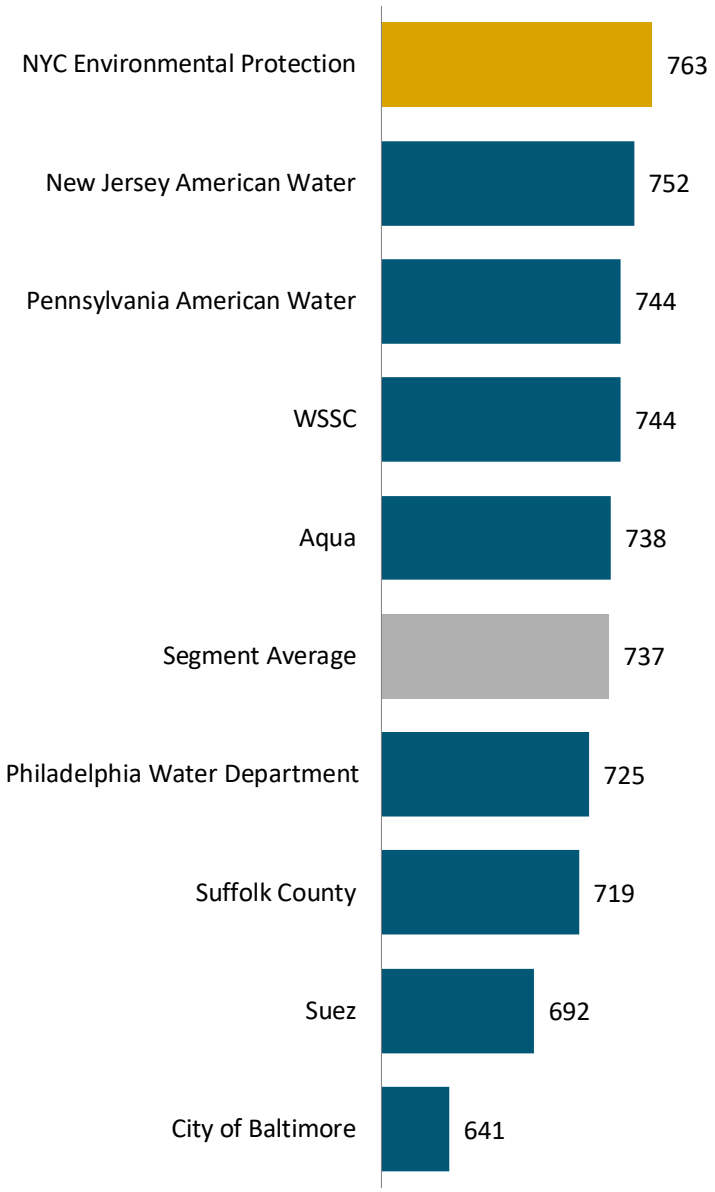
Source: J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study[SM]

J.D. Power
2022 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

Northeast — Large



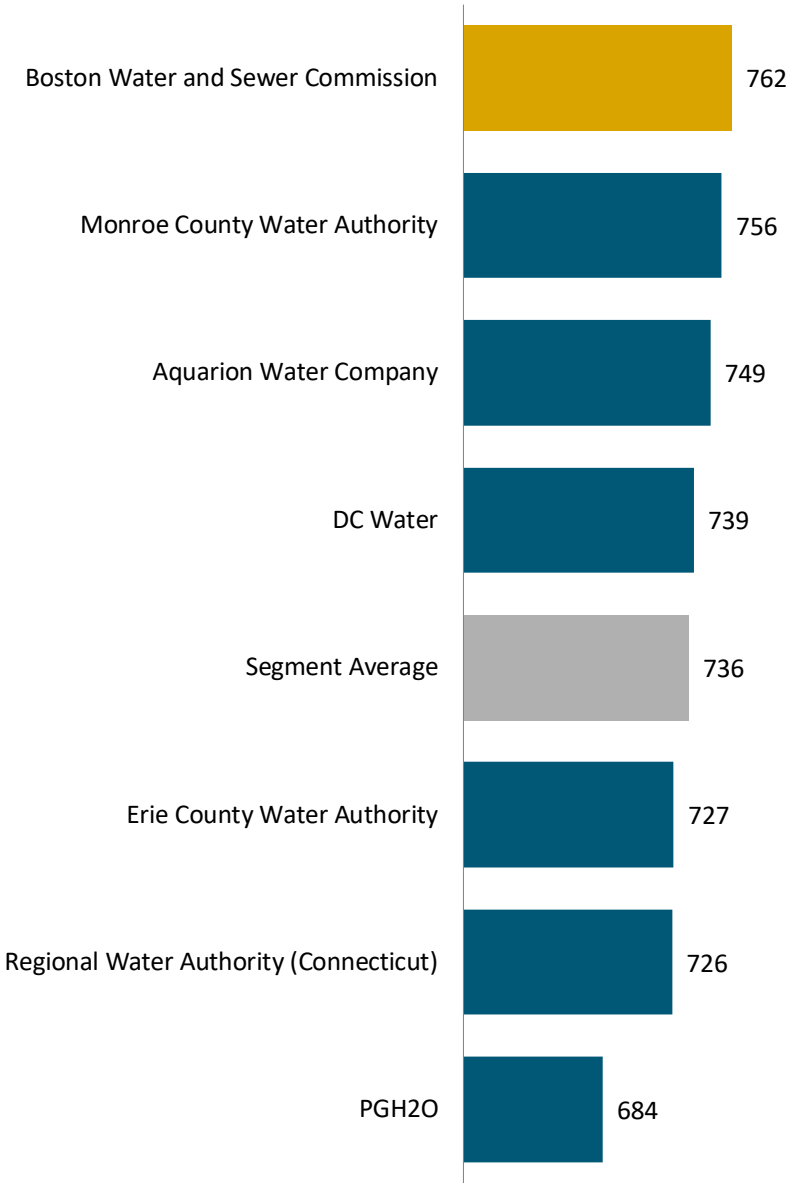
Source: J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2022 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

Northeast — Midsize



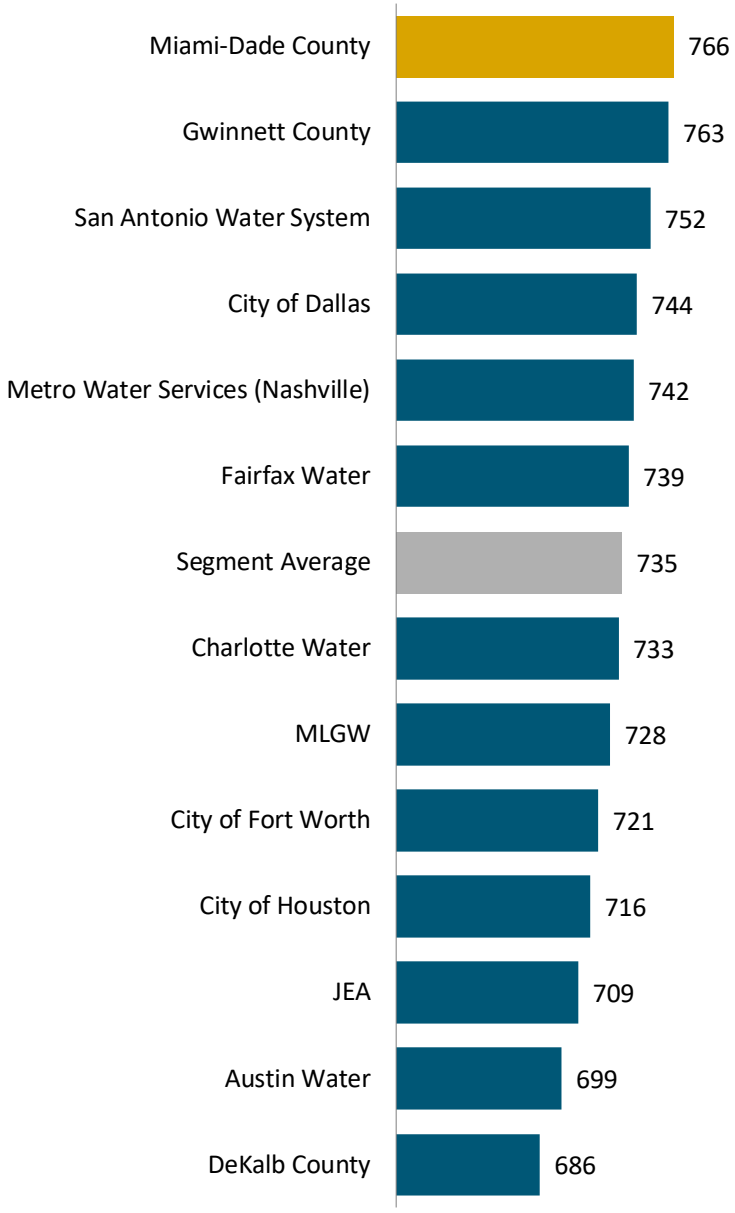
Source: J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2022 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

South — Large



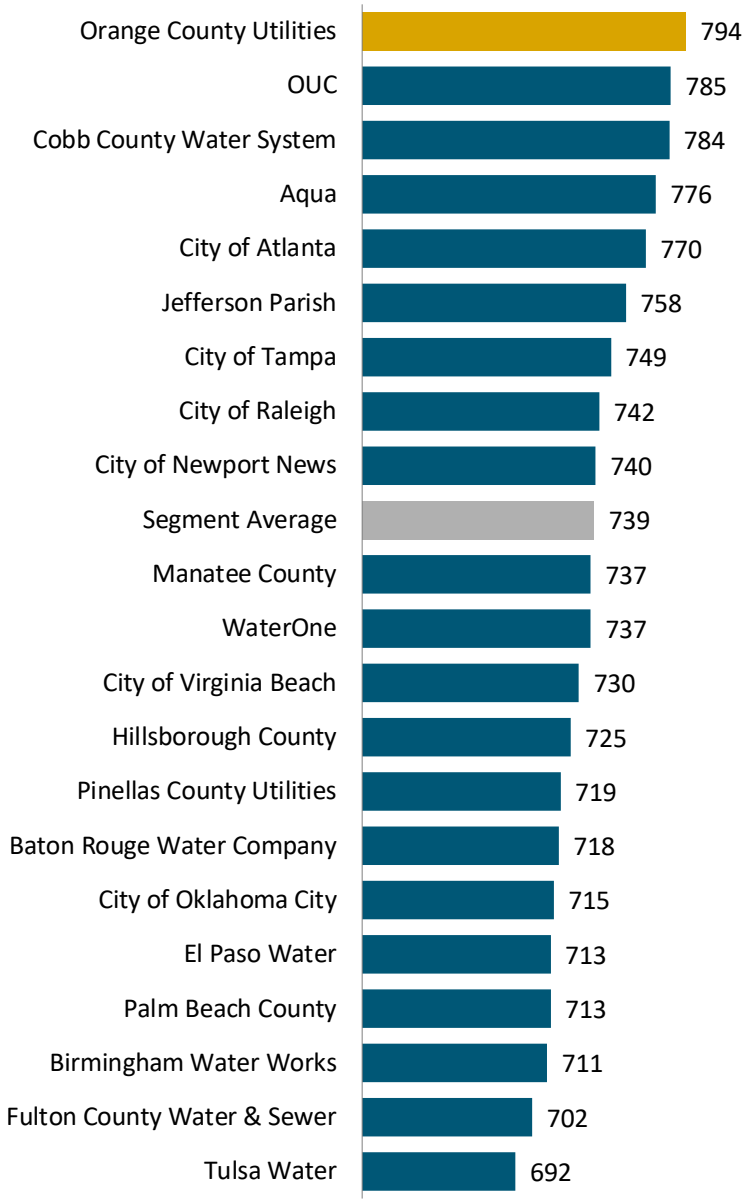
Source: J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2022 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

South — Midsize



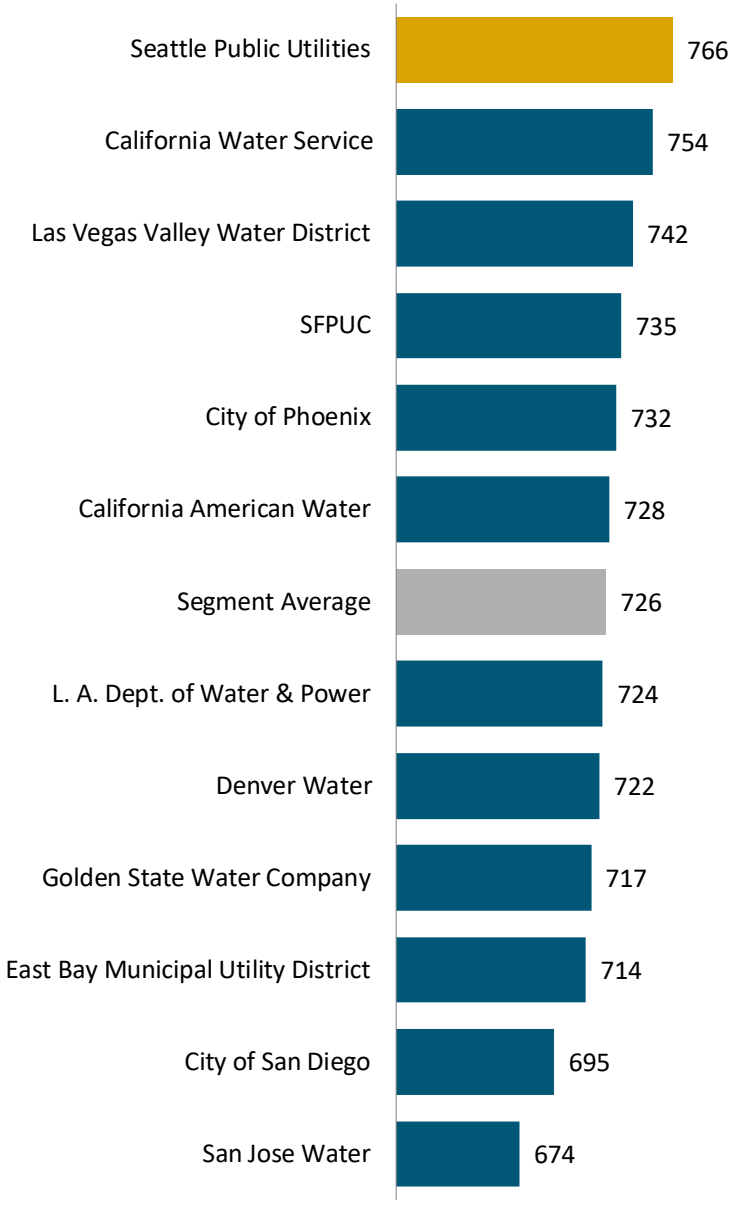
Source: J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2022 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

West — Large



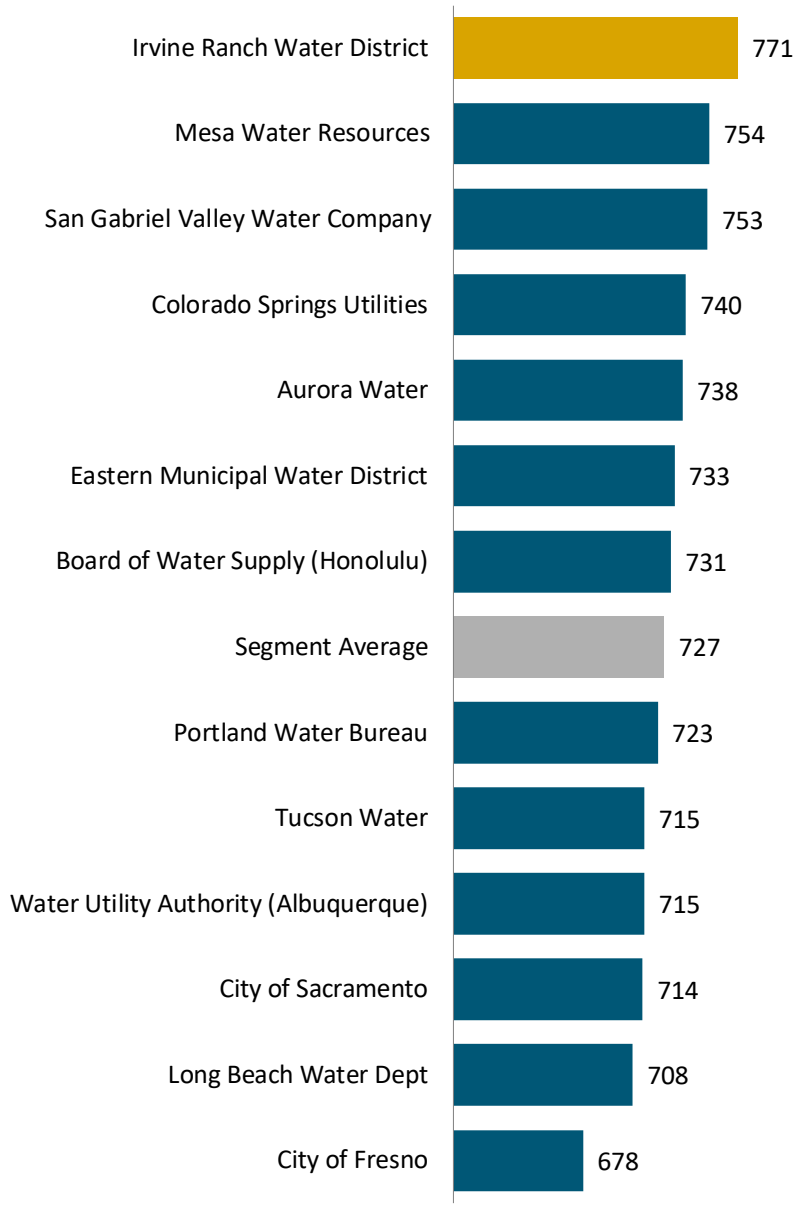
Source: J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2022 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

West — Midsize



Source: J.D. Power 2022 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. POWER

Press Release

Water Utilities Counteract Negative Effects of Inflation with Strong Customer Communication Strategies, J.D. Power Finds

Overall Customer Satisfaction Rises Despite a 6% Average Price Increase

TROY, Mich.: 3 May 2023 — Significant increases in monthly utility bills are not typically met with open arms by consumers, but the nation's water utilities have shown that it is possible to improve customer satisfaction in a rising rate environment with strong communications strategies. According to the J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study,[SM] released today, overall customer satisfaction with residential water utilities is up 3 points (on a 1,000-point scale), even as average monthly bills have increased 6% during the past year. This runs counter to the trend of declining customer satisfaction occurring among gas and electric utilities.

"With monthly rates continuing to rise and the water supply running dangerously low in many parts of the country, there has never been a more critical time for water utilities to proactively communicate with their customers about what they are doing to protect our drinking water today and into the future," said **Andrew Heath, senior director of utilities intelligence at J.D. Power**. "Many water utilities have heard that message loud and clear and are now setting the standard for effective customer outreach and communication. Along the way, they are also managing to buck the trend of declining customer satisfaction that we have seen in other utilities in this inflationary environment."

Following are key findings of the 2023 study:

- **Customer satisfaction rises with price increases:** Overall customer satisfaction with residential water utilities is 734, up 3 points from last year's study. The improvement comes despite a $5.80 (6%) increase in the average monthly bill amount vs. 2022. Water usage has been roughly flat compared with last year.

- **Communications and customer service drive customer satisfaction:** This year's increase in customer satisfaction is driven largely by improvements in communications, which have risen 7 points vs. last year, and customer service, which has increased 6 points vs. last year. The communications factor continues to show improvement across each wave of the study, suggesting that utilities are proactively reaching out to customers throughout the year to provide updates on pricing, safety and supply issues.

- **Fragility of the underlying resource in the spotlight:** Even as dangerously low water levels in the Colorado River system have spurred the federal government to propose cutting water allotments in several states, 44% of utility customers perceive their utility is properly ensuring the future water supply. That sentiment is consistent across states supplied by the Colorado River as well as in those that are not.

Study Rankings

The study measures customer satisfaction with water utilities in eight geographic regions. Highest-ranked utilities and scores, by region, are as follows:

- Midwest Large: **Illinois American Water** (781) (for a fourth consecutive year)

- Midwest Midsize: **Aqua** (752) (for a second consecutive year)
- Northeast Large: **NYC Environmental Protection** (784) (for a second consecutive year)
- Northeast Midsize: **Boston Water and Sewer Commission** (761) (for a second consecutive year)
- South Large: **Miami-Dade County** (786) (for a second consecutive year)
- South Midsize: **Cobb County Water System** (791)
- West Large: **California Water Service** (797)
- West Midsize: **Irvine Ranch Water District** (766) (for a second consecutive year)

The U.S. Water Utility Residential Customer Satisfaction Study, now in its eighth year, measures satisfaction among residential customers of 92 water utilities that deliver water to populations of at least 400,000 and is reported in four geographic regions and two size categories: Midwest Large; Midwest Midsize; Northeast Large; Northeast Midsize; South Large; South Midsize; West Large; and West Midsize. Overall satisfaction is measured by examining 33 attributes in six factors (listed in order of importance): quality and reliability; price; conservation; billing and payment; communications; and customer service. The study is based on the responses of 36,833 residential water utility customers and was conducted in four waves from June 2022 through March 2023.

For more information about the U.S. Water Utility Residential Customer Satisfaction Study, visit https://www.jdpower.com/business/utilities/water-utility-residential-customer-satisfaction-study.

See the online press release at http://www.jdpower.com/pr-id/2023040.

About J.D. Power
J.D. Power is a global leader in consumer insights, advisory services and data and analytics. A pioneer in the use of big data, artificial intelligence (AI) and algorithmic modeling capabilities to understand consumer behavior, J.D. Power has been delivering incisive industry intelligence on customer interactions with brands and products for more than 50 years. The world's leading businesses across major industries rely on J.D. Power to guide their customer-facing strategies.

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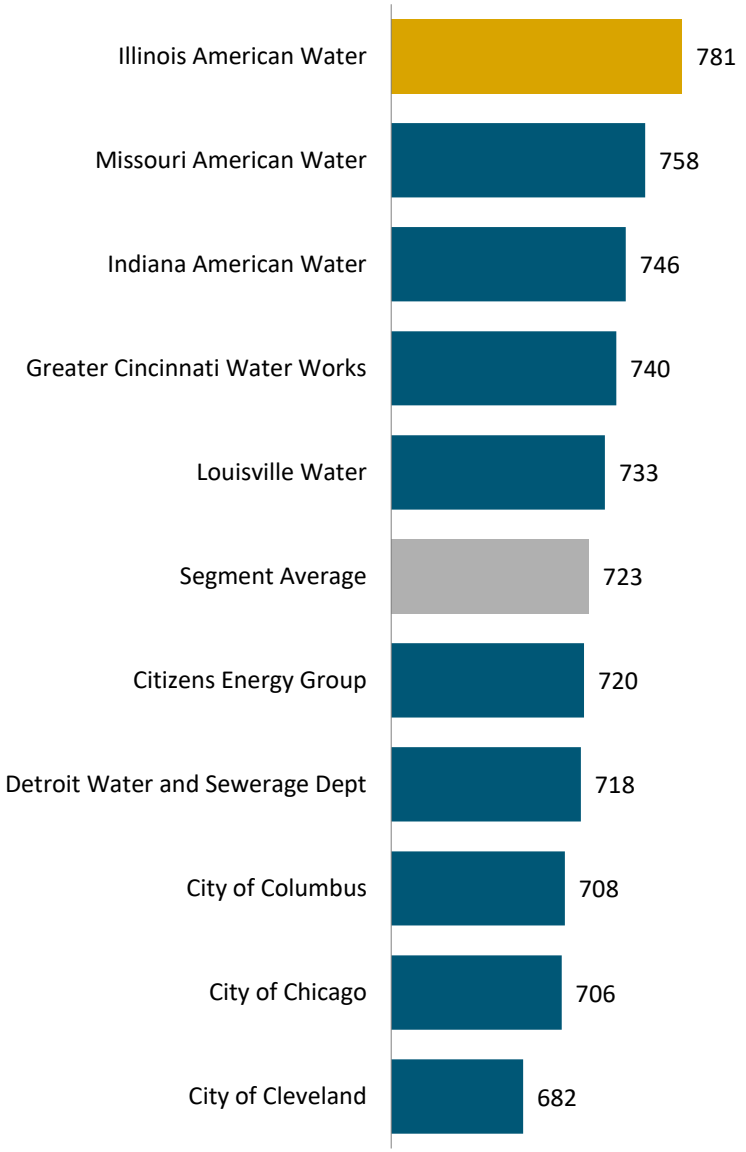
# # #
Note: Eight charts follow.

J.D. Power
2023 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

Midwest — Large



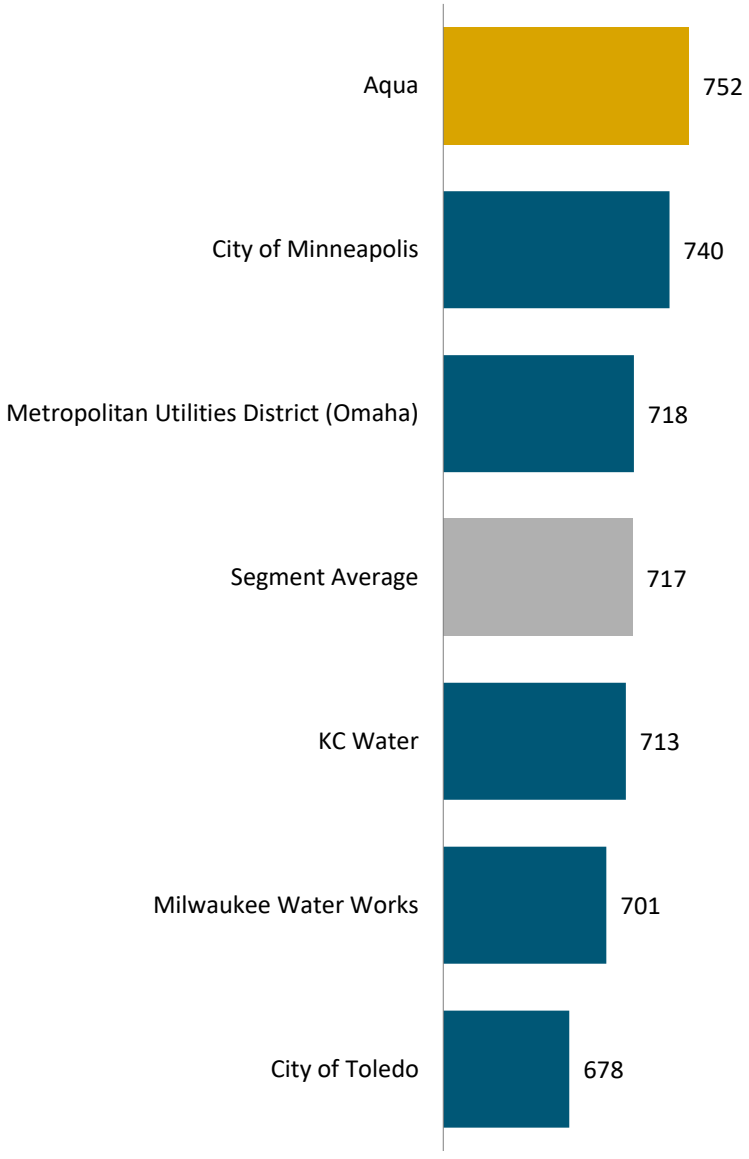
Source: J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2023 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

Midwest — Midsize



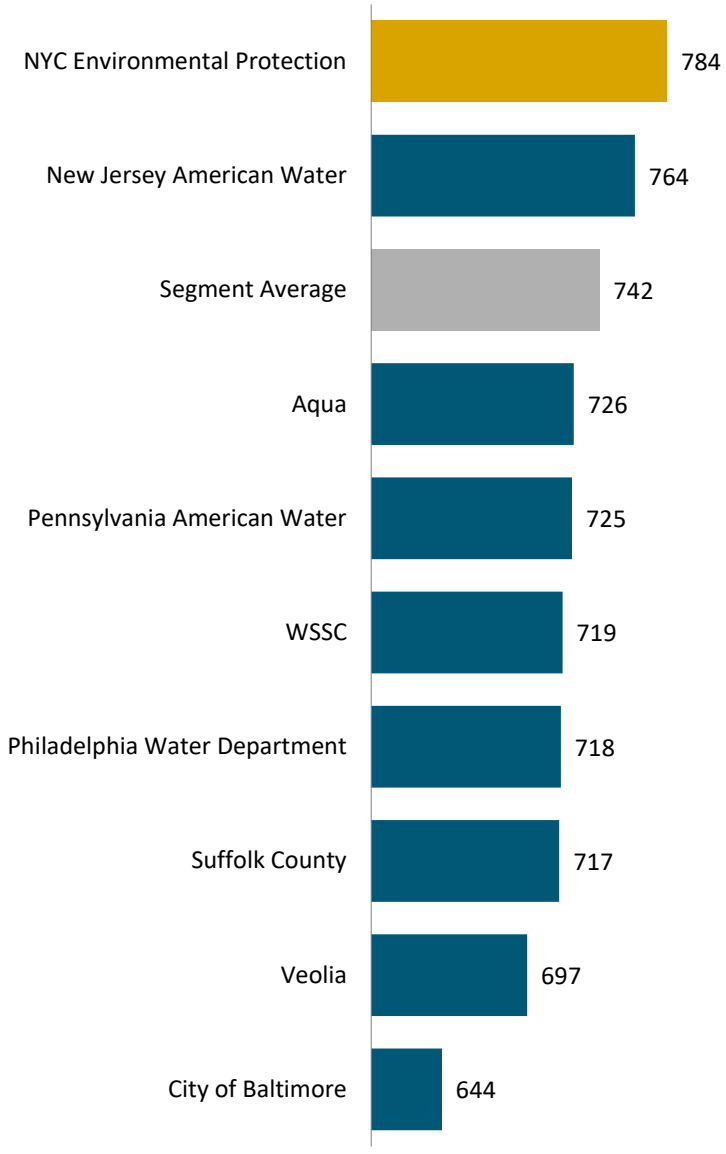
Source: J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2023 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

Northeast — Large



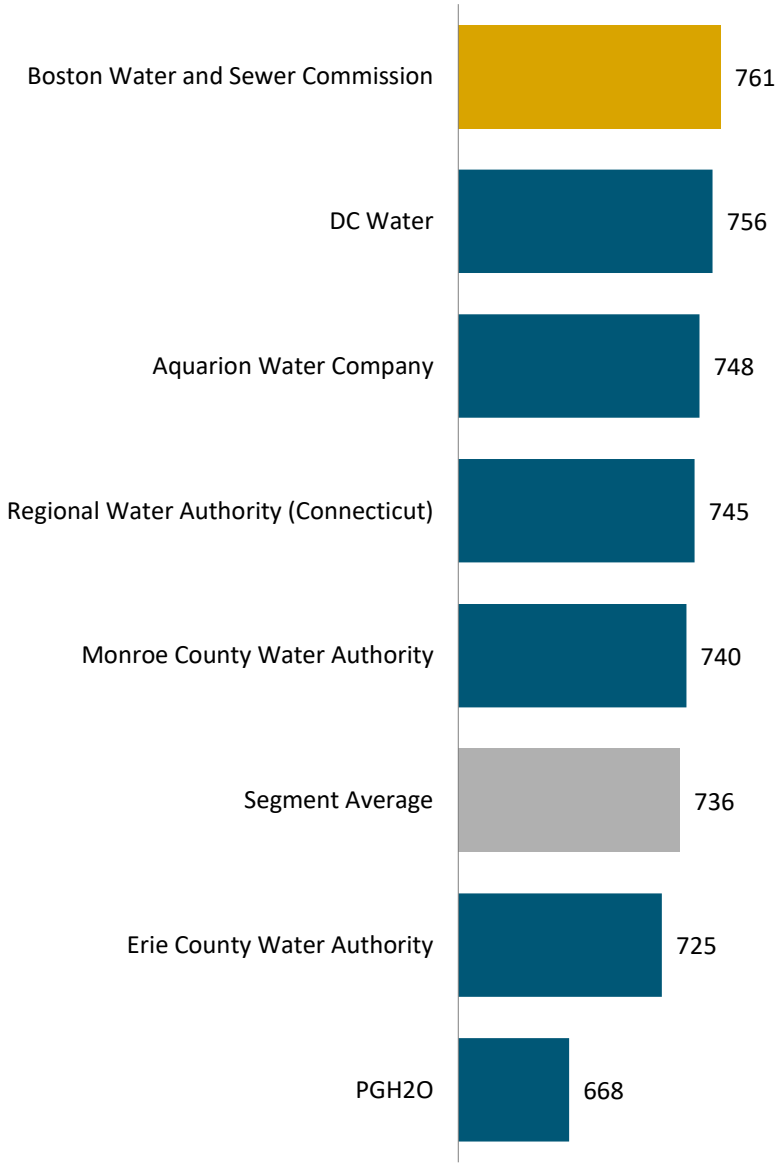
Source: J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2023 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

Northeast — Midsize



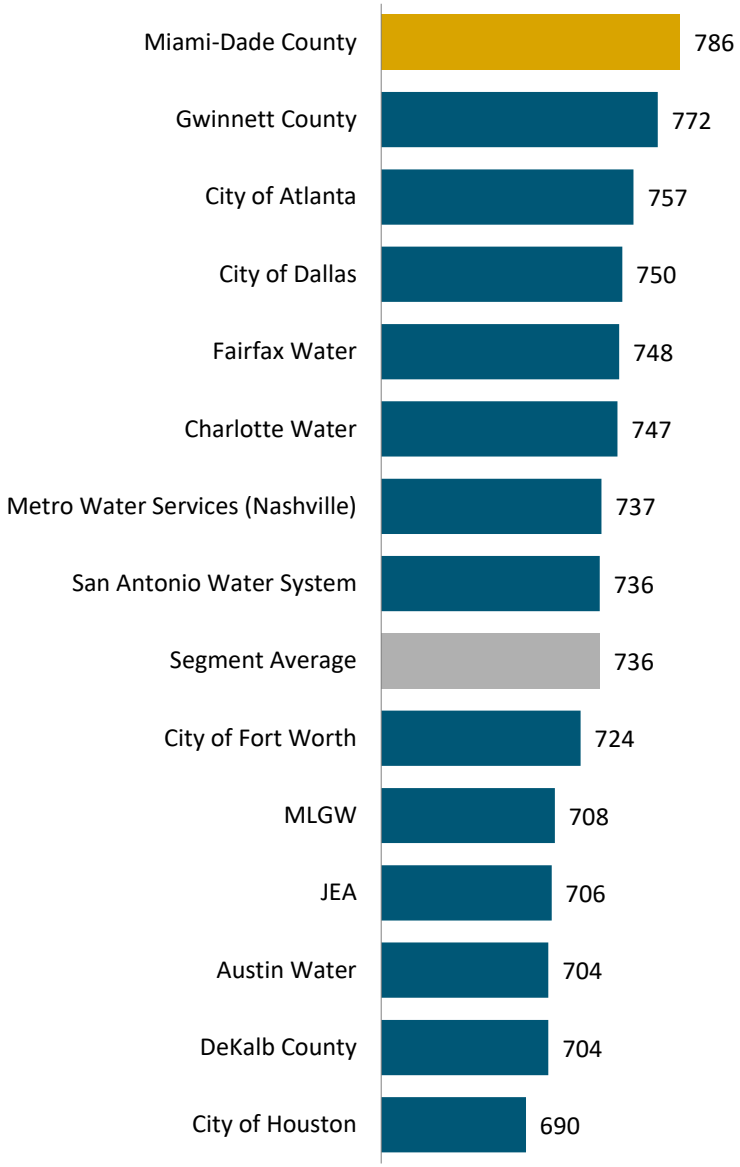
Source: J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2023 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

South — Large



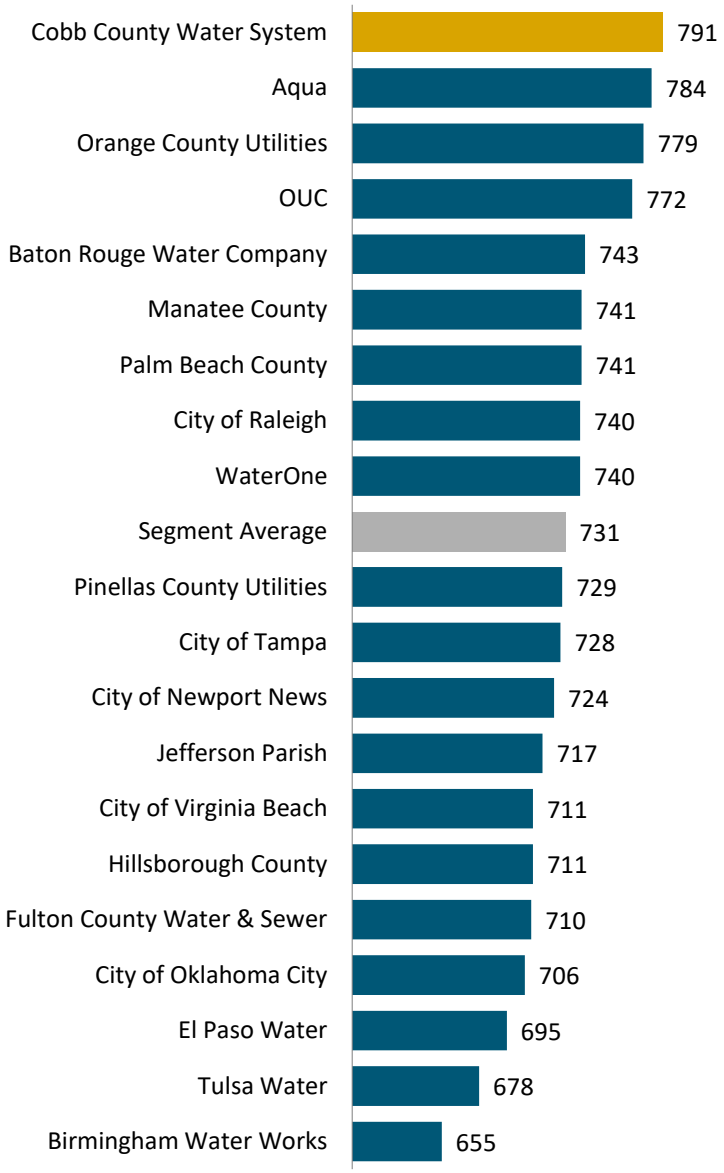
Source: J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2023 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

South — Midsize



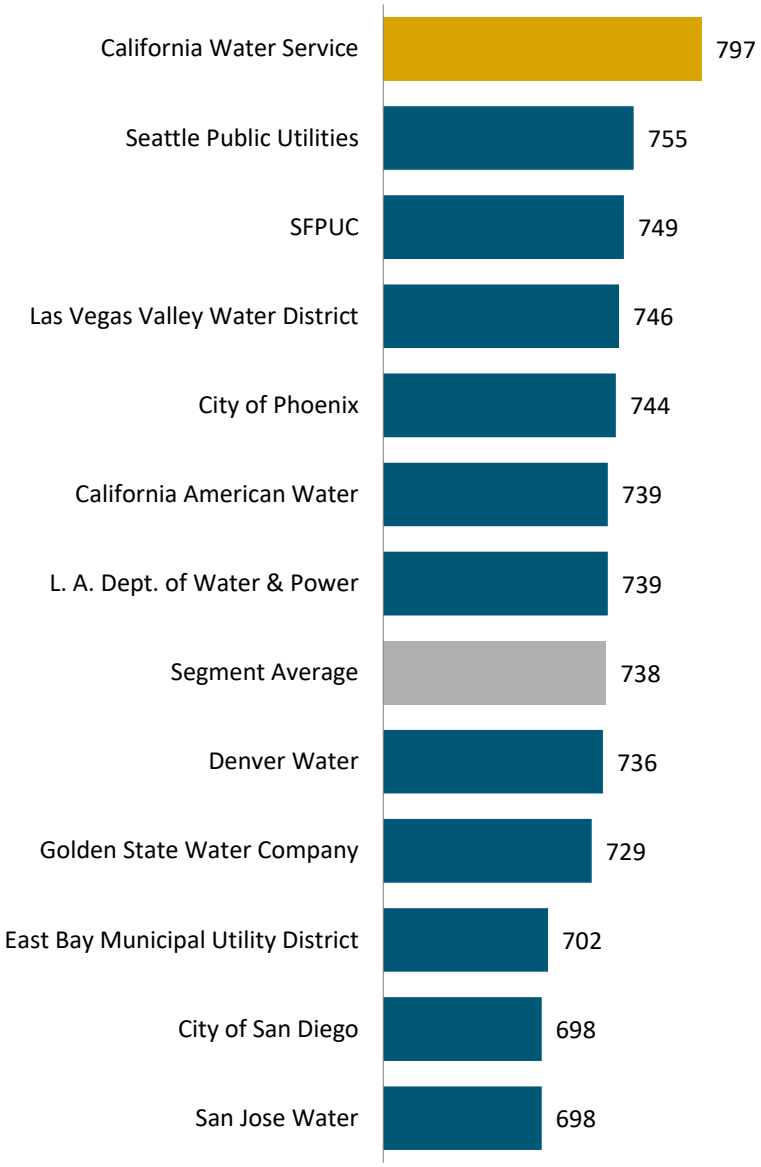
Source: J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study℠

J.D. Power
2023 U.S. Water Utility Residential Customer Satisfaction Study[SM]

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

West — Large



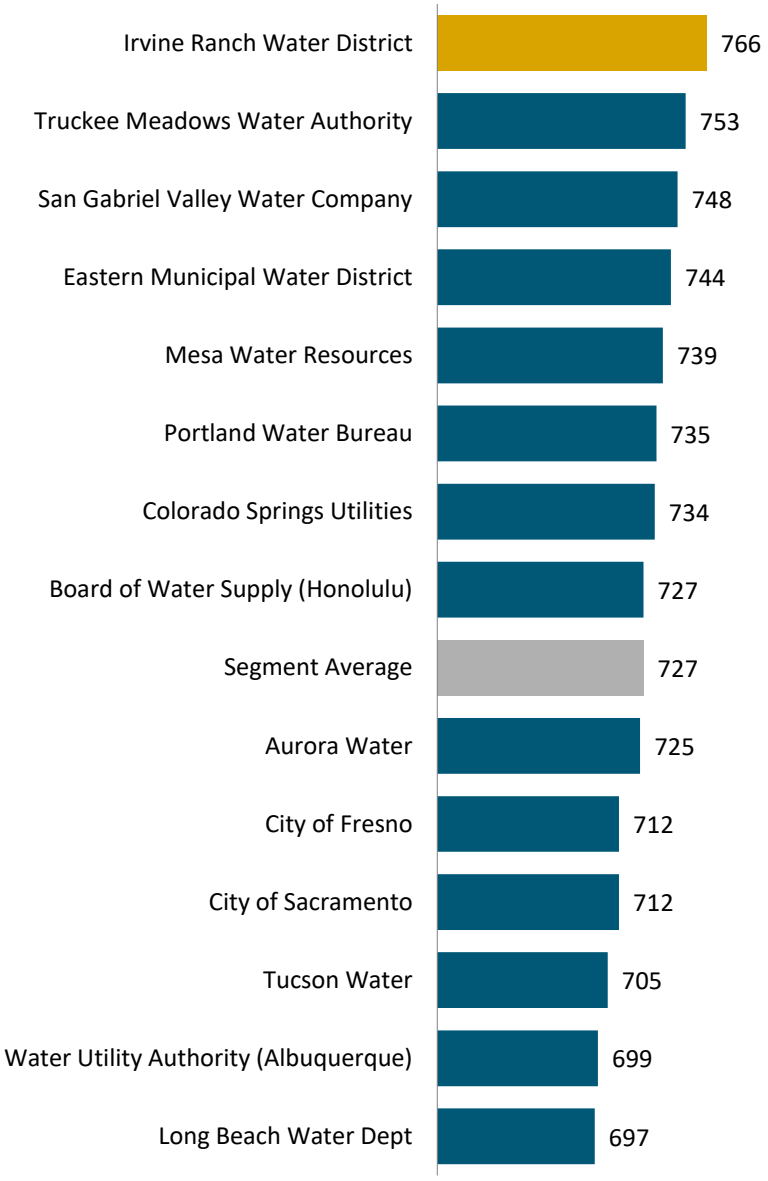
Source: J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study[SM]

J.D. Power
2023 U.S. Water Utility Residential Customer Satisfaction Study℠

Overall Customer Satisfaction Index Ranking

(Based on a 1,000-point scale)

West — Midsize



Source: J.D. Power 2023 U.S. Water Utility Residential Customer Satisfaction Study℠

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

12. Refer to Kentucky American's response to the Attorney General's First Request, Item 15.

    a. Explain what is meant by Service Company referral bonuses.

    b. Explain what is meant by Service Company contract services-outplacements.

Response:

a. American Water offers an employee referral program that awards referral bonuses under defined circumstances to current employees who referred a qualified candidate who has been selected to fill a vacant position within the company.

b. Service Company contract services-outplacements refers to temporary or contingent staff that are not direct employees of American Water Works Service Company, Inc.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

13. Refer to Kentucky American's response to the Attorney General's First Request, Item 17. The Attorney General requested for the Company to provide a list that identifies all miscellaneous costs for the test year, including but not limited to dinners (including all holiday dinners), gifts, donations, membership dues, annual meeting costs, etc. For each cost indicate whether it was removed from or included in the requested revenue requirement. Kentucky American responded by stating that it, "did not forecast the miscellaneous costs at a detail transaction level for the test year. Please see KAW_R_AGDR1_NUM017_081823_Attachment 1 for a listing of transaction details for the actual period of 01/01/2022 through 12/31/2022, which was the basis for the forecasted test year. Charitable Contributions were removed and Inventory Physical Write-off Scrap was normalized before applying inflation factor to calculate the forecasted test year."

    a. If Kentucky American did not forecast the miscellaneous costs at a detailed transaction level for the test year then explain how a determination can be made as to whether costs that are normally excluded for ratemaking purposes have been included in the proposed revenue requirement.

    b. Explain how the inclusion of dinners (including all holiday dinners), gifts, donations, membership dues, and annual meeting costs complies with Commission precedent.[3]

    c. Refer to KAW_R_AGDR1_NUM017_081823_Attachment 1, and provide a detailed list of what type of expense could fall under each type of "Name of offsetting account." For example, explain what type of expense would fall under Employee Expense, Labor Natural Account, Customer Education, Community Relations, Regulatory Exp- Amortization, Co Dues/Membership Dues, Low Income Pay Program, etc.

Response:

    a. As part of the forecasting in the rate case, Kentucky-American reviewed and analyzed the actuals for miscellaneous expenses in order to make a determination of costs to be included or excluded for ratemaking purposes. For example, miscellaneous expenses fall into certain categories, such as Charitable Contributions, which allows the Company to determine what to include and what

[3] Case No. 2003-00433, *An Adjustment of the Gas and Electric Rates, Terms, and Conditions of the Louisville Gas and Electric Company*, (Ky. PSC June 30, 2004), Order at 49 – 52; Case No. 2003-00434, *An Adjustment of the Electric Rates, Terms, and Conditions of Kentucky Utilities Company*, (Ky. PSC June 30, 2004), Order at 42 – 45.

to exclude. Consistent with past ratemaking practices, the Company excludes Charitable Contributions and Penalties. In Case No. 2023-00191, Charitable Contributions were removed and $0 in Penalties were recorded, so there was no need to make any adjustment. These costs were projected at $0 in the forecasted test year for ratemaking purposes.

b. Upon review of the detail transaction level for 2022, the starting point in calculating the forward test year, $5,374 was spent on food and $6,411 was spent on gifts/promotional items. Donations ("Charitable Contributions") have already been excluded the forecasted test year, and as stated in the Company's response to AG 2-14, Kentucky-American will remove from the forecasted test year the portion of membership dues related to covered activities when it files its base period update after the base period closes. The Company will also remove gifts/promotional items expense in that update. Kentucky-American is not aware of any other costs, consistent with the cited Commission precedent, that should be removed from the forecasted test year. Please see table below for details:

Type	2022 Actuals	Inflation Factor %	Forecasted Test Year	After Base Period Update
Food	$5,374	6.05%	$5,699	$5,699
Gifts/Promotional Items	$6,411	6.05%	$6,799	$0
Charitable Contributions	$145,379	N/A	$0	$0
Membership Dues – Covered Activities (AG 2-14)	$2,403	6.05%	$2,549	$0
Total	**$159,567**		**$15,047**	**$5,699**

c. The "Name of offsetting account" refers to the other line items for a particular transaction. For example, if the transaction was a vendor invoice, the "Name of offsetting account" would reference the vendor identification number in Kentucky-American's system. Therefore, that field is dependent on the document type of the transaction. As another example, for those transactions that are journal entries, the "Name of offsetting account" could reflect the account from where that transaction is being reclassed. Some examples are as follows: Employee Expense could be from a Community relations event, Labor Natural Account could be a Lab supplies expense, Customer Education could be from a Community Partnership.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

14. Refer to the Kentucky American's response to the Attorney General's First Request, Items 21 – 24. Explain in detail how the Company's inclusion of dues in the revenue requirement that are or may be used for legislative advocacy, regulatory advocacy, and public relations complies with Commission precedent.[4]

Response:

Kentucky-American will update membership dues/fees for the forecasted test year when it files its base period update after the base period closes. In that update, the Company will remove amounts specifically identified in AG 1-21, part a. Please see below for details:

Organization	2022 Amount	Inflation Factor %	Forecasted Amount (to be removed)
Building Industry Association of Kentucky	$20	6.05%	$21
Building Industry Association of Kentucky	$25	6.05%	$27
Central Kentucky Apartment Association	$58	6.05%	$62
Kentucky Chamber of Commerce	$50	6.05%	$53
Kentucky Chamber of Commerce	$2,250	6.05%	$2,386
Total	**$2,403**		**$2,549**

[4] Case No. 2018-00358, *Electronic Application of Kentucky-American Water Company for an Adjustment of Rates* (Ky. PSC June 27, 2019), Order at 40 – 41; Case No. 2003-00433, *An Adjustment of the Gas and Electric Rates, Terms, and Conditions of the Louisville Gas and Electric Company*, (Ky. PSC June 30, 2004), Order at 49 – 52; Case No. 2003-00434, *An Adjustment of the Electric Rates, Terms, and Conditions of Kentucky Utilities Company*, (Ky. PSC June 30, 2004), Order at 44 – 45.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

15. Refer to the Application generally. Explain in detail whether Kentucky American included any business development costs, either direct or allocated costs, in the revenue requirement.

    a. If so, provide the total amount of business development costs, a description for each cost, and a breakdown of the costs by category.

    b. If business development costs were included in the revenue requirement, explain in detail how it complies with Commission precedent.[5]

Response:

The revenue requirement includes direct and allocated costs associated with Kentucky American Water's business development activities.

a. The revenue requirement includes $180,082 in direct labor costs associated with Kentucky American Water's one business development employee. Please refer to the labor workpaper provided in KAW_R_PSCDR1_NUM001_Attachment_CONFIDENTIAL.zip

   Kentucky American also included Service Company business development costs in the amount of $106,069, cost details can be found in the Totals tab on the workpaper entitled KAWC 2023 Rate Case – Support Services Exhibit.

b. The costs included in this proceeding are reasonable, prudently incurred costs that benefit customers. Business Development activities benefit customers directly and indirectly by mitigating the costs to be recovered per customer, enhancing purchasing power, and spurring activities that contribute to their local economies.

   Business development activities which grow our customer base enable the Company to spread system investment costs and operating expenses across a larger customer group, thereby mitigating the costs to be recovered per customer. For example, despite the Company's operating expenses increasing by approximately $4 million from 2012 through 2022, due in part to the customer base expanding by approximately 14,000 customers during that time period, operating expense per customer only increased slightly, from $275 per customer in 2012 to $276 per customer in 2022.

   The Company's growing customer base also enhances the Company's purchasing power capabilities, which allows American Water to purchase goods and services in

[5] Case No. 2018-00358, *Electronic Application of Kentucky-American Water Company for an Adjustment of Rates* (Ky. PSC June 27, 2019), Order at 40 – 41.

bulk quantities at competitive prices, for the benefit of its customers. These investments optimize system service and sustainability while leveraging economies of scale to minimize rate increases.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Krista E. Citron

16. Refer to Kentucky American's response to the Attorney General's First Request, Item 26(g).

    a. Explain why the forecasted annual cost of the Qualified Infrastructure Program ("QIP") Rider for 2024 is $20.7 million, while the forecasted annual cost of the QIP for 2025 – 2028 is between $42.5 million and $46 million.

    b. Kentucky American asserts that, "QIP to date has been primarily cast iron water mains, there are other material types in KAWC's system that are also aging past their useful life and are also prone to leaking or breaking and in need of replacement." Explain in detail the other material types that Kentucky American states are aging past their useful life and are prone to leaking and breaking and in need of replacement.

Response:

    a. The proposed expansion of the QIP is not scheduled to begin until 2025, which is reflected in the 2025-2028 numbers. Since 2024 is the future test year in this case, there is not a separate QIP Rider. Rather, the $20.7 million in planned work on Budget Line B – Main Replacements is considered part of the base rates for that year.

    b. Kentucky American's system is primarily made up of the following material types: cast iron, ductile iron, asbestos cement, PVC/plastic, concrete, steel, HDPE, and unknown/other type. Every single material type listed already has segments at or beyond their expected lifecycle, with more sections aging past that point each year.

    While cast iron and galvanized steel are the two material types most prone to breaking, Kentucky American experiences main breaks on all other material types as well. PVC and plastic pipe can become brittle over time; ductile iron is more prone to expansion/contraction related breaks in association with seasonal weather changes; and PCCP (prestressed concrete) can experience breaks when the reinforcing steel layer is compromised. Most metal pipes are subject to corrosion and tuberculation (residue build-up on the interior of the pipe) over time. Cast iron is prone to pinhole deterioration, which is rarely discovered at the ground's surface and therefore more likely to slowly leak over a long period of time before replacement.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Krista E. Citron

17. Refer to Kentucky American's response to the Attorney General's First Request, Item 26(j). As originally requested, if Kentucky American's QIP is not modified in the pending case, what is the replacement cycle for the infrastructure in the Company's water system? For example, is the Company's water system on a 200-year replacement cycle, 300-year replacement cycle, etc.?

Response:

The current rate of 10-13 miles replaced per year represents an average replacement rate of 0.5 percent of the total system per year. At this replacement rate, it would take approximately 204.5 years to replace the entire distribution system.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Krista E. Citron

18. Refer to Kentucky American's response to the Attorney General's First Request, Item 26(k). As originally requested, if Kentucky American's QIP is modified and accelerated in the pending case, what is the replacement cycle for the infrastructure in the Company's water system? For example, would the Company's water system be on a 100-year replacement cycle, 200-year replacement cycle, etc.?

Response:

The proposed rate of 27-34 miles replaced per year represents an average replacement rate of 1.1 to 1.4 percent of the total system per year. At an accelerated replacement rate of roughly 29 miles per year, it would take approximately 80 years to replace the entire distribution system, which more closely reflects the average lifespan of pipe materials as indicated in the Citron Direct Testimony on page 6 and discussed in KAW_DT_Citron_Exhibit_1 ("Stantec Report").

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Krista E. Citron

19. Refer to Kentucky American's response to the Attorney General's First Request, Items 26(j) and (k). Explain in detail what replacement cycle for a utility's water infrastructure system is generally accepted by experts as reasonable. For example, a 100-year replacement cycle, 200-year replacement cycle, etc. Provide a copy of all supporting documentation regarding the same.

Response:

In general, a replacement cycle that more closely reflects the expected lifespans of the pipe materials themselves is the goal. However, there is not a "typical" or "preferred" cycle because it should be based on the characteristics of each system. The 2021 Report Card for America's Infrastructure generated by the American Society of Civil Engineers (ASCE) states that water utilities across the country are increasing the rate of pipe replacement and repair:

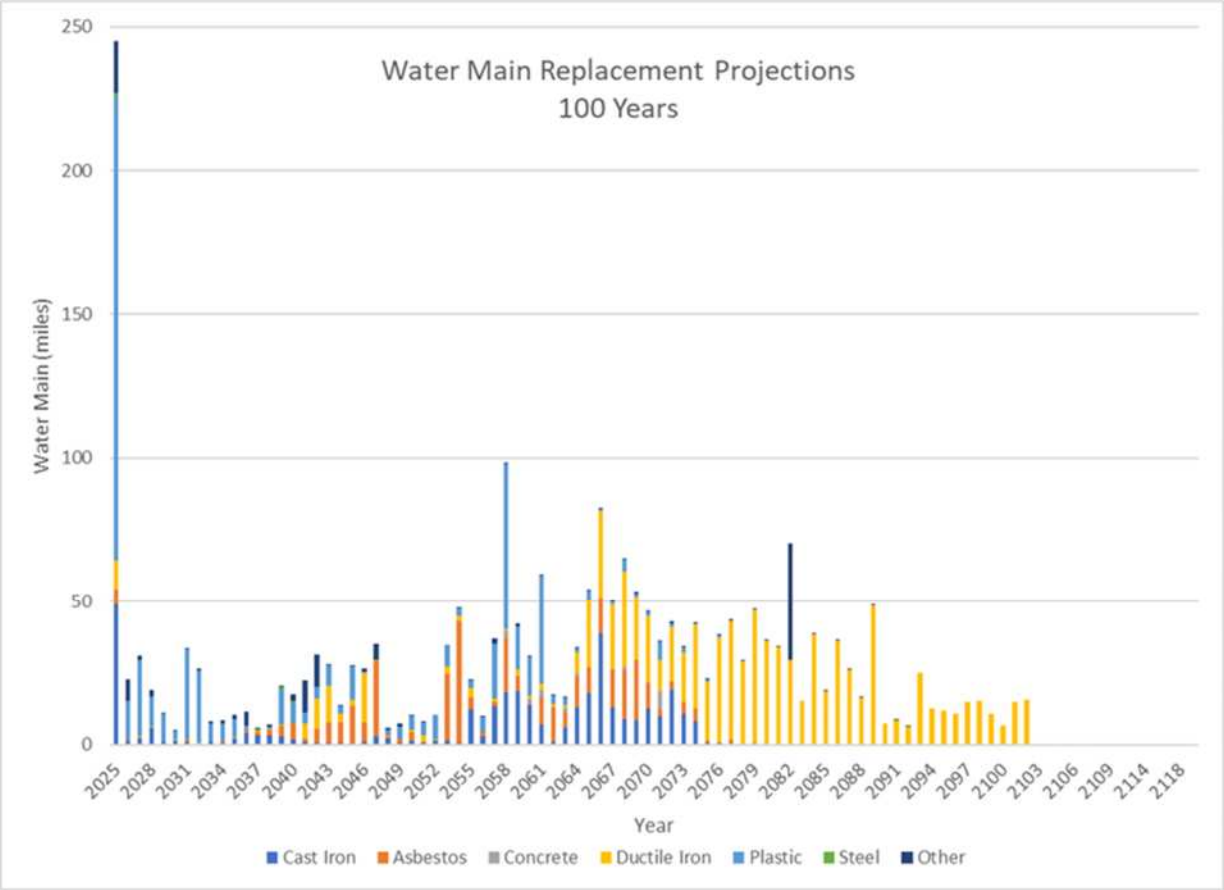
> "In 2015, utilities were replacing, on average, 0.5% of their pipes per year, meaning it would take an estimated 200 years to replace the entire system. By 2019, utilities were replacing between 1% and 4.8% of their pipelines per year on average, a replacement rate that matches the lifecycle of the pipes."

A copy of the 2021 Report Card is attached as KAW_R_AGDR2_NUM019_092123_Attachment 1. Utah State University's Buried Structures Laboratory performed a study in 2018 that showed an average 125-year national pipe replacement rate:

> "According to the survey, an average of 0.8 percent of installed pipe is replaced each year across the country. This equates to a 125-year national pipe replacement schedule. Pipe replacement rates should be between 1 percent and 1.6 percent, equivalent to 100-year and 60-year replacement schedules, respectively. In general pipe replacement rates need to increase."

A copy of the study is attached as KAW_R_AGDR2_NUM019_092123_Attachment 2.

Referring back to the assessment of Kentucky American's system performed earlier in 2023, KAW_DT_Citron_Exhibit_1, nearly 250 miles of pipeline are already at or beyond their expected lifecycle. It would not be reasonable to attempt to replace all 250 miles in a single year. Kentucky American is proposing increasing our replacement rate from approximately 0.5% per year to 1.1-1.4% per year, or 27-34 miles, to help address these nearly 250 miles needing replacement, as well as the additional miles of main (generally less than 50 per year) that are approaching their life expectancy.


Water Main Replacement Projections
100 Years
Water Main (miles)
250
200
150
100
50
0
2025
2028
2031
2034
2037
2040
2043
2046
2049
2052
2055
2058
2061
2064
2067
2070
2073
2076
2079
2082
2085
2088
2091
2094
2097
2100
2103
2106
2109
2114
2118
Year
Cast Iron
Asbestos
Concrete
Ductile Iron
Plastic
Steel
Other

Drinking Water

C-

EXECUTIVE SUMMARY

Our nation's drinking water infrastructure system is made up of 2.2 million miles of underground pipes that deliver safe, reliable water to millions of people. Unfortunately, the system is aging and underfunded. There is a water main break every two minutes and an estimated 6 billion gallons of treated water lost each day in the U.S., enough to fill over 9,000 swimming pools. However, there are signs of progress as federal financing programs expand and water utilities raise rates to reinvest in their networks. It is estimated that more than 12,000 miles of water pipes were planned to be replaced by drinking water utilities across the country in the year 2020 alone. In 2019, about a third of all utilities had a robust asset management program in place to help prioritize their capital and operations/maintenance investments with limited dollars, which is an increase from 20% in 2016, Finally, water utilities are improving their resilience by developing and updating risk assessments and emergency response plans, as well as deploying innovative smart water technologies like sensors and smart water quality monitoring.

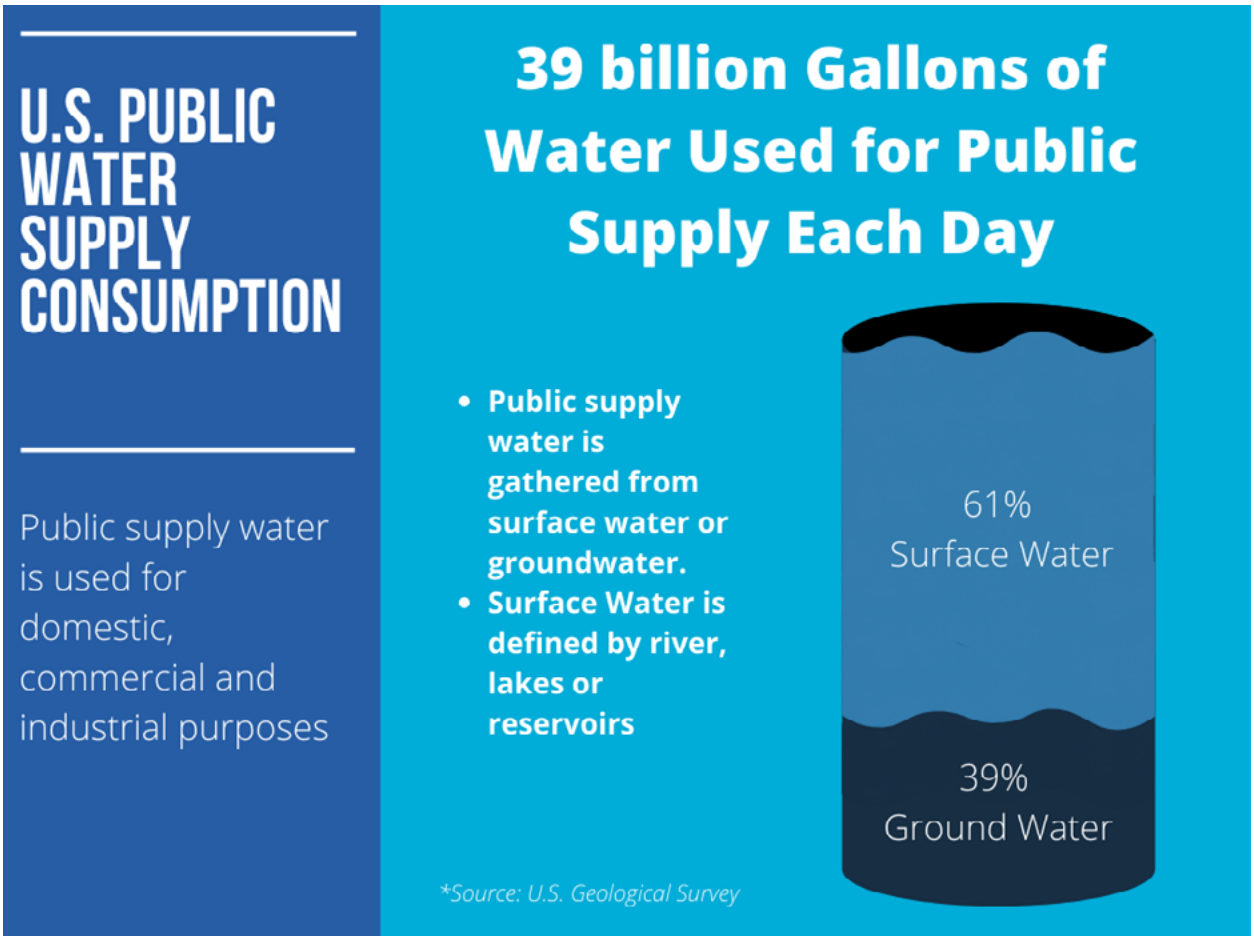
CAPACITY & CONDITION

Access to clean and safe drinking water is critical to public health and economic prosperity and, on average, people use around 82 gallons of water per person, per day in the United States. Nearly half of water utilities report declining or flat total water sales in the past 10 years, largely due to efficiency improvements. Water usage dropped 3% from 2010 to 2015, despite a 4% increase in the nation's total population. Due to declining water usage, there is currently adequate drinking water capacity in the U.S. About 39 billion gallons of water a day are withdrawn from surface water or groundwater sources for public supply. Public supply use represents about 12% of total freshwater withdrawals.

There are more than 148,000 active drinking water systems in the nation. Just 9% of all community water systems serve over 257 million people, while the bulk of community water systems — 91%, or nearly 46,000 in total — serve communities with populations under 10,000 people. About 13 million households in the nation rely on water from private wells.

Our nation's drinking water infrastructure is composed of 2.2 million miles of pipe, most of which is underground and unseen by the millions of consumers who rely on it every day; unfortunately, this often means that water infrastructure is out of sight and thus out of mind. Some of the nation's oldest pipes were laid in the 19th century, and pipes that were laid post-World War II have an average life span of 75 to 100 years, meaning that many of them are reaching the end of their design life.

Between 2004 and 2017, various sources estimate there were between 10 to 37 leaks and breaks per 100 miles of pipe. One report found a 27% increase in water main break rates between 2012 and 2018, reaching an estimated 250,000 to 300,000 breaks per year; this is equivalent to a water main break every two minutes. Smaller utilities can have up to twice as many pipe breaks



than larger utilities, in part because smaller utilities often have more miles of pipe per customer and have a smaller customer base from which to collect revenue, resulting in less funds for repair and asset management.

Water utilities are increasing the rate of pipe replacement and repair. In 2015, utilities were replacing, on average, 0.5% of their pipes per year, meaning it would take an estimated 200 years to replace the entire system. By 2019, utilities were replacing between 1% and 4.8% of their pipelines per year on average, a replacement rate that matches the lifecycle of the pipes. It is estimated that more than 12,000 miles of water pipes were planned to be replaced by drinking water utilities across the country in 2020.

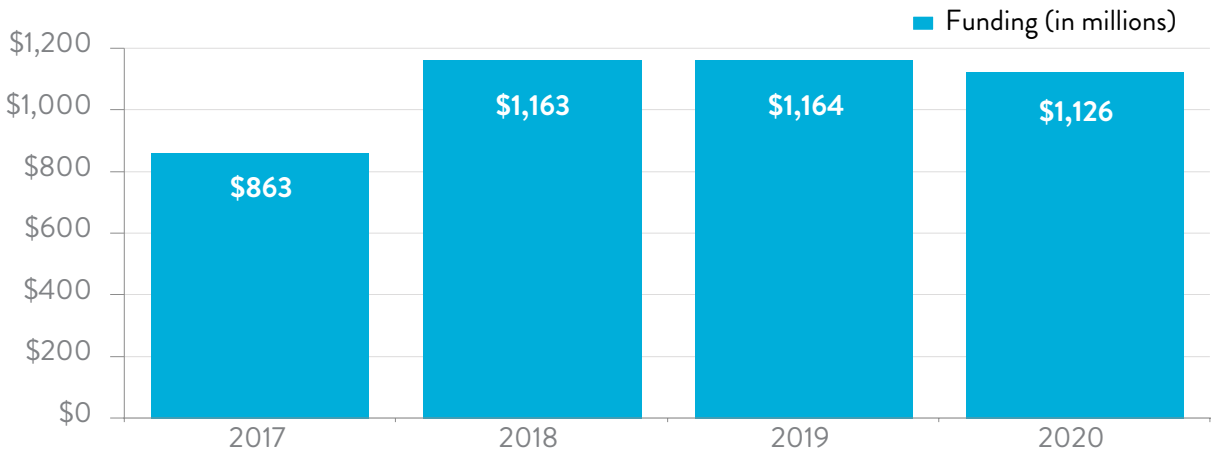
Drinking water systems currently lose at least 6 billion gallons of water, or 9,091 Olympic-size swimming pools, every day. This equates to 2.1 trillion gallons of non-revenue water loss per year. The U.S. lost an estimated $7.6 billion of treated water in 2019 due to leaks.

FUNDING

Funding for drinking water infrastructure has not kept pace with the growing need to address aging infrastructure systems, and current funding sources do not meet the total needs. In general, however, state and local governments have invested more than their federal counterparts. Despite the growing need for drinking water infrastructure, the federal government's share of capital spending in the water sector fell from 63% in 1977 to 9% of total capital spending in 2017. On average, about two-thirds of public spending for capital investment in water infrastructure since the 1980s has been made by state and local governments.

EPA Drinking Water State Revolving Fund Appropriations

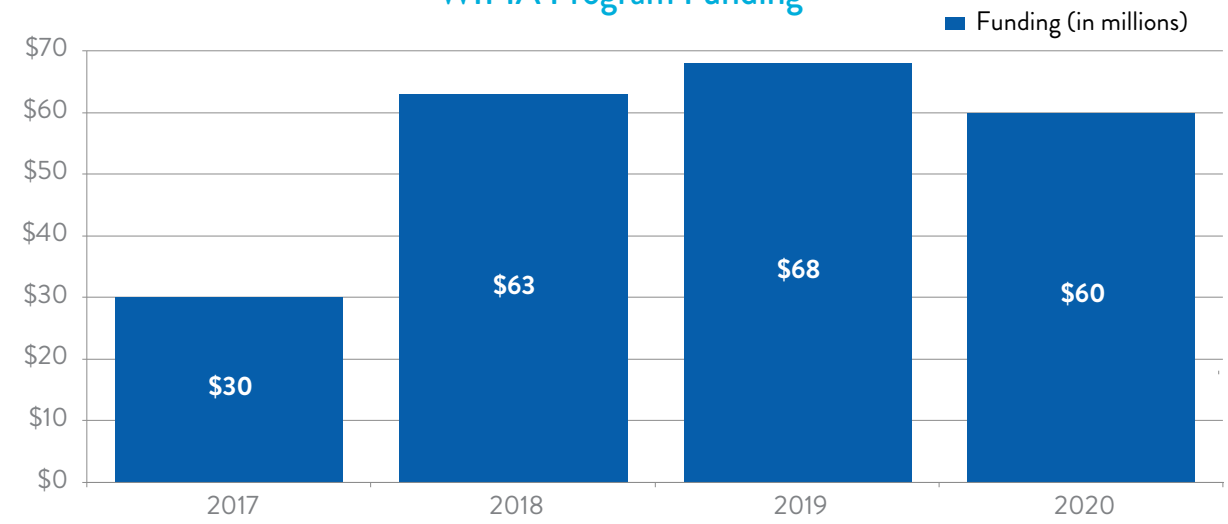
The DWSRF provides low-interest loans to state and local drinking water infrastructure projects. It has continued to receive increased federal appropriations since Fiscal Year (FY) 2017.



However, there is some limited federal support. The U.S Environmental Protection Agency's (EPA) Drinking Water State Revolving Fund (DWSRF) provides low-interest loans to state and local drinking water infrastructure projects. The EPA provides an allotment for each state based on its Drinking Water Needs Survey that is conducted every four years, and states in turn provide a 20% funding match. From 2013 to 2018, the DWSRF program grew from just over $2 billion in 2013 to nearly $3 billion in 2018, providing loans of increasing sizes to states. Federal appropriations for the DWSRF helped boost the size of the program from FY17 to FY20. In 2018, the median size of a loan was about $1 million, and one quarter of the projects were co-funded with another source, including funding from the U.S. Department of Agriculture's (USDA) Rural Development program.

The EPA's Water Infrastructure Finance & Innovation Act (WIFIA) program offers the sponsors of large projects (generally over $20 million) a new financing tool to leverage limited federal resources, stimulate additional investment in our nation's drinking water, wastewater, and stormwater infrastructure, and encourage greater private sector participation. As of 2019, prospective borrowers have submitted letters of interest for 156 projects, requesting over $21 billion in WIFIA loans, including $3.9 billion in requests for drinking water projects. Recognizing the program's success, Congress doubled the program's funding in FY20 compared to FY17.The additional support increased the program's lending capacity from $2.5 billion in 2017 to $6 billion in 2019.

WIFIA Program Funding



The U.S. Department of Agriculture's (USDA) Rural Development has over 40 programs in place to support drinking water needs in rural communities across the nation. For example, its Water & Environmental Programs (WEP) provides direct and guaranteed loans, grants, technical assistance, and training to build critical infrastructure for populations of 10,000 or less. From 2015 to 2019, USDA provided over $4.5 billion for 2,016 drinking water projects.

Federal funding and financing is critical, but the primary drinking water infrastructure funding mechanism is user fees. The average nationwide monthly drinking water rate increased 31% from 2012 to 2018. Although water rates have increased, utilities are still facing funding gaps; only 21% of all U.S. utilities report being able to fully cover the cost of providing drinking water services, and only 20% of very large utilities and 10% of small utilities felt they will be able to provide full cost service in five years. Renewal and replacement of aging water and wastewater infrastructure, as well as the financing for capital improvements, are the top two issues facing the water industry.

Although 88% of Americans pay drinking water rates that are lower than the EPA's standard of affordability, it is estimated that up to 36% of households will not be able to afford the cost of drinking water by 2024. The EPA standard for affordability is that households spend no more than 2% on drinking water and 4.5% of median household income on both drinking water and wastewater services.

OPERATIONS & MAINTENANCE

Decades old drinking water infrastructure systems, declining water use, costs of regulatory compliance, and stagnant federal funding has resulted in many water utilities struggling to fund the cost of operations and maintenance of these systems.

Maintenance costs reached an all-time high of $50.2 billion above capital in 2017, in part due to deferred capital projects. A recent survey found that 47% of the maintenance work undertaken by utilities is reactive and done as systems fail.

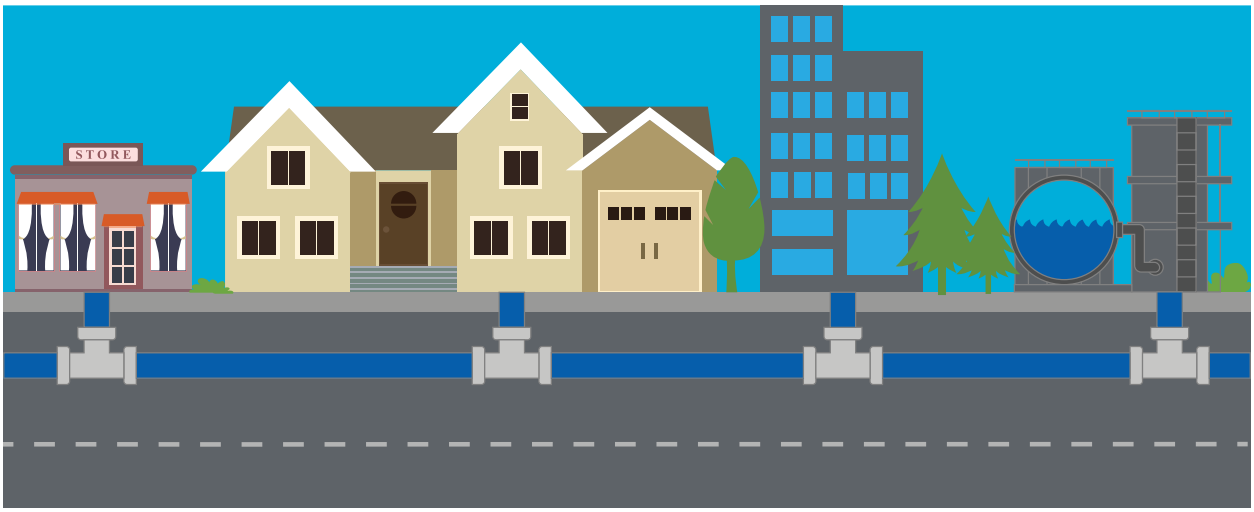
One of the measures that utilities are taking to improve operations and maintenance and shore up resilience and affordability is the development of asset management programs, which shifts decision-making from reactive to proactive. Some states have asset management requirements for drinking water systems, but there is no federal requirement. Other states give priority for DWSRF loans to water projects that have an asset management plan or provide funding for asset management plan development, training, and technical assistance. Overall, nearly a third of drinking water utilities have a robust asset management plan in place, which is an increase from 20% in 2016, while another 55% of utilities are in the process of implementation.

SUSTAINABLE WATER INITIATIVE FOR TOMORROW (SWIFT) IN EASTERN VIRGINIA

FUTURE NEED

Our nation's drinking water systems face staggering public investment needs over the next several decades. ASCE's 2020 economic study, *"The Economic Benefits of Investing in Water Infrastructure: How a Failure to Act Would Affect the U.S. Economic Recovery"* found that the annual drinking water and wastewater investment gap will grow to $434 billion by 2029. Additionally, the cost to comply with the EPA's 2019 Lead and Copper Rule is estimated at between $130 million and $286 million.

Drinking water utilities also face increasing workforce challenges. Much of the current drinking water workforce is expected to retire in the coming decade, taking their institutional knowledge along with them. Between 2016 and 2026, an estimated 10.6% of water sector workers will retire or transfer each year, with some utilities expecting as much as half of their staff to retire in the next five to 10 years.



PUBLIC SAFETY

Since 1974, the EPA has regulated the nation's public drinking water supply through the Safe Drinking Water Act (SDWA). The EPA sets national health-based standards and determines the enforceable maximum levels for contaminants in drinking water. All water suppliers are required to notify consumers upon learning of a serious water quality problem, and states and the EPA are required to prepare annual summary reports of water system compliance that must be made available to the public. In 2019, the number of public water systems with health-based violations was 15% lower than in 2017, and public water systems that were returned to SDWA compliance increased nearly 7% compared to 2017.

Utilities face the increasing challenge of keeping pace with emerging contaminants such as per- and polyfluoroalkyl substances (PFAS), lead and copper in drinking water, and the regulatory requirements needed to remain in compliance with the SDWA. The EPA found that about 12% of water utilities' needs are directly attributable to SDWA compliance. Utilities in more rural communities have a smaller rate-payer base, which results in less revenue and limited financial capacity to address aging infrastructure and compliance costs. Some struggling community water systems have found success in voluntarily partnering with a larger water utility to access the capital and expertise needed to meet SDWA compliance.

RESILIENCE & INNOVATION

As the nation faces more frequent extreme weather events, water utilities are taking action to increase the resilience of their systems to ensure safety and reliability. In fact, a 2019 survey found that emergency preparedness is one of the top 10 issues facing the water industry. The America's Water Infrastructure Act of 2018 required community water systems serving more than 3,300 people to develop or update risk assessments and emergency response plans (ERPs). The law sets deadlines, all before December 2021, by which water systems must complete and submit the risk assessment and ERP to the EPA. The law also specifies the components that the risk assessments and ERPs must address.

Utilities are also developing innovative smart water technologies such as leak detection, seismic resilient pipes, smart water quality monitoring, and real time data sensors, just to name a few. These technologies improve resilience by allowing utilities to respond to changing climate conditions, improve efficiency of operations by reducing water losses, and deliver real-time data that allows for interactive decision-making.

WATER TRAP ROCK WATER TREATMENT FACILITY IN LOUDOUN COUNTY, VIRGINIA

Drinking Water

RECOMMENDATIONS TO RAISE THE GRADE

- Triple the amount of annual appropriations to the Drinking Water State Revolving Fund program and fully fund the Water Infrastructure Finance and Innovation Act program and the U.S. Department of Agriculture Rural Development programs.
- Utilities should implement asset management programs, tools, and techniques to evaluate asset condition and risk, and to prioritize capital and O&M decisions; states should provide funding, training, and technical assistance for asset management programs.
- Increase utilities' resilience by integrating smart water technologies such as machine learning software and real time data sensors into drinking water infrastructure systems.
- Eliminate the state cap on private activity bonds for water infrastructure projects to bring an estimated $6 billion to $7 billion annually in new private financing.
- Increase federal and local support to find, train, and retain the next generation of the drinking water sector workforce to help offset the large number of expected retirements.
- Utilities need to conduct revenue forecasting models to determine the necessary rate revenues that reflect the true cost of water that is needed to provide safe, reliable drinking water and more resilient infrastructure.
- Develop and fund affordability programs to ensure that low-income and vulnerable communities do not bear a disproportionate burden of rate increases.
- Support voluntary partnerships for small community water systems in need.

Drinking Water

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Water Main Break Rates In the USA and Canada: A Comprehensive Study

March 2018
An Asset Management Planning Tool for Water Utilities

UtahStateUniversity

Utah State University
Buried Structures Laboratory
Steven Folkman, Ph.D., P.E.

Executive Summary

The economic prosperity of modern cities is based on a complex infrastructure network located both above and below ground. A critical component to public health and economic well-being is our drinking water which is brought to the tap through an elaborate network of underground pipe distribution systems. Since most of this infrastructure is underground, it is out of sight and often neglected. Empirical data on water main breaks helps utilities in their repair and replacement decision making processes in order to deliver clean drinking water to their customers at an affordable price. This report documents the survey results of water main breaks and operating characteristics at utilities located in the US and Canada. A similar survey was conducted by Utah State University approximately six years ago and published in 2012 (Folkman, 2012). This 2018 report references this previous study to compare and examine changes over time and discuss the importance of water main break data in the context of water asset management planning.

Evidence of Decline

North America's water infrastructure is in decline. The signs of distress surface daily as water mains break creating floods and service disruptions. The loss of service is more than an inconvenience, causing significant social and economic disruptions. Economic impacts include loss of treated water, increased maintenance budgets, overtime hours for service personnel, traffic and business disruptions, and damage to private property. "Aging and deteriorated water mains are threats to the physical integrity of distribution systems, causing adverse effects on flow capacity, pressure, and water quality in drinking water services" (Grigg, et al., 2017). Disruptions due to water main failures are now a common occurrence. The overall assessment of our infrastructure is not good. In 2009, the American Society of Civil Engineers issued a USA Infrastructure Report Card and gave a D- to drinking water and wastewater infrastructure (ASCE, 2009). In a small sign of improvement, the 2017 ASCE Infrastructure Report Card (ASCE, 2017) grade was raised to a D. In the 1990s, a comprehensive American Water Works Association (AWWA) study also indicated that water main replacement was inadequate (Kirmeyer et al., 1994). The AWWA has formally tracked issues and trends in the US. The top concern in the AWWA surveys for both 2016 and 2017 is "renewal and replacement (R&R) of aging water and wastewater infrastructure" (AWWA, 2017).

The Measurement

The most important and critical factor used to quantify the condition and occurrences of failing underground pipe networks is **water main break rates**. Water main break rates are calculated for all pipe materials used in the transport of water to create a measurement to judge pipe performance and durability. Water main break rates for each utility can vary year to year and even seasonally. However, in aggregate, break rates produce a compelling story which can aid in asset management decision making as it relates to defining pipe criticality and costs of repairing and replacing our underground water pipes.

Purpose and Highlights

This comprehensive water main break rate study for the USA and Canada compiles the collective experience of 308 utilities which should be used for making future pipe replacement decisions. It is the desire of the researchers and participants to offer data and analysis that utility managers, engineers and elected officials can apply to the circumstances of their own operations to facilitate water infrastructure asset management planning and pipe replacement decision making. The objective is to reduce operating costs, service level impacts and health risks to their customers. Highlights of the water main break study include aggregate data on pipe material break rates, the analysis of age and corrosion in failure modes, related observations on pressure, delivery demands, effects of soil corrosivity, and new national metrics for pipe replacement rates and population served per mile of pipe.

The Primary Researcher

Dr. Steven Folkman is a registered Professional Engineer, a member of AWWA and a member of the Transportation Research Board Committee on Culverts and Hydraulic Structures, and has oversight of Utah State University's (USU) Buried Structures Laboratory. The Buried Structures Laboratory at USU has been involved in analysis and testing of all kinds of pipe and associated structures for over 50 years. Previous directors include Dr. Reynold Watkins and Dr. Al Moser who are internationally recognized experts. Dr. Moser and Dr. Folkman are coauthors of the widely used text, *Buried Pipe Design* (McGraw Hill, 3rd Edition). Dr. Folkman's expertise includes structural dynamics, linear and nonlinear finite element analysis utilizing soil/structure interaction, and testing. The USU Buried Structures Laboratory is recognized as one of two laboratories in the United States for performing large scale tests on buried pipes. It is from this expertise and background that the surveys of water main breaks were developed and analyzed to complete this comprehensive study.

Major Findings

The comprehensive nature of this study has provided a national water infrastructure condition assessment and review comparing pipe material performance. Additionally, several national-level metrics which utilities can use for asset management benchmarking purposes are included.

1. Nearly 200,000 Miles of Pipe Condition and Operation Surveyed

A total of 197,866 miles of pipe were reported by the 308 basic survey participants. Of those, 281 participants were able to provide water main break data covering 170,569 miles of pipe. This represents 12.9% of the total length of water mains in the USA and Canada. Equally significant, the utilities providing break data serve a total population of 52,477,346 people. This represents 14.5% of the total population of the US and Canada. The survey recorded 23,803 failures that needed repairs which is a significant basis for break data. It is one of the largest surveys conducted on water main failures and the results give an accurate representation of water main performance and operating conditions in North America. This report can be used to update "average estimated service life" assumptions for pipe materials when considering asset management pipe renewal and replacement decision-making.

2. Break Rates Have Increased 27% in the Past Six Years

Between 2012 and this 2018 report, overall water main break rates increased by 27% from 11.0 to 14.0 breaks/(100 miles)/year. Even more concerning is that break rates of cast iron and asbestos cement pipe, which make up 41% of the installed water mains in the US and Canada, have increased by more than 40% over a 6-year period.

3. 82% of Cast Iron Pipes are Over 50 Years Old and Experiencing a 46% Increase in Break Rates

Cast iron (CI) pipes represent the largest pipe material inventory in North America. 82% of all CI pipe is over 50 years old and their break rates have increased significantly by 46% since 2012 and are expected to continue to increase. 27% of asbestos cement (AC) pipe is also over 50 years in age and AC pipe breaks have increased by 43% in that same 6-year period. CI and AC pipe together are mostly responsible for the spike in overall break rates since 2012. Utilities with large amounts of cast iron and/or asbestos cement pipes may need to accelerate their replacement rates. CI and AC pipes are no longer manufactured and many are reaching the end of their expected lives.

4. Nationwide One Mile of Installed Water Main Serves 308 People

While the industry has assumed 325 people are served for 1 mile of distribution system pipe in urban areas, this survey finds a new national metric of 308 people served per mile of pipe regardless of utility size (or 191 people/km). The data indicates that an average utility has 607 miles of pipe and serves a population of 186,752 people.

5. 85% of Water Main Inventory is Less Than 12" in Diameter

67% of all water mains are 8" (200 mm) or less in diameter and the range of 10" to 12" (250 to 300 mm) sizes make up another 18% of all installed water mains.

6. Smaller Utilities Have Two Times More Main Breaks Than Large Utilities

The survey results show that smaller utilities can have break rates more than twice as high as larger ones. This may be attributable to the fact that larger utilities are better funded which results in improved data, engineering design, installation procedures, and asset management practices. A small or rural utility would typically have more pipe miles per customer. This can result in greater financial burdens in maintaining their water systems compared to larger or urban utilities.

7. Pipe Material Use Differs by Region

Water main pipe material usage varies significantly over geographic regions (see Figure 11). This suggests that the selection and use of pipe materials are based on historical preference versus comparative cost analysis or environmental conditions. The upper northwest and eastern half of the USA (Regions 1, 4, 6, 7, and 8 as illustrated in Figure 1) have either cast iron or ductile iron pipe for much of the installed pipe length. Regions 3, 5, and 9 have more PVC pipe than any other material. The most common pipe material in Region 2 is asbestos cement and it is unique in that respect.

8. A Large Data Set Provides Increased Accuracy

The water main break experiences of one utility may not represent another. Factors such as climate, pipe material, installation practices, and soil corrosivity can greatly affect failure rates. Design and installation practices are very important. Every utility should properly design and install pipe - regardless of material. Many previous studies have

been based on a small subset of large utilities. This study provides an increase in accuracy due to the extensive participation of utilities.

9. Four Types of Pipe Materials Make Up 91% of Water Mains

91% of the installed water mains utilize a combination of cast iron (CI) at 28%, ductile iron (DI) at 28%, polyvinyl chloride (PVC) pipe at 22%, and asbestos cement (AC) at 13%. The remaining 9% of pipes used are represented by polyethylene (HDPE), steel, molecularly oriented PVC (PVCO), concrete steel cylinder (CSC), and other materials.

10. PVC Pipe Has the Lowest Overall Failure Rate

When failure rates of cast iron, ductile iron, PVC, concrete, steel, and asbestos cement pipes were compared, PVC had the lowest overall failure rate. This was also the case in the 2012 survey and is confirmed by other industry sources. A lower failure rate contributes to a lower total cost of ownership and helps confirm the performance and longevity of PVC pipes. PVC is not subject to corrosion, unlike ferrous and concrete steel cylinder pipes.

11. Corrosion is a Major Cause of Water Main Breaks

75% of all utilities surveyed reported one or more areas with corrosive soil conditions. Utilities with a higher percentage of iron pipe may experience a higher percentage of corrosion related breaks. This would especially apply to pipe installed without an increased investment in condition assessment, pipe monitoring and corrosion control measures. Corrosive soils and other environmental risks drive up the total cost of ownership. The most common failure mode reported in the detailed survey is a circumferential crack which is the most common failure mode of cast iron (CI) and asbestos cement (AC) pipes. Corrosion issues can be a contributor to many failure modes.

12. Cast Iron Pipe Has 20 Times More Breaks in Highly Corrosive Soils Than in Low Corrosive Soils

Analyses of soil corrosivity completed in this study shows that a cast iron (CI) pipe in highly corrosive soil is expected to have over 20 times the break rate of a CI pipe in low corrosive soil. Traditionally, the thickness of the iron pipe wall provided the additional corrosion protection. CI pipes manufactured after World War II have significantly higher failure rates due to thinner walls. The resulting higher main breaks with iron pipes due to corrosive soils is consistent with other research and studies.

13. Newer and Thinner-Wall Ductile Iron Pipe Has 10 Times More Breaks in Highly Corrosive Soils Than in Low Corrosive Soils

Ductile iron (DI) pipe in highly corrosive soil has over 10 times the break rate than a DI pipe in low corrosive soil. Cast iron (CI) and DI pipe corrode at about the same rate. Corrosion is an important failure mode for CI pipe and is the predominant failure mode for DI pipe. The many types of corrosion can also be combined with other environmental and operating conditions, all contributing to water main failures. Because the wall thickness of DI pipe has decreased over time, internal and external corrosion are a bigger concern for this pipe product.

14. 80% of Utilities Use Some Form of Corrosion Protection for Ductile Iron Pipe

80% of respondents to the detailed survey indicated they utilized some form of corrosion protection for ductile iron pipe with polywrap being the predominate method.

15. The Average Age of Failing Water Mains is Approximately 50 Years Old

When asked for the typical age of a failing water main, the detailed survey participants reported an average value of 50 years. 43% of water mains are between 20 and 50 years old and 28% of all mains are over 50 years old. In 2012 the average age of failing water mains was reported as 47 years. Based on the detailed survey, the average expected life of installed pipe today is 84 years, up from 79 years in the 2012 study. Given the qualitative nature of these questions, the typical age of a failing water main and expected pipe life have not changed significantly over the past 6 years. While pipe life can be estimated at over 100 years, actual life is affected by soil corrosivity, installation practices, and other factors.

16. 45% of Utilities Conduct Condition Assessment of Water Mains

45% of utilities use some form of regular condition assessment of their water mains. Condition assessment is considered a basic part or early step in the development of an asset management program.

17. Over 16% of Installed Water Mains are Beyond Their Useful Life

A total of 16% of installed water mains are beyond their useful lives (up from 8% reported in the 2012 study) and utilities do not have the funds to replace them. For utilities to survive this trend, and considering 28% of all mains are over 50 years old, improved asset management will be essential. These figures correspond well with an EPA study (EPA, 2002) that shows the amount of pipe needing immediate replacement is growing rapidly.

18. The National Rate of Pipe Replacement is 125 Years

According to the survey, an average of 0.8% of installed pipe is replaced each year. This equates to a 125-year replacement schedule. Pipe replacement rates should be between 1% and 1.6%, equivalent to 100-year and 60-year depreciation and/or replacement schedules, respectively. In general, pipe replacement rates need to increase. Asset management and life cycle costing practices can help a utility optimize its pipe renewal and replacement activities. The report finds that on average, utilities have a 125-year replacement rate on water main pipes as the new national average.

19. Construction Related Failures are the Same for Both Ductile Iron and PVC Pipes

The detailed survey asked utilities to report the number of failures related to construction activities and identify the pipe material that failed. The vast majority of construction related failures involved either ductile iron (DI) or PVC pipe and the number of failures for each material was essentially identical. Therefore, DI and PVC pipe have an equivalent rate of construction related failures. This points to the need to improve construction practices for underground infrastructure regarding installation, location services and inspection.

20. Acceptance of PVC Pipe for Use in Water Systems Has Increased by 23% Since 2012

PVC pipe approval has increased from 60% of water utilities allowing its use in 2012 to 74% of utilities allowing its use in 2018. The number of utilities approving of ductile iron, concrete steel cylinder, and steel pipes for use in water systems remains essentially the same.

21. Open Cut Remains the Primary Pipe Installation Method

Open cut pipe installation/replacement remains the primary method used. Where open cut is difficult, other installation methods are used. 62% of utilities have used directional drilling and it is highly recommended in locations where open cut replacement is difficult.

22. The Average Supply Pressure is 69 psi With the Average Maximum at 119 psi

Pressure is an important component in pipe design and material selection. A well-controlled system operated below design limits will lead to extended pipe life. The basic survey provided an average operating pressure of water mains as 69 psi, which is well below the pressure rating of most water mains. The reported maximum operating pressure in the basic survey had an average value of 119 psi.

23. The Average Daily Gallons Per Day Per Person is 137 With a Peak Demand Factor of 1.8

The average daily water demand for utilities which participated in the detailed survey was 137 gallons per day per person with a peak demand of 251 gallons per day per person. This suggests successful water conservation efforts and “value of water” campaigns nation-wide.

24. Estimated Average Water Loss to Leakage is 10%

A total of 200 utilities provided an estimate of their water loss due to leakage and the average reported value was 10%. This statistically significant number suggests that pressure reduction, leak detection and pipe replacement has contributed to the overall reduction of water loss in water distribution systems.

25. Most Utilities Have a Moderate to High Soil Corrosion Risk

Using soil analysis data, corrosion index values were computed for 281 of the cities that participated in the survey. The study found a direct correlation between soil corrosiveness and break rates of metallic pipes. A typical city has a corrosion risk rating somewhere between moderate and high, demonstrating the importance of corrosion mitigation for water systems.

1.0 Introduction

In the United States and Canada, population growth during three main time periods – 1800s, 1900–1945, and post 1945 – led to the installation of underground water infrastructure. Pipes constructed in each of these three eras could all start to fail at nearly the same time over the next couple of decades for a number of reasons ranging from age and corrosion to inadequate design and poor installation. Additionally, the life span of the materials used has become shorter with each new investment cycle (WIN, 2002).

There are approximately 155,693 public water systems in the United States with 52,110 community water systems providing year-round water services for residents. Over 286 million Americans get their tap water from a community water system (CDC, 2017). These community water systems across the US face the inevitable cost of pipe repair and replacement while dealing with decreasing water quality and increasing water loss. It is believed that at many utilities, pipe replacement levels are inadequate to keep up with the rate of deterioration. Maintaining an obsolete system can cause severe financial hardship for cities as well as increase public health risks. Infrastructure asset management is an approach which can help utilities bring together the concepts, tools, and techniques to manage assets at an acceptable service level at the lowest life-cycle cost. Life-cycle costing and assessment analysis can help utility management select pipe materials with a long-expected life that also contributes to a low cost over the expected life of the pipe, while also considering environmental impacts and risks (see Sustainable Solutions, 2017 or Khurana, 2017).

This study provides key inputs to water asset management's life-cycle cost analysis through a comparison of break-rates of commonly used pipe materials. Also, utility operating characteristics given in this report can provide the pipeline designers and system operators with reference values to plan for system replacement and expansion.

1.1. Aging Water Infrastructure

In 2007, the Conference of Mayors conducted a survey of over 300 cities representing over 55 million citizens and over 186,149 miles of water distribution mains (US Conference of Mayors, 2007). A high majority (86.2%) of cities use the number of water main breaks per unit length to evaluate drinking water pipe performance. The survey results concluded that water main breaks continue to be a major concern with 45% of cities experiencing more than 50 breaks annually. Cities also stated that repair and replacement cycles require a long-term view: 43% of city drinking water pipe system repair and replacement cycles extend beyond 50 years; and, 65% of city sewer pipe system repair and replacement cycles extend beyond 200 years. Water operation and maintenance managers recognize that older pipe systems may be constructed with multiple materials such as concrete, cast iron, wood, and some of these pipes may be over 125 years old. Asset inventory, condition assessment and asset management planning practices provide valuable information to enable utilities to more efficiently replace older pipes constructed with underperforming materials.

The EPA's Aging Water Infrastructure research program (EPA, 2010) is working toward the goal of making our nation's water infrastructure sustainable by supporting research and by promoting strategic asset management. The current efforts of the American Society of Civil Engineers Grand Challenge (ASCE, 2017) also helps engineers focus on improving the nation's infrastructure report card grade. ASCE's Grand Challenge aims to enhance the performance and value of water infrastructure by 2025 with a focus on innovation, life cycle costing and transformational change from design to delivery.

The water industry has seen many types of academic surveys and studies on water main replacement programs and the benefits of asset management, condition assessment and prioritization. However, many utilities have not historically tracked all of the elements of water main break data. Over the past 20 years, most utilities have come to realize the importance of tracking all aspects of their infrastructure in a GIS-centric platform and have collected records on the types, sizes, and repair histories of their pipes. As this trend continues, more data and

analysis will be available to the industry to improve water distribution system repair and replacement decision making. This comprehensive report based on statistically significant experiences from 308 utilities also draws from other relevant studies to be the most complete and authoritative study on water main break data based on pipe material. Many water utilities consider pipe breaks to be a crucial factor when deciding which pipes to replace. According to a Water Research Foundation (WaterRF) study, 75% of water utilities cited pipe breaks as a key criterion in pipe replacement decisions. Other common factors noted were pipe age (45%), low flows (40%), condition or material type (30%), and need for pipe size changes (30%). In addition, pipe breaks in a water distribution system are one of three critical metrics that can be used to measure the degree of optimization in the system. The other two metrics are chlorine residual (measuring water quality integrity) and pressure management (measuring hydraulic integrity). Breaks reflect the physical condition of a distribution system (WaterRF, Asset Management, 2017).

According to another WaterRF publication, the average pipe break rate (regardless of cause) for water utilities is between 21 to 27 breaks per 100 miles of pipeline per year. An additional WaterRF study cited an average of 25 breaks per 100 miles per year. Although water utilities typically take action to manage and reduce pipe breaks through monitoring, preventing all pipe failures is impossible (WaterRF, Knowledge Portals, 2017).

2.0 The Survey

2.1. Methodology

During 2017, Utah State University conducted a survey of utilities across the USA and Canada to obtain data on water main failures of water supply systems. The study was comprised of two parts: a basic survey and a detailed survey. The focus of the basic survey was to examine the number of failures utilities were experiencing and how those failures related to the pipe materials used and the age of the failing pipes. This effort focused on water supply mains (sewer and force main pipes were excluded) and excluded pipes with diameters under 3 inches. A variety of pipe materials are used in water supply systems and over the past 100 years the materials have evolved with different manufacturing technologies. As a result, pipe performance has changed. A goal of both the basic and detailed surveys was to look at which materials were performing best at a snapshot in time and to track how pipe age affects failure rates. The focus of the detailed survey was to obtain additional utility operational characteristics, pipe age and size, multi-year failure data, and applications of trenchless technologies.

The primary method used to distribute the surveys was email. A subcontractor experienced at mass emailing was utilized along with multiple email lists. Initial emails were sent to personnel at water utilities during April through June of 2017. This report will refer to the survey results herein as the 2018 study to correspond with its date of publication. Participants were given links to both the basic and detailed surveys and requested to complete both, or at a minimum, complete the basic survey. Follow up phone calls were also used to encourage participation. The basic survey participants were asked for data from a previous 12-month time period and thus the results represent a time period that mostly coincides with the year 2016. A total of 308 utilities responded to the basic survey. Of those, 281 utilities were able to provide water main break data in the basic survey and 98 responded to the detailed survey. This comprehensive study covers 170,569 miles of pipe with water main break data. An additional 27 utilities responded with partial data but are not included in the 170,569 mile total to simplify this report. The USA and Canada

were divided into nine regions and the 281 basic survey respondents were categorized according to the region and the size of the utility based on amount of pipe. This comprehensive study documents the results from both the basic and detailed surveys and draws from other relevant industry sources.

2.2. Objectives and Goals of the Study

There were many objectives of the surveys. These objectives include:

- Understanding the age and size distribution of pipe in water utilities
- Providing utilities with data they can use such as typical and maximum water pressure in water mains, average and maximum daily demands of water, and leakage rates
- Itemizing pipe failures over a time period with the data broken down by material type and age
- Identifying the most common pipe failure modes and materials as identified by the utility
- Determining whether corrosive soils are present, analyzing the influence of corrosive soils on break rates, and identifying corrosion prevention methods being used
- Highlighting pipe replacement plans, expected pipe life of new pipe and condition assessment methods
- Determining which pipe materials are allowed

FIGURE 1: REGIONS USED TO REPORT SURVEY RESULTS

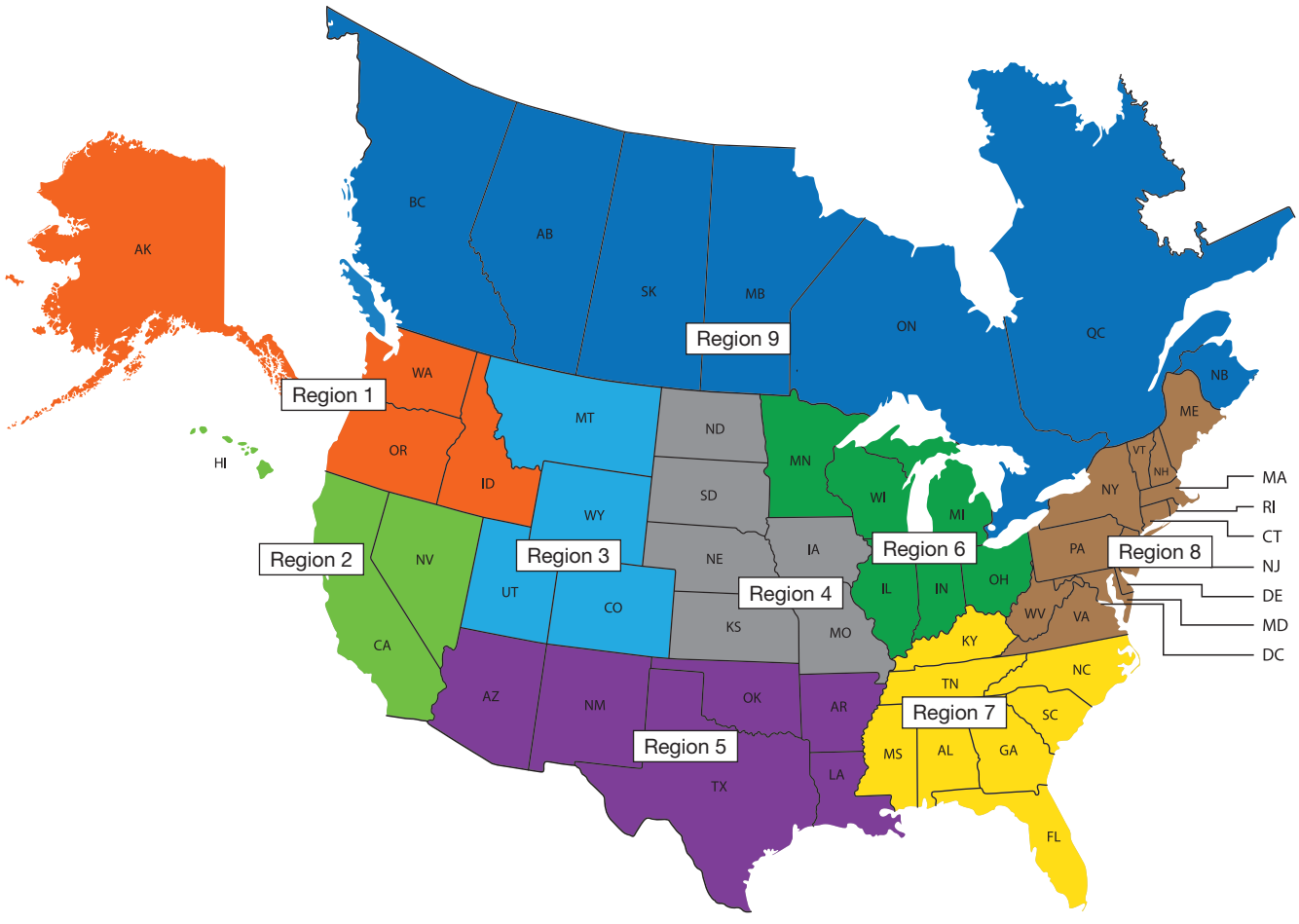


TABLE 1: NUMBER OF SURVEY RESPONDENTS WITH WATER MAIN BREAK DATA BY REGION

Region	Basic Survey			Detailed Survey		
	Number of Respondents	Miles of Pipe	Population Served	Number of Respondents	Miles of Pipe	Population Served
1	18	10,395	3,790,992	9	5,361	2,142,784
2	33	28,096	13,047,139	10	14,781	7,768,396
3	14	9,676	2,611,838	6	7,237	1,729,838
4	24	11,039	1,965,740	7	5,041	960,148
5	44	28,649	5,779,390	18	23,080	3,522,330
6	64	24,220	6,922,536	21	13,312	3,896,092
7	28	20,291	5,508,899	8	8,632	1,020,243
8	35	21,064	5,584,389	9	9,345	1,996,568
9	21	17,138	7,266,423	10	11,307	4,112,900
Total	281	170,569	52,477,346	98	98,097	27,149,299

FIGURE 2: LENGTH OF PIPE FROM EACH REGION THAT RESPONDED TO THE BASIC AND DETAILED SURVEYS

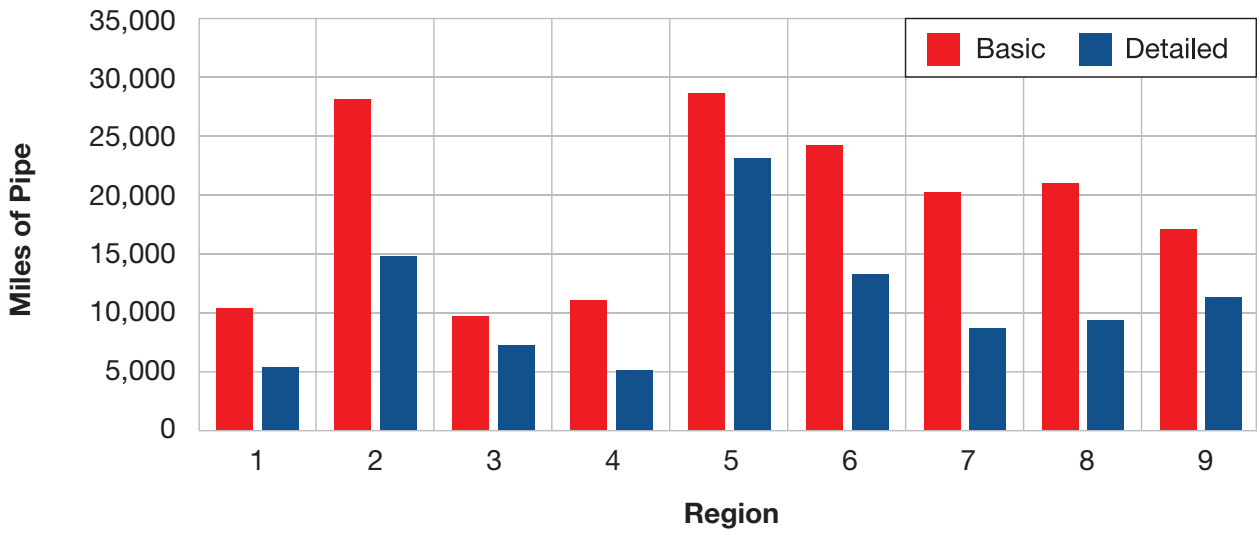
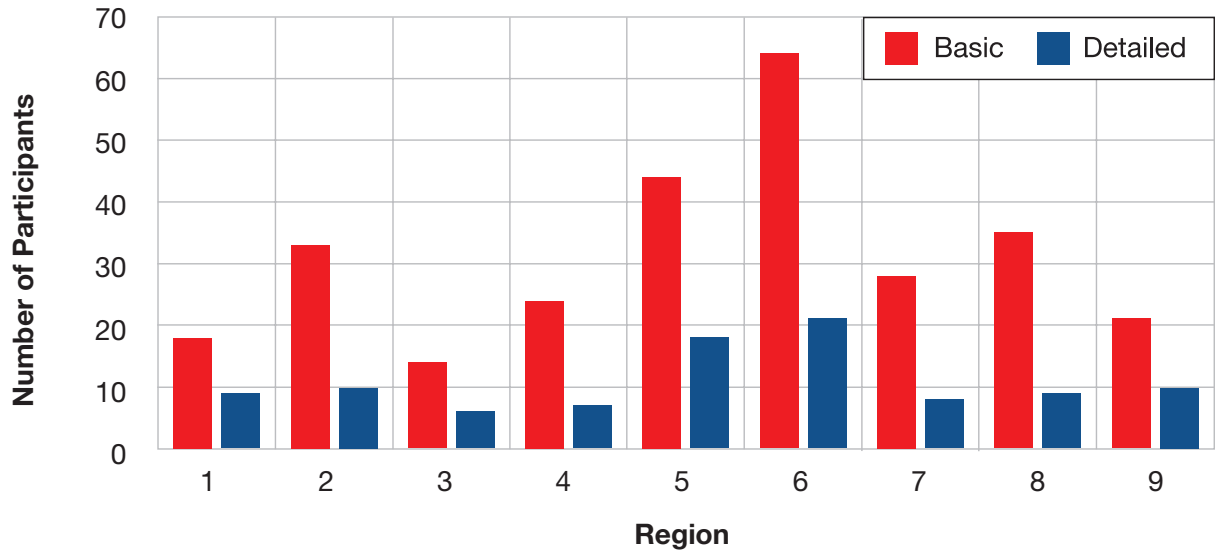


FIGURE 3: NUMBER OF RESPONDENTS FROM EACH REGION THAT RESPONDED TO THE BASIC AND DETAILED SURVEYS



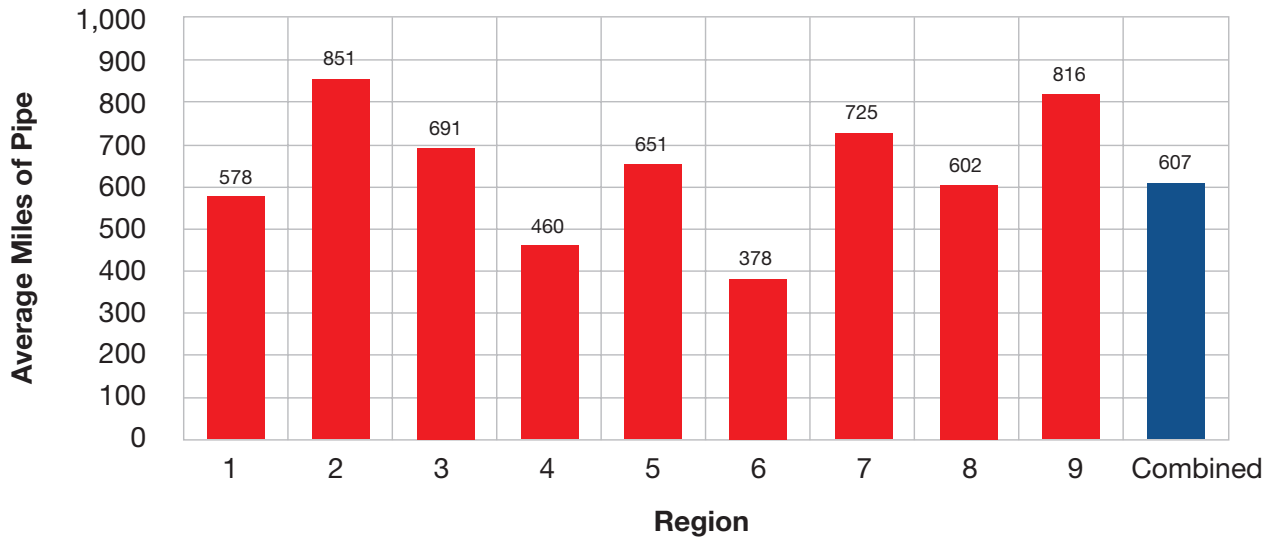
2.3. Survey Regions

In total, 281 utilities participated in the surveys and provided failure data. To examine regional variations, nine survey regions in the United States and Canada were selected. The regions defined in the study are used here to indicate the wide geographical distribution of the respondents. Table 1 lists the number of respondents with failure data, the miles of pipe, and the population served in the basic and detailed surveys from each region. Figure 1 illustrates the locations of the nine different regions used in this report. Respondents were asked to report the length of water supply mains in their system but not to include sewer or force mains or lines with a diameter less than 3 inches. Figure 2 illustrates the miles of water main pipe that were reported in the basic and detailed surveys on a regional basis. A total of 170,569 miles and 98,097 miles of pipe was reported by respondents in the basic and detailed surveys, respectively. Figure 3 illustrates the number of respondents from each region. There were 26 additional respondents to the basic survey that could not provide failure data and these are not included in the miles of pipe or populations served in Table 1. The respondents are distributed across a large survey area. The basic survey was able to get respondents from 48 of the 50 states in the US and 7 out of 10 provinces in Canada. This study is more comprehensive than other studies to date.

Based on miles of pipe shown in Figure 2, the basic survey got the most miles of pipe from Regions 2 and 5. Figure 3 shows that the peak number of respondents came from Region 6.

Figure 4 shows the average miles of pipe per utility for the basic survey by region. Region 2 had the highest average pipe length of 851 miles and Region 6 had the smallest with 378 miles. Overall, based on the basic survey, an average utility participant had 607 miles of pipe and served 186,752 people. For comparison, the 2012 survey results reported an average utility had 626 miles of pipe and served 164,325 people, which are similar results. The 2012 survey had 188 respondents covering 117,603 miles of pipe with failure data and thus the 2018 basic survey had a 49% increase in respondents and 45% more miles of pipe. This increase in survey coverage increases the statistical validity of this study.

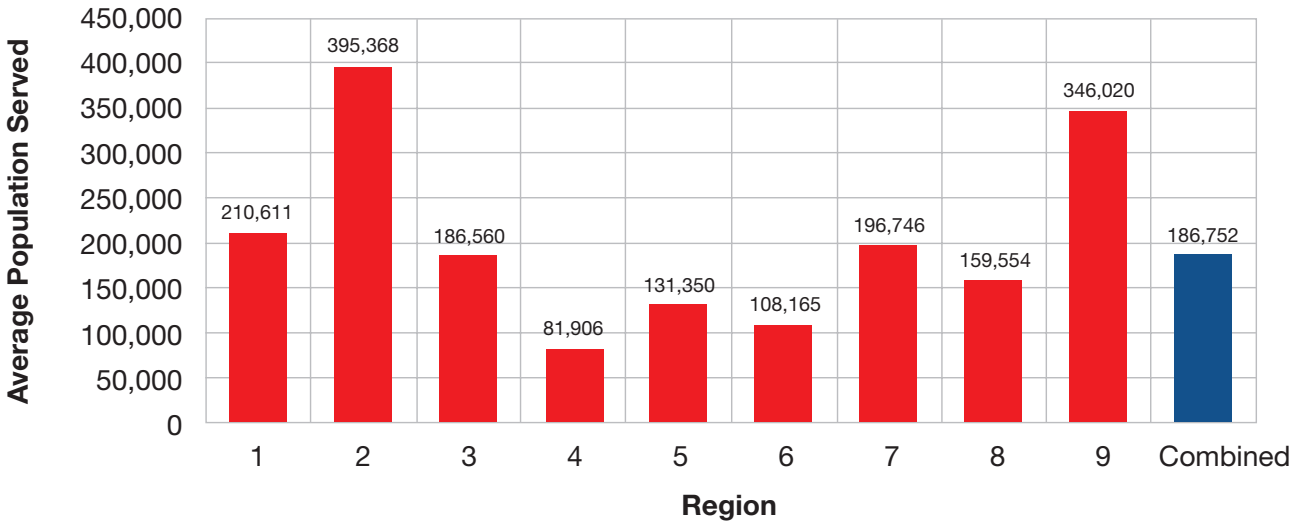
FIGURE 4: AVERAGE MILES OF PIPE FROM EACH REGION RESPONDING TO THE BASIC SURVEY



2.4. Size of Survey Participants

Figure 5 shows the average population served per utility for each region in Figure 1. The average population served per utility for the entire basic survey was 186,752.

FIGURE 5: AVERAGE POPULATION SERVED FROM EACH REGION RESPONDING TO THE BASIC SURVEY

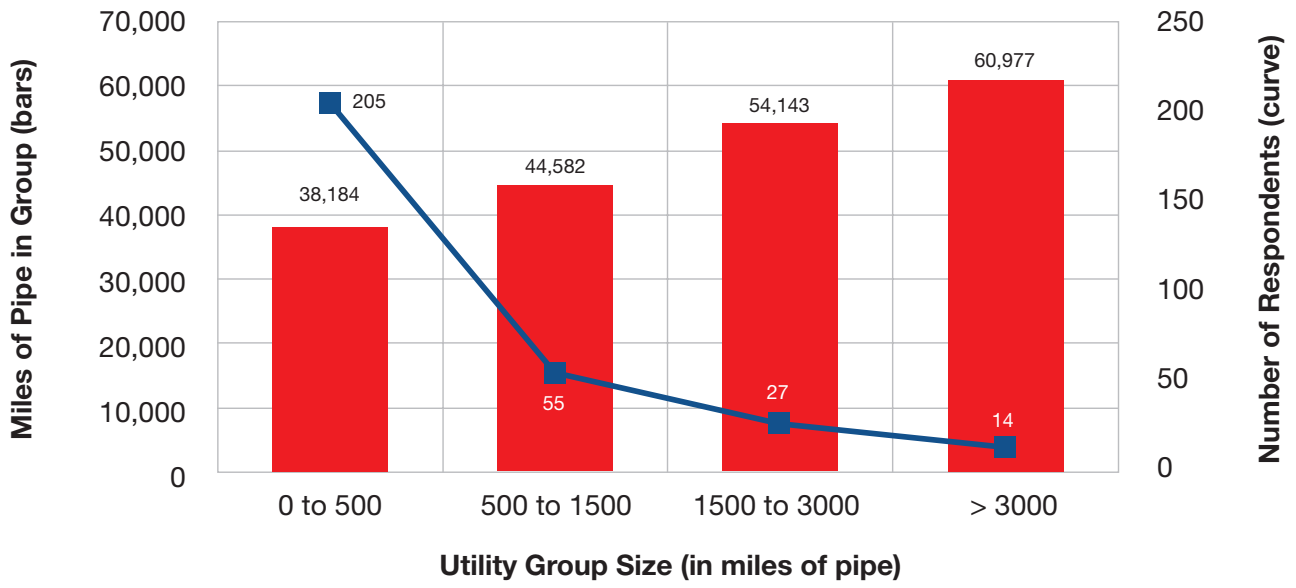


Four categories of utility size were used as shown in Table 2 and each survey participant was allocated to one of the categories based on the miles of installed water mains. Figure 6 shows the distribution of total miles of pipe from the basic survey based on these categories (bar graph) along with the number of respondents (line graph with right axis). Respondents covered the range from very small to very large with each group from Table 2 well represented. In terms of total length of pipe from each of the size groups in Table 2, this survey has reasonable uniform distribution of pipe length from small to large utilities.

TABLE 2: GROUPING OF UTILITY SIZE

Description	Miles of Pipe Installed
Small Utility/City	0 to 500 miles
Medium Utility/City	500 to 1500 miles
Large Utility/City	1500 to 3000 miles
Very Large Utility/City	Over 3000 miles

FIGURE 6: TOTAL MILES OF PIPE IN THE BASIC SURVEY IN EACH SIZE GROUP DEFINED IN TABLE 2 AND THE NUMBER OF RESPONDENTS (CURVE AND RIGHT AXIS)



2.5. Miles of Pipe vs. Population

Figure 7 illustrates the relationship between the population served by the utilities participating in the basic survey and the number of miles of water main pipe. The trend line and equation are a best fit to the data. The slope of this line indicates that there are on average 322 people served for each mile of water main installed. Figure 7 tends to be biased by the points most distant from the origin. Figure 8 utilizes the data in Table 1 to compute average population served per mile of pipe for each region. We see that this produces an overall average of 308 people served per mile. More rural areas such as Regions 3, 4, and 5 have lower population to miles of pipe ratios as expected. Utilities that were exclusively transmission systems were excluded. This compares with a commonly used estimate of 325 people per mile (Eidinger, 2001). The 2012 survey reported this value as 264 people served per mile. Pipe breaks in utilities with a higher count of people per mile would have a greater impact on the community.

FIGURE 7: POPULATION SERVED RELATIVE TO TOTAL MILES OF PIPE FROM THE BASIC SURVEY

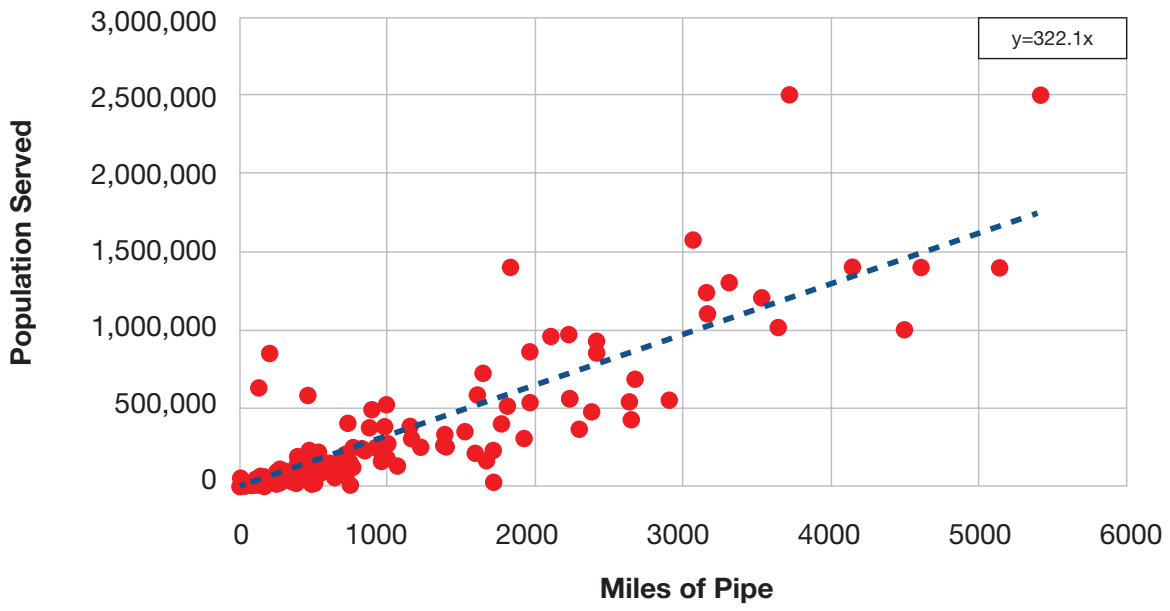
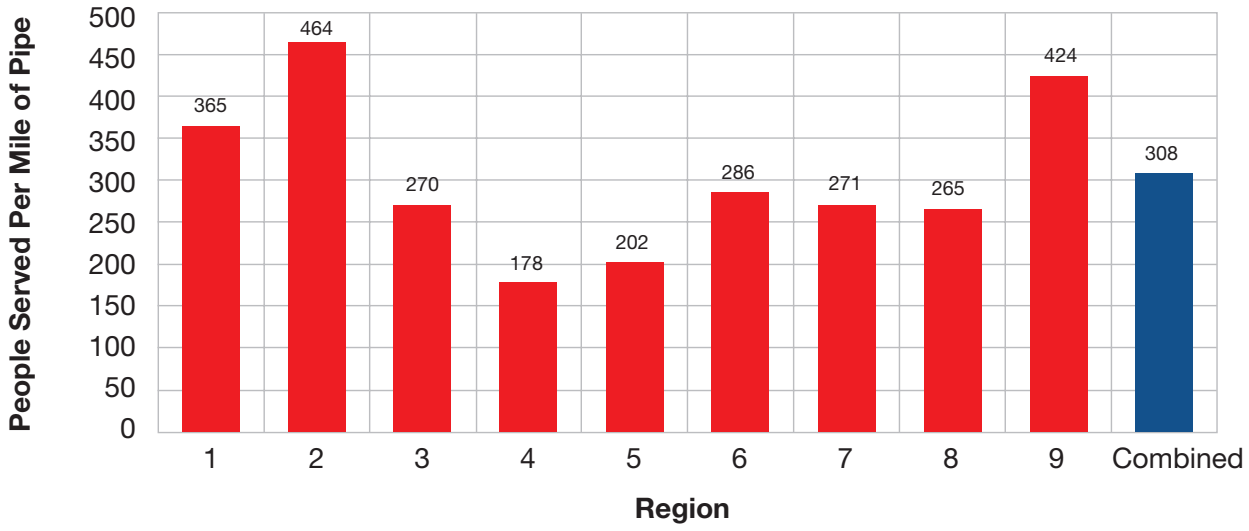


FIGURE 8: POPULATION SERVED PER MILE BY REGION



2.6. Survey Sample Size

The total length of water main pipe reported by the 281 basic survey participants with break data was 170,569 miles (the survey did not include sewer or force mains). Based on an EPA report, there are approximately 880,000 miles of distribution pipe in the USA (EPA, 2007). Other EPA reports (EPA, 2002 and EPA, 2013) estimate the amount of installed water main pipe in the USA at over 1 million miles and 1.5 million miles. Using the above result of 308 people/mile of water main and the current US population of 326.0 million, this produces an estimate of 1.06 million miles of pipe. Currently, a commonly cited value for the length of water mains in the US is 1.2 million miles (Walton, 2016). The population of Canada is estimated at 36.7 million. Assuming there are 308 people served per mile of pipe in Canada, then an estimate of the miles of pipe in Canada is 119,156 miles. Table 3 summarizes this data along with survey results from Table 1 to show that this survey covered approximately 14.5% of the population and 12.9% of the miles of water mains in both the US and Canada. Thus, survey sample size is significant and therefore can provide reliable results.

Small and rural communities may find it challenging to renew their water infrastructure in the coming years. Small utilities have fewer people, and those people are often more spread out, requiring more pipe "miles per customer" than urban systems (AWWA, 2012). This has the effect of increasing the financial burden of maintaining these systems.

TABLE 3: SUMMARY CALCULATIONS OF THE COVERAGE OF THE BASIC SURVEY

	Population	Miles of Pipe
US	326,000,000[1]	1,200,000[3]
Canada	36,700,000[2]	119,156[4]
Total	362,700,000	1,319,156
Survey Response (with break data)	52,477,346	170,569
Survey Coverage (%)	14.5%	12.9%

1- Source: https://www.census.gov/popclock/
2- Source: http://www.worldometers.info/world-population/canada-population/
3- Source: (Walton, 2016)
4- From: the population of Canada 36,700,000 and there are 308 people/mile of pipe.

3.0 Pipe Materials

Table 4 lists the pipe materials and their abbreviation used in this report. Many pipe products have evolved over the years of use, and most pipe products could be broken down into subcategories based on pipe manufacturing and surface treatments. These changes along with new installation techniques should affect life expectancy of the pipe. Both the basic and detailed surveys were intended to be relatively simple to complete and, thus, encourage wide scale participation of the water utilities. Most utilities have limited records as to which specific pipe materials were installed decades ago and what corrosion protection measures were used. Therefore, tracking subcategories of material types was not part of this study.

Figure 9 illustrates the length of pipe reported in the basic survey broken down by pipe material. The "Other" category in Figure 9 includes materials such as copper, fiberglass (FRP), and some galvanized steel. It is noted that galvanized steel was reported in both the steel and other categories by participants, which was unfortunate. Figure 10 illustrates the percentage of total length of water mains separated by pipe material. There is so little HDPE pipe (859 miles) and PVCO pipe (83 miles) in this survey, that these two pipe materials will be added to the of the "Other" category in the remainder of this report. If there are only small amounts of a pipe material utilized, break rates can be highly inaccurate because of large scatter in the data. It is significant to consider that over 91% of the water mains are made from asbestos cement, cast iron, ductile iron, and PVC materials. This is consistent with earlier studies (Stone et al., 2002).

TABLE 4: MATERIAL TYPES AND THEIR ABBREVIATIONS

Abbreviation	Description
AC	Asbestos Cement
CI	Cast Iron
CSC	Concrete Steel Cylinder
DI	Ductile Iron
HDPE	High Density Polyethylene
PVC	Polyvinyl Chloride
PVCO	Molecularly Oriented PVC
Steel	Steel

FIGURE 9: LENGTH OF PIPE SEPARATED BY MATERIAL TYPE FROM THE BASIC SURVEY

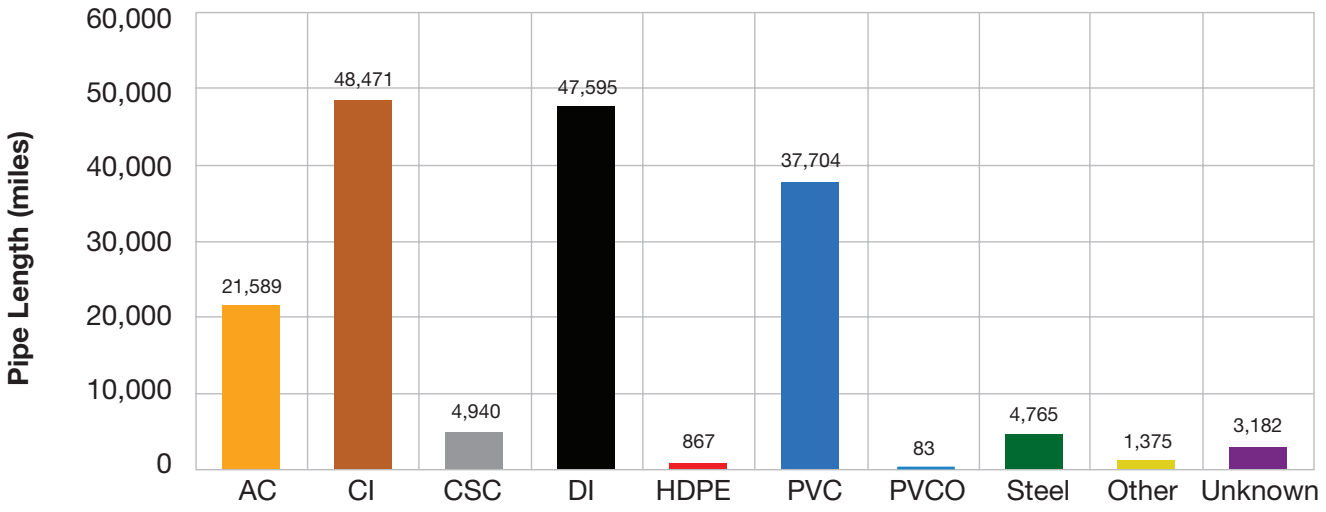


FIGURE 10: PERCENT OF TOTAL LENGTH OF PIPE SEPARATED BY MATERIAL TYPE

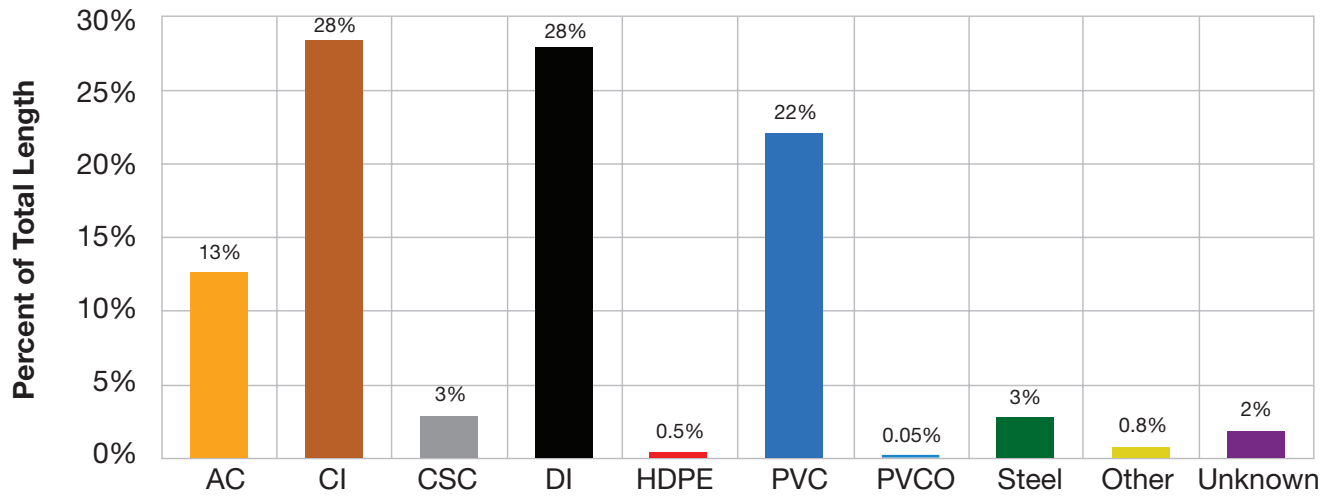


Figure 11 illustrates the regional distribution of pipe material usage as a percentage of the total length in that region. It is interesting to note the significant differences in regional pipe material utilization. Cast iron (CI) and ductile iron (DI) pipe represent approximately 86% of the water mains in Region 6 and over 75% in Regions 4, 7, and 8. PVC has a leading role in Regions 3, 5 and 9 and is slightly behind asbestos cement (AC) pipe in Region 2. AC pipe has a significant presence in Regions 2 and 5. Region 2 is unique in that it is the only region where AC pipe is the most common material. This suggests that the selection and use of pipe materials are based on historical preference versus comparative cost analysis or environmental conditions. Since CI and AC pipes are no longer manufactured in the US and Canada, the use of these materials in water systems should be decreasing with time as they are replaced. By applying asset management best practices, life cycle cost analysis should be used to do a comparative total cost of ownership evaluation of what pipe material should replace the CI and AC pipes.

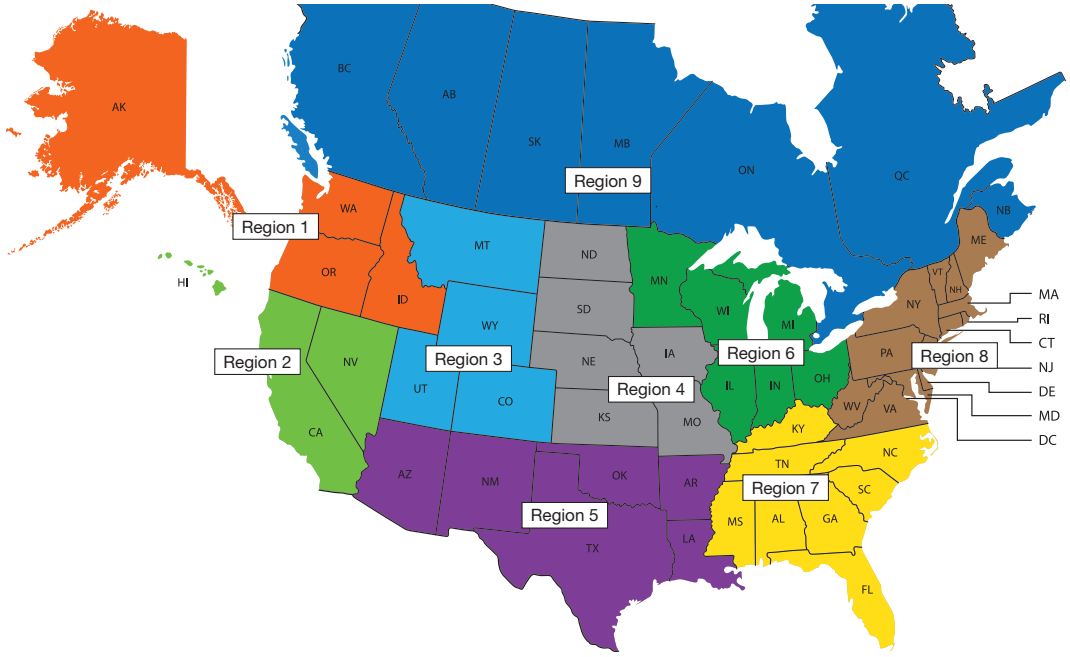
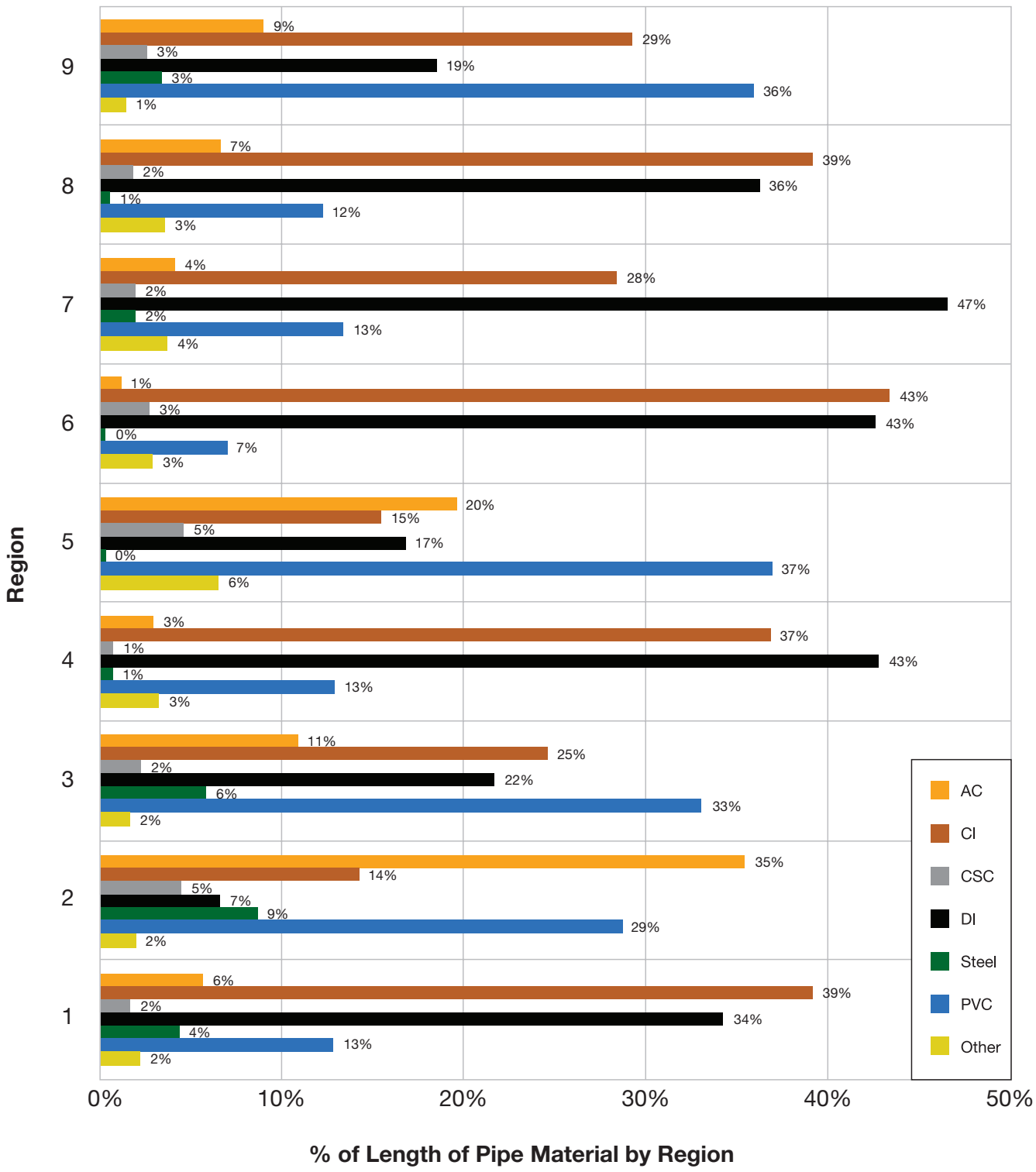


FIGURE 11: REGIONAL PERCENTAGE OF LENGTH OF PIPE BY MATERIAL TYPE (BASIC SURVEY)



3.1. Pipe Age and Diameter

The detailed survey asked respondents to provide the distribution of installed pipe by age and by material type. Four age groups were provided; 0 to 10 years, 10 to 20 years, 20 to 50 years, and over 50 years. Figure 12 shows the age distribution for all pipe materials combined and shows 28% of installed pipes are over 50 years old. Figure 13 illustrates the age distribution for each material type by length. For example, essentially all cast iron pipe is over 20 years old and 18% of it is in the 20 to 50 year category while 82% is over 50 years of age.

Figure 14 shows the age distribution as a percentage of total length of all pipe materials. For example, cast iron pipe older than 50 years is 20% of all installed pipe. For ages between 0 to 10 years, ductile iron (DI) and PVC both have about 5% of the total installed length. The most common pipe materials installed during the last 10 years are DI and PVC.

FIGURE 12: PIPE AGE DISTRIBUTION FOR ALL MATERIAL TYPES FROM THE DETAILED SURVEY

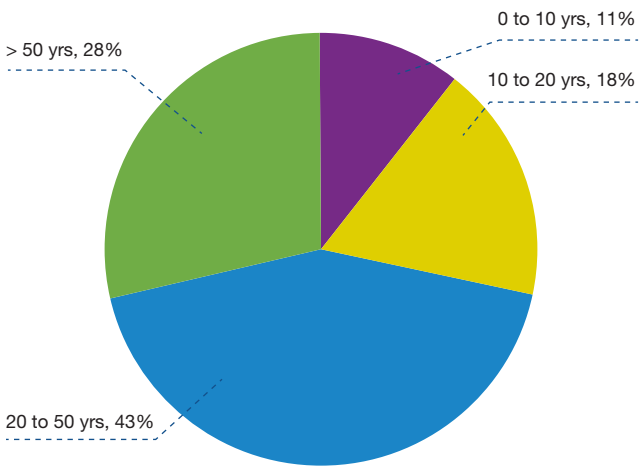


FIGURE 13: PIPE AGE DISTRIBUTION FOR EACH MATERIAL TYPE FROM THE DETAILED SURVEY

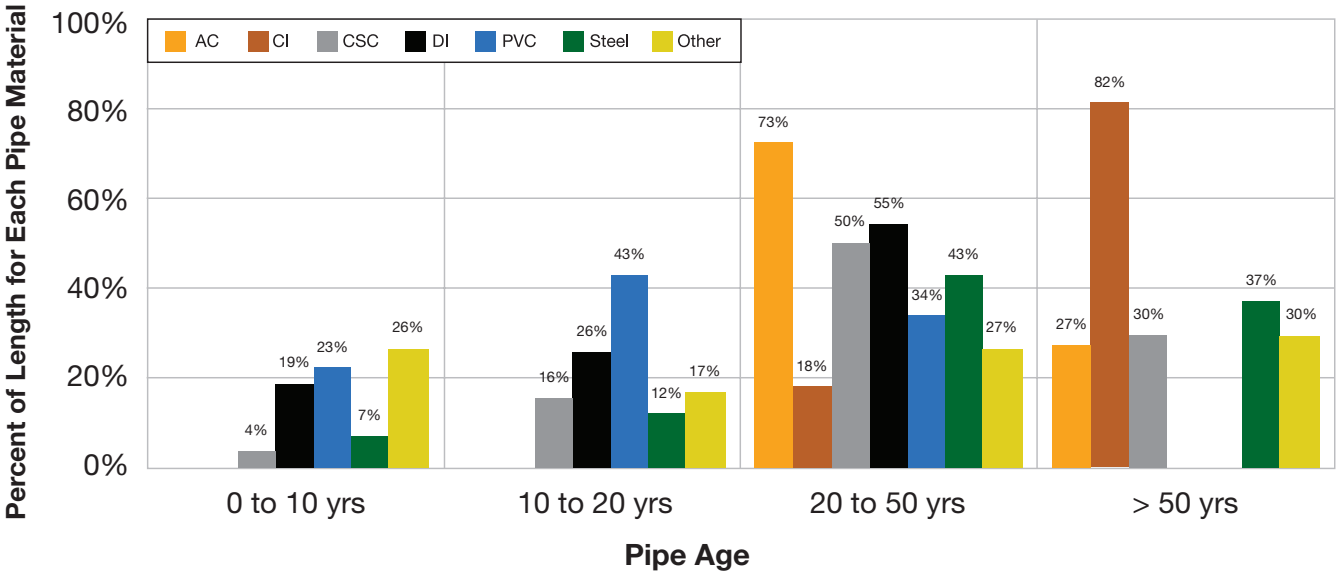
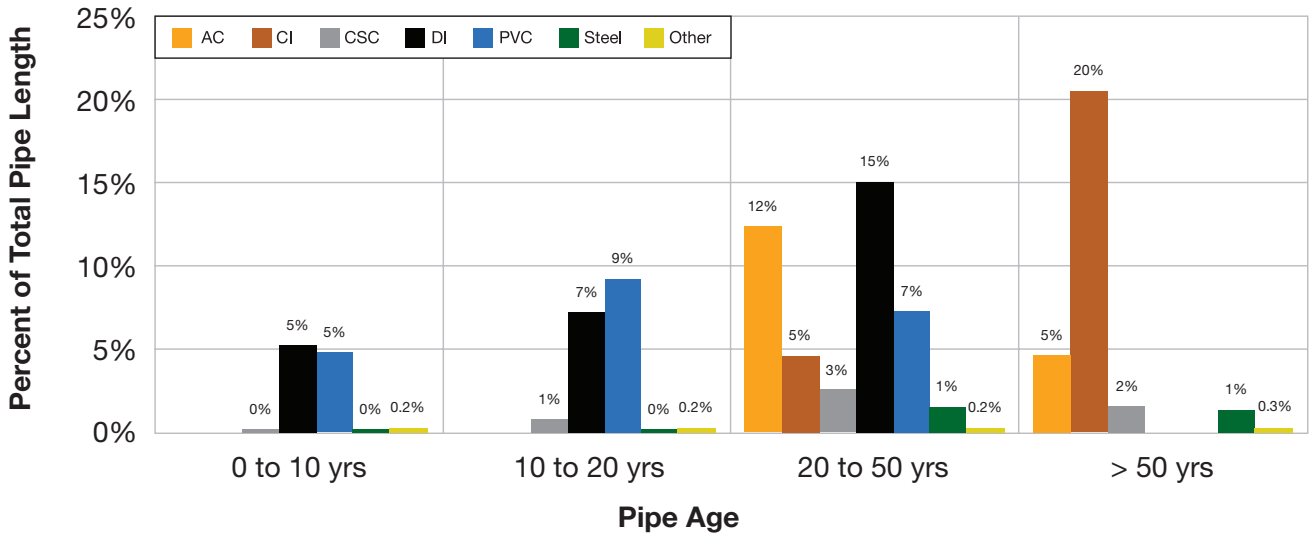


FIGURE 14: PERCENT OF TOTAL LENGTH OF PIPE BY AGE FROM THE DETAILED SURVEY



The detailed survey respondents were also asked to break down the fraction of total installed pipe length by six pipe diameter categories. Figure 15 illustrates the percentage of water main that fit into each size range. Figure 15 indicates that approximately 67% of the installed pipe is 8 inches or less in diameter. The 2012 survey found that 66% of the pipe was 8 inches or less in diameter showing good agreement. Earlier studies assumed 73% of water pipes were 10 inches or less in diameter (Stone et al., 2002). Figure 16 illustrates the diameter distribution for each material type. Figure 16 shows that large diameter transmission pipes are dominated by steel and concrete pipe materials with 18% of all concrete pipe and 14% of all steel pipe having a diameter greater than 48-inches. Figure 17 illustrates the percent of total length of all pipe materials broken down by material type and diameter. Figure 17 illustrates that cast iron pipe from 3 to 8 inches in diameter represents over 19% of the installed pipe.

FIGURE 15: PERCENT OF TOTAL LENGTH OF PIPE BY AGE FROM THE DETAILED SURVEY

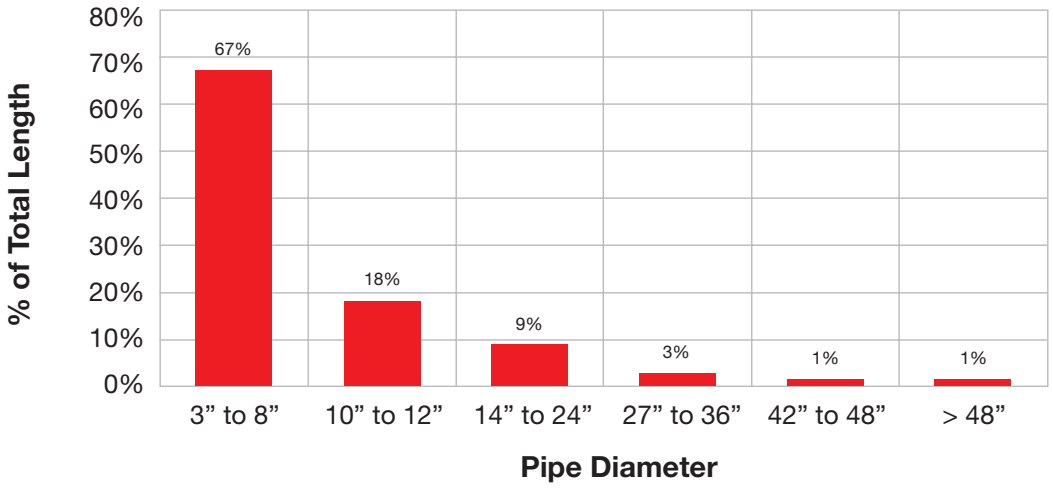


FIGURE 16: PIPE DIAMETER DISTRIBUTION BY MATERIAL TYPE FROM THE DETAILED SURVEY

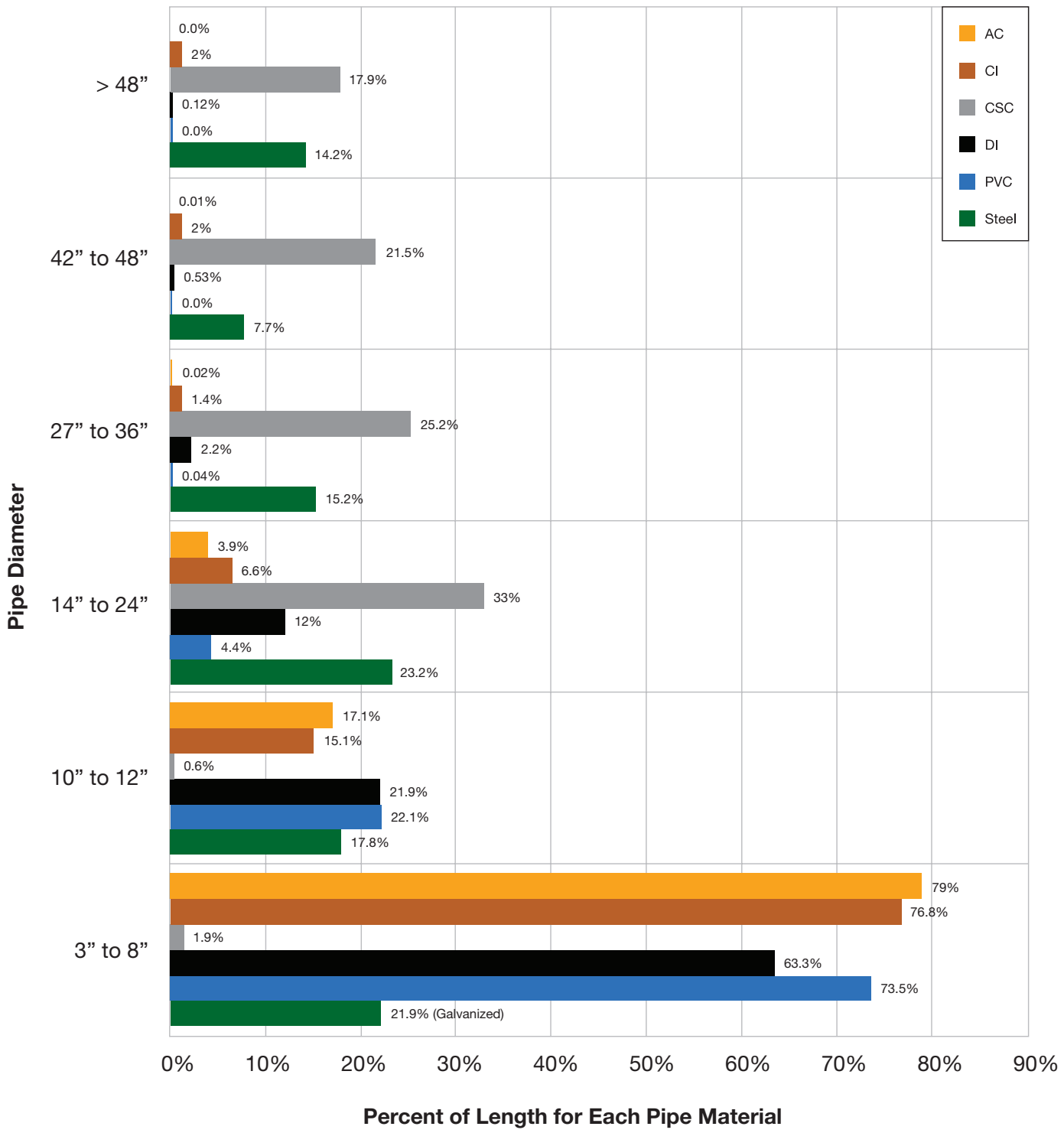
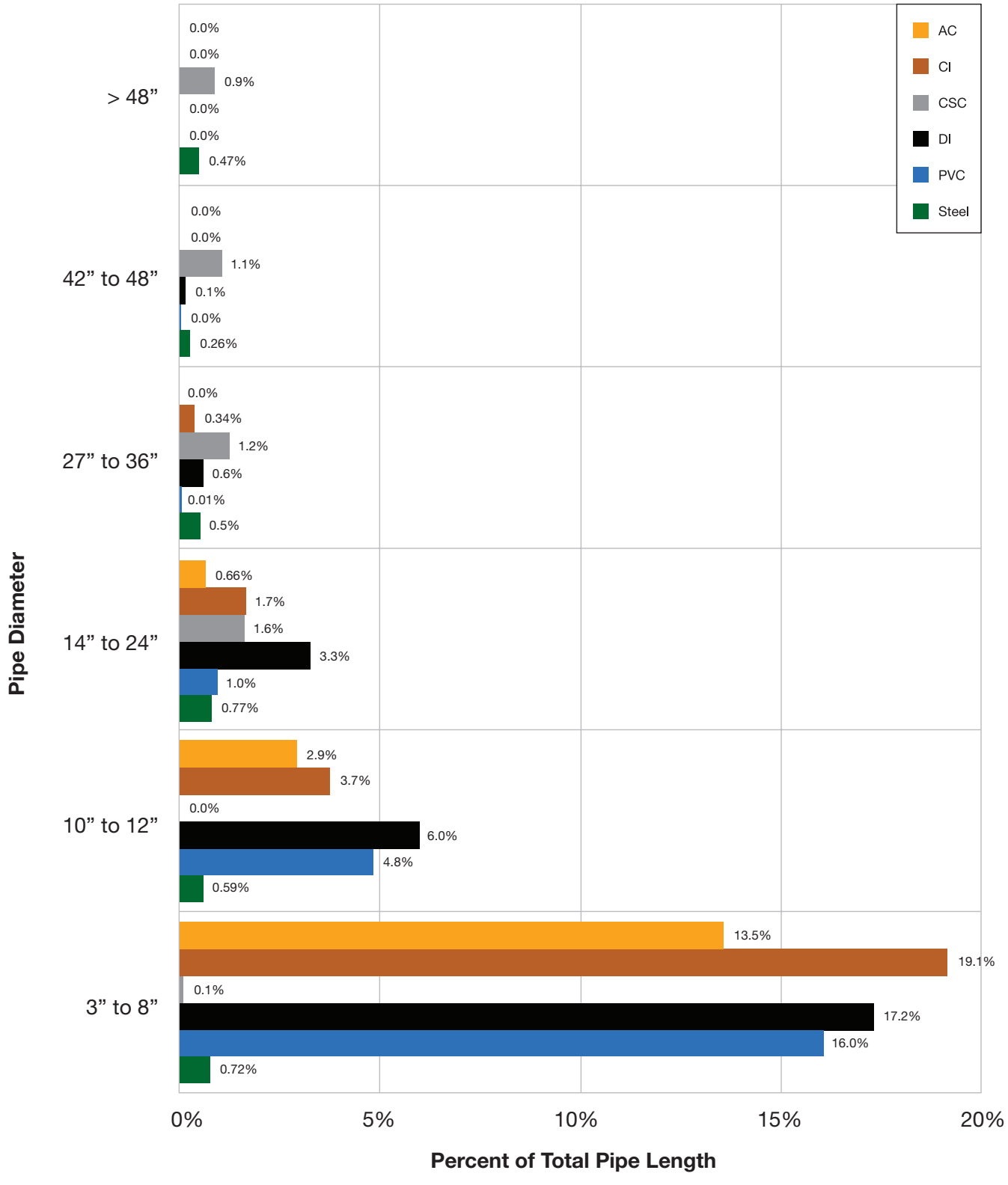


FIGURE 17: PERCENT OF TOTAL PIPE LENGTH BROKEN DOWN BY PIPE DIAMETER AND MATERIAL TYPE FROM THE DETAILED SURVEY



4.0 Delivery Pressure and Volume

The basic survey asked for the average and maximum water supply pressures. The mean values are 69 and 119 psi. The average of the reported values is illustrated in Figure 18. In the 2012 survey, the average pressure was 77 psi which has good agreement with this survey result but also indicates a possible downward trend. It is noted that some utilities have reduced operating pressures to reduce leakage rates. Pressure control and reduction is a common methodology to both reduce water leaks and reduce water main breaks.

The detailed survey asked for the average and maximum daily water demand. The reported values were divided by the population served and averaged. Utilities that were only transmission systems were excluded. The average water demand is 137 gallons per day for each person. The maximum water demand is 251 gallons per day for each person. Water demands are related to the population served. Figure 19 plots each utility's average and maximum demand values in units of MGD (millions of gallons per day) versus the population served in millions. Also provided are linear fit equations to the data (the dotted lines) and their equations. For example, a utility with a population of one million people would have a maximum water demand of 215 MGD and an average demand of 131 MGD.

FIGURE 18: AVERAGE AND MAXIMUM WATER SUPPLY PRESSURES

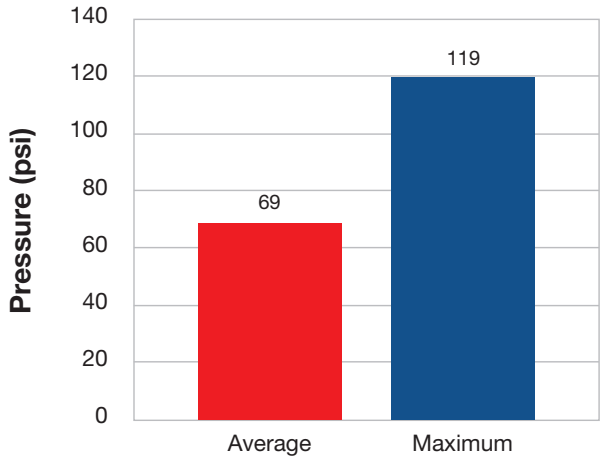
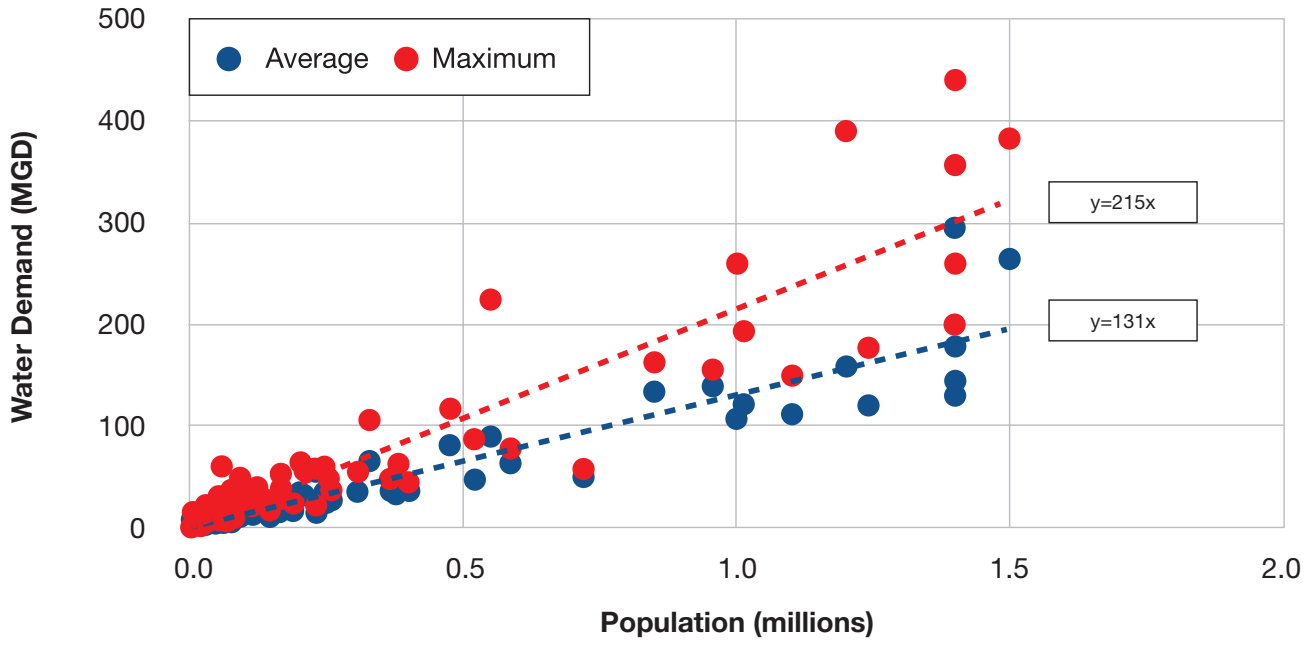


FIGURE 19: AVERAGE AND MAXIMUM WATER DEMAND VERSUS POPULATION



5.0 Computing Water Main Failure Rates

Both the basic and detailed surveys asked respondents to consider a water main failure as one where leakage was detected, and repairs were made. However, they were requested to not report failures due to joint leakage, construction damage, or tapping of service lines because these failures are not indicative of pipe degradation and are often identified early in the first year of operation. The goal was to examine pipe longevity.

Utilities reported the number of failures over a recent 12-month period for each pipe material and the installed length of each pipe material. The failure rate was computed by dividing the total number of failures from all utilities for a particular pipe material by the total length of that pipe material.

For example, the survey reported a total of 23,803 failures of water mains during a recent 12-month period for all pipe materials. The total installed water main length from the survey was 170,569 miles (or 1705.69 hundreds of miles). Thus, the overall failure rate is 23,803/1705.69 = 14.0 failures/(100 miles)/year. This represents a 27% increase from the 2012 survey which had a rate of 11 failures/(100 miles)/year.

This simple method for computing failure rates was used because it discourages biases toward large or small utilities. It is noted that utilities experience widely different failure rates for the same pipe material. Indeed, this should not be surprising. Several significant variables affect the results including pipe age, soil types (corrosive or noncorrosive), different corrosion prevention techniques, different installation practices, and climate such as extreme cold and drought events.

Literature reviews indicate that between 250,000 and 300,000 breaks occur every year in the U.S., which corresponds to a rate of 25 to 30 breaks/(100 miles)/year (Grigg, 2007; Deb et al., 2002). The AWWA Partnership for Safe Water Distribution System Optimization Program goal for a fully-optimized distribution system is 15 breaks per 100 miles of pipe annually (AWWA Partnership for Safe Water, 2011). Pipe material performance and selection is an important component of optimizing distribution systems.

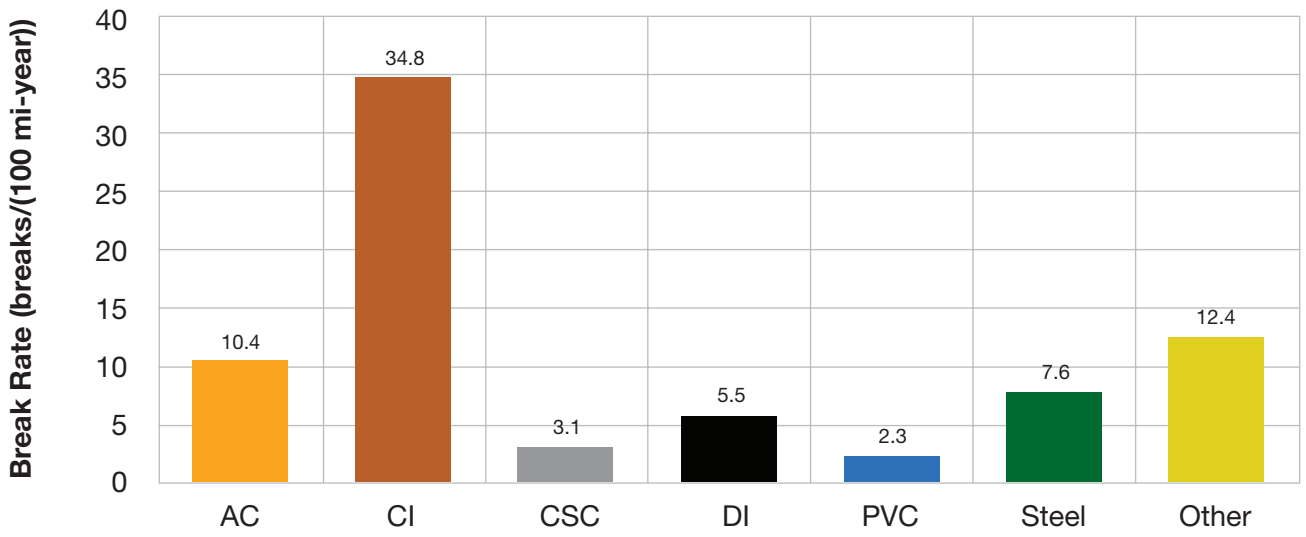
5.1. Failure Rates for Each Pipe Material

The survey measured pipe failures over a recent 12-month period and was broken down by material type. Table 5 lists the total length of pipe by material type, the number of failures (breaks) over a recent 12-month period, the break rate for each pipe material, the 2012 survey break rates, and the percent change in break rates. Figure 20 illustrates the failure rates as a function of material type. In both the 2012 and 2018 surveys, PVC was the pipe material with the lowest break rate.

TABLE 5: SUMMARY OF FAILURE DATA FROM THE BASIC SURVEY OVER A 12-MONTH PERIOD

	Length	Failures	2018 Break Rate	2012 Break Rate	% Change
AC	21,589	2,240	10.4	7.1	46%
CI	48,471	16,864	34.8	24.4	43%
CSC	4,940	152	3.1	5.4	-43%
DI	47,595	2,627	5.5	4.9	13%
PVC	37,704	878	2.3	2.6	-10%
Steel	4,765	362	7.6	13.5	-44%
Other	5,506	680	12.4	21	-41%
Total	170,569	23,803	14.0	11	27%

FIGURE 20: BREAK RATES OF EACH PIPE MATERIAL FROM THE BASIC SURVEY



Comparing this 2018 survey with the 2012 survey in Table 5 shows that overall, break rates increased by 27%. The change is primarily due to failures in asbestos cement (AC) and cast iron (CI) pipes with increases of break rates by over 40%. As Figure 14 shows, AC and CI pipe represent the largest percentage of oldest pipe currently installed and thus are nearing the end of their useful lives. Many studies show that water-main failure rates generally increase exponentially over time (Kleiner, 2002). One could envision a rapid increase in break rates in the future as illustrated in Figure 21. Certain utilities could experience the need to rapidly accelerate the rate at which they are replacing CI and AC water mains. If a break rate doubles, the economic impact is significant; one would need to double the number personnel repairing the breaks along with supplies while loss of treated water increases, and societal impacts could be devastating.

Figure 22 compares the break rates of the 2012 and 2018 surveys. Since over 90% of installed pipe consists of AC, CI, DI, and PVC, the break rates for those material types will be most accurate. From 2012 to 2018, Figure 22 shows a small decrease in break rates for PVC and a small increase for DI pipe. The overall consistency of those values demonstrates they are accurate. Again, the increase in break rates for AC and CI pipes is a very significant observation.

The amount of concrete and steel pipe in this survey is less than 6% of the total installed pipe length. When only a small amount of pipe break data is available, the accuracy of the break rates from survey data will be decreased. The 42% decrease in break rate for concrete pipe was likely due to the fact that over twice as much concrete pipe is in this 2018 survey and should be more accurate. Steel pipe also saw a large decrease in break rates. The break rate for steel pipes are largely attributed to smaller diameter galvanized steel pipes that are rapidly being replaced. Large diameter steel pipes used in transmission lines have a very low break rate.

FIGURE 21: EXPONENTIAL CHANGE IN BREAK RATES

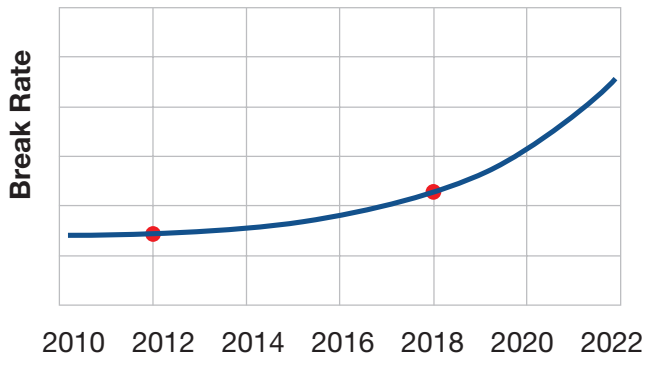
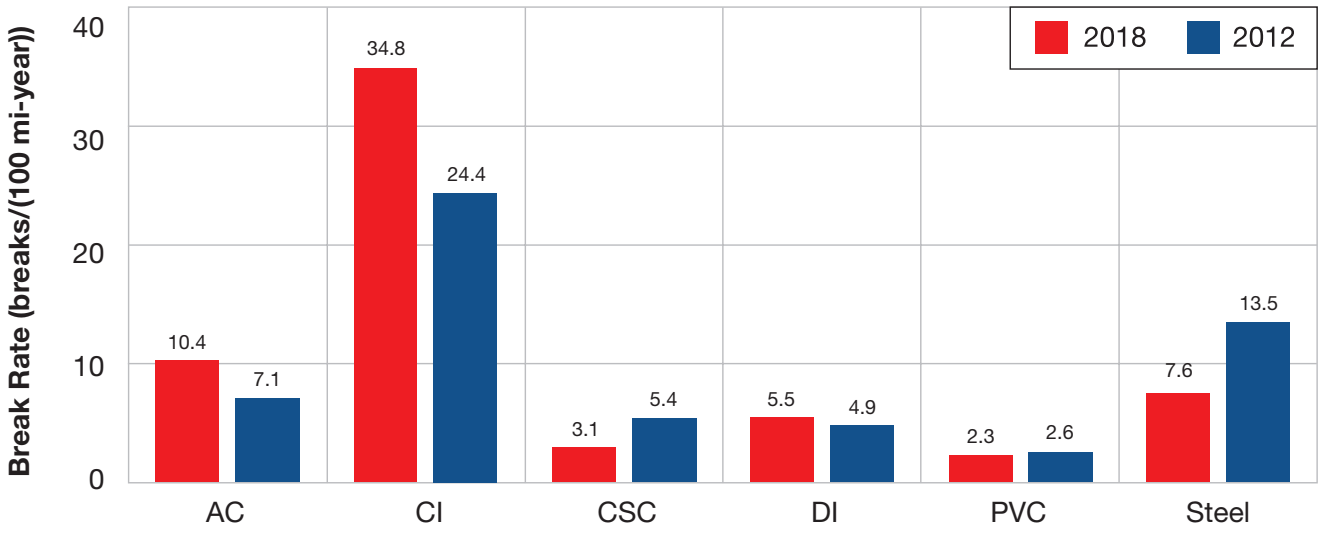


FIGURE 22: COMPARISON OF BREAK RATES OF THE 2018 AND 2012 SURVEYS



The size of a utility can affect break rates. Three sizes of utilities are considered here based on the length of pipe; small with less than 200 miles, intermediate with 200 to 1000 miles, and large with over 1000 miles. Figure 23 illustrates the overall break rate (for all pipe materials) and then separated by the four most common pipe materials in these three utility sizes. The large utilities consistently had lower break rates than intermediate and smaller utilities. This is likely due to better funding and larger staffs for engineering design, monitoring and information gathering, installation oversight, and repair of water mains. It is very significant that small utilities consistently have break rates at least double that of a large utility.

FIGURE 23: BREAK RATES BY UTILITY SIZE FROM THE BASIC SURVEY

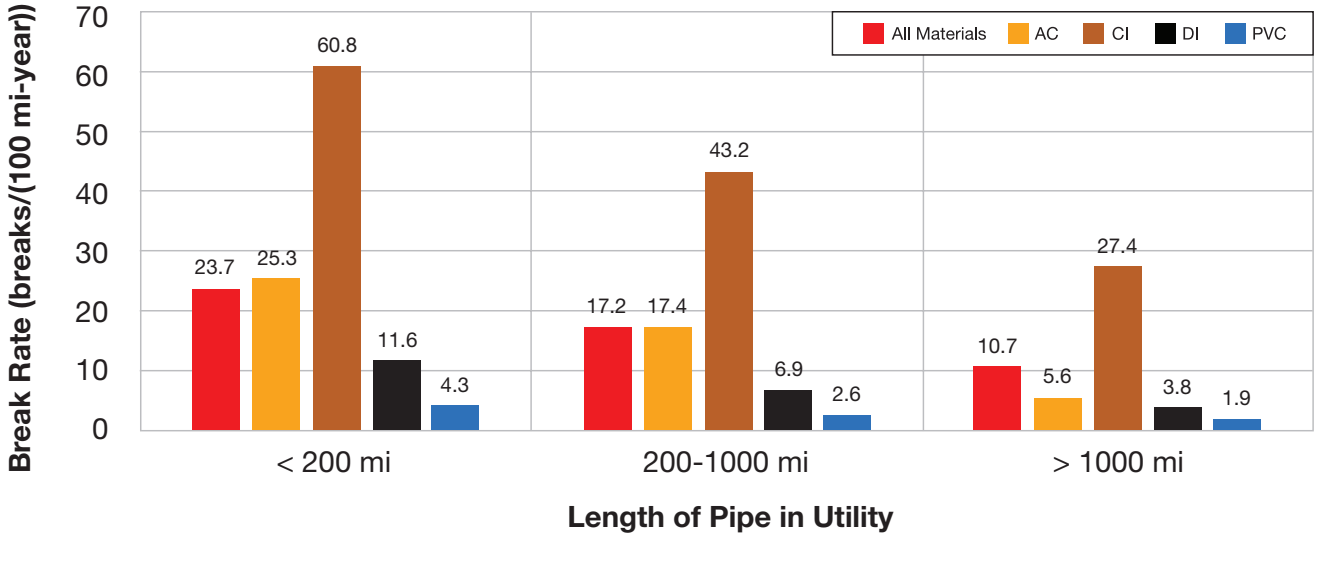


Figure 24 illustrates the overall break rate broken down by region. Clearly not all regions are experiencing the same failure rate. In Table 1, the number of respondents for each region is reported. It was desired to separate US and Canadian break rate data. This is illustrated in Figure 25. Canada can have very corrosive soils (Seargeant, 2013) and this is reflected in the high break rates of cast and ductile iron pipes in Figure 25. Seargeant reported that the highly corrosive soil in Edmonton necessitated a transition from cast iron to asbestos cement pipes in 1966 and then to PVC starting in 1977. The transition to PVC has produced a dramatic reduction in water main break rates for the city.

FIGURE 24: OVERALL BREAK RATES BY REGION FROM THE BASIC SURVEY

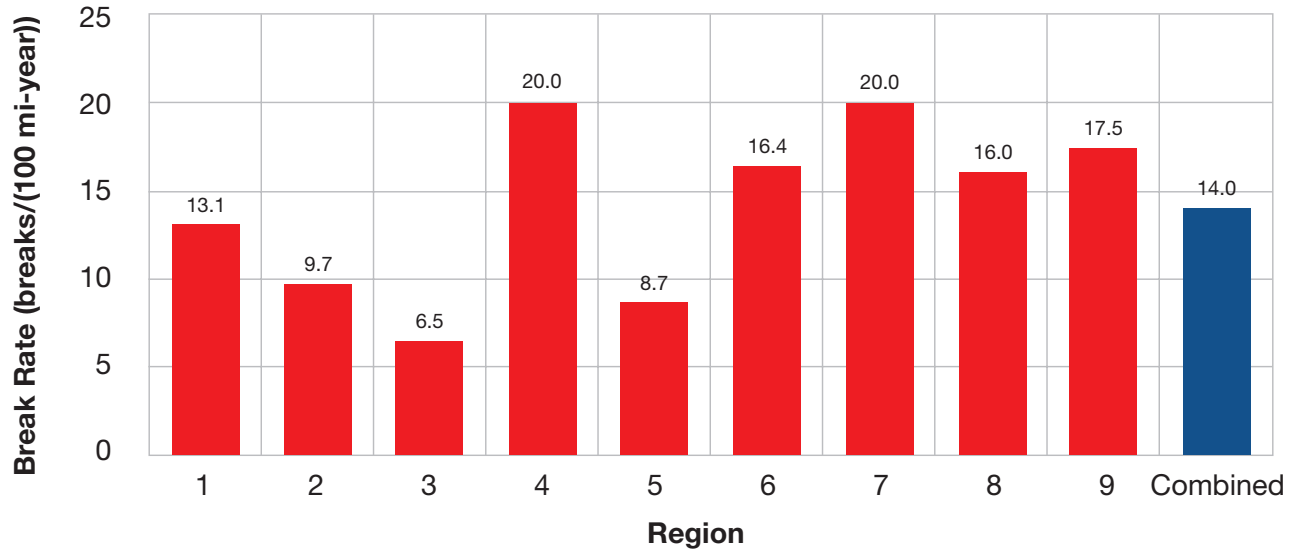
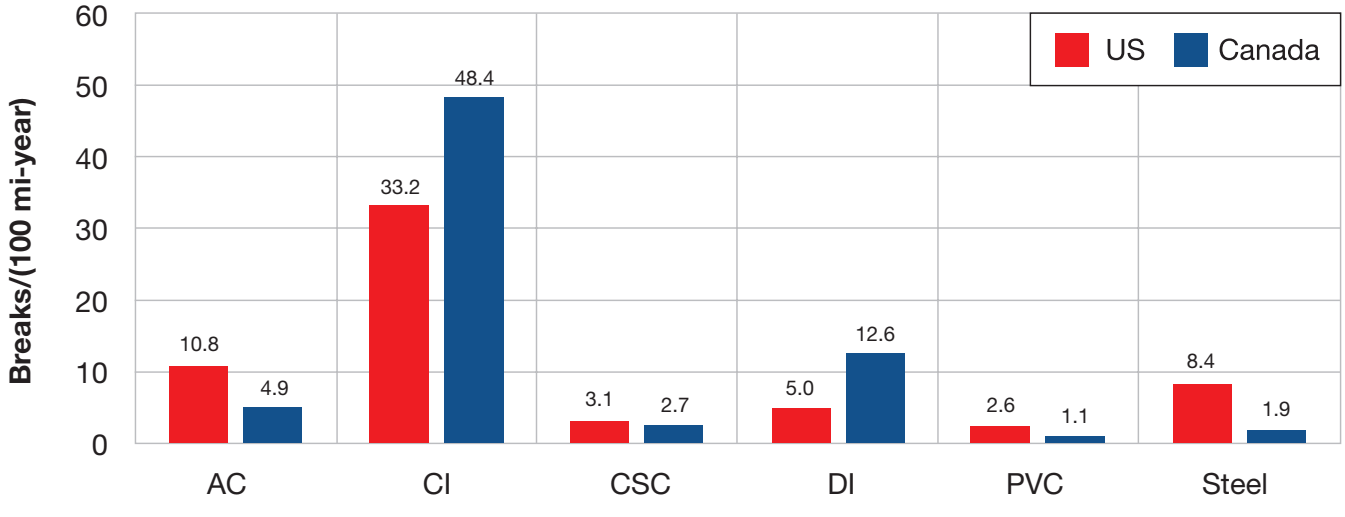


FIGURE 25: BREAK RATES FROM THE US AND CANADA FOR SELECTED MATERIAL TYPES



5.2. Effects of Age

The basic survey asked respondents to break down the failures into the decade when they were installed. Some of the respondents did not know the age of the failed pipes and they were not included in the results. Figure 26 illustrates the percentage of failures of each pipe material based on the decade of installation. For example, asbestos cement (AC) pipe had 60% of the breaks from pipe installed in the 1960's, 28% in the 1970's, and 12% of the breaks in pipes installed in the 1980's. Note that the largest percentage of failures is usually not in the oldest pipes (AC being an exception), which has several possible causes. One important cause is the amount of pipe present in a given age range. As the older pipe is replaced there is less available to fail. Also, cast iron and ductile pipe wall thickness has decreased over the years which can affect time to failure. The results in Figure 26 are also related to when a pipe material was introduced or removed from the market. AC pipe has not been installed in the USA and Canada in the past 25 years, and thus, all AC pipe failures date from the 1980's and earlier. Little cast iron pipe has been installed since the 1980's and that is reflected in Figure 26. Widespread ductile iron and PVC pipe production in the USA did not start until about 1970, so we should expect to see a small failure percentage for both DI and PVC installed in the 1960's and none in the 1950's and earlier.

Most of the failure versus age distributions in Figure 26 seem to be quasi bell-shaped (again, asbestos cement pipe failures are an exception). It would appear the AC pipe installed in the 1960's may be near its end of life and utilities may want to consider planning for rapid replacement of that pipe. Cast iron pipe shows the most uniform failure distribution and does not give much guidance on which pipe age needs replacement first.

5.3. Target Replacement Break Rate

The detailed survey asked participants if they utilized a target break rate at which pipe replacement was implemented. Only 28% of the respondents said that they had a specific value. The average response was a target rate of 11 breaks/(100 miles)/year. Most respondents commented that they do not have a specific target break rate. However, break rates are a very important factor when locations for critical services are considered and when roads are being reconstructed. Although Figure 26 provides some insight to when pipe needs to be replaced, the most appropriate metric to making this decision should come from looking at break rates at sections of pipe with a similar age and material.

5.4. Most Common Failure Age and Mode

The detailed survey asked the participants the typical pipe age of most water main failures. The average response was 50 years with a range from 10 to 100 years. In 2012 the average age of failing water mains was reported as 47 years. Given the qualitative nature of this question, the typical age of a failing water main has not changed significantly over the past six years.

The detailed survey requested participants to select the most common failure mode from the following: corrosion, bell split, circumferential crack, longitudinal crack, leakage at joints, fatigue, or other. Figure 27 illustrates that 56% of the respondents identified a circumferential crack as the most common followed by corrosion at 28%. These are the typical failure modes of CI and AC pipe.

An alternate approach to examine the failure modes is by using those reported in the basic survey. Participants were asked to provide a cause of failure from the following list; circumferential crack, longitudinal crack, corrosion (internal or external), bell splitting, rock impingement, other, or unknown. Where multiple failures occurred, multiple causes were given, and each was given equal weight. Figure 28 illustrates the percentage of each failure mode with unknown responses ignored. Again, the top two failure modes are circumferential cracks followed by corrosion.

FIGURE 26: PERCENT OF FAILURES PER DECADE OF INSTALLED PIPE MATERIAL

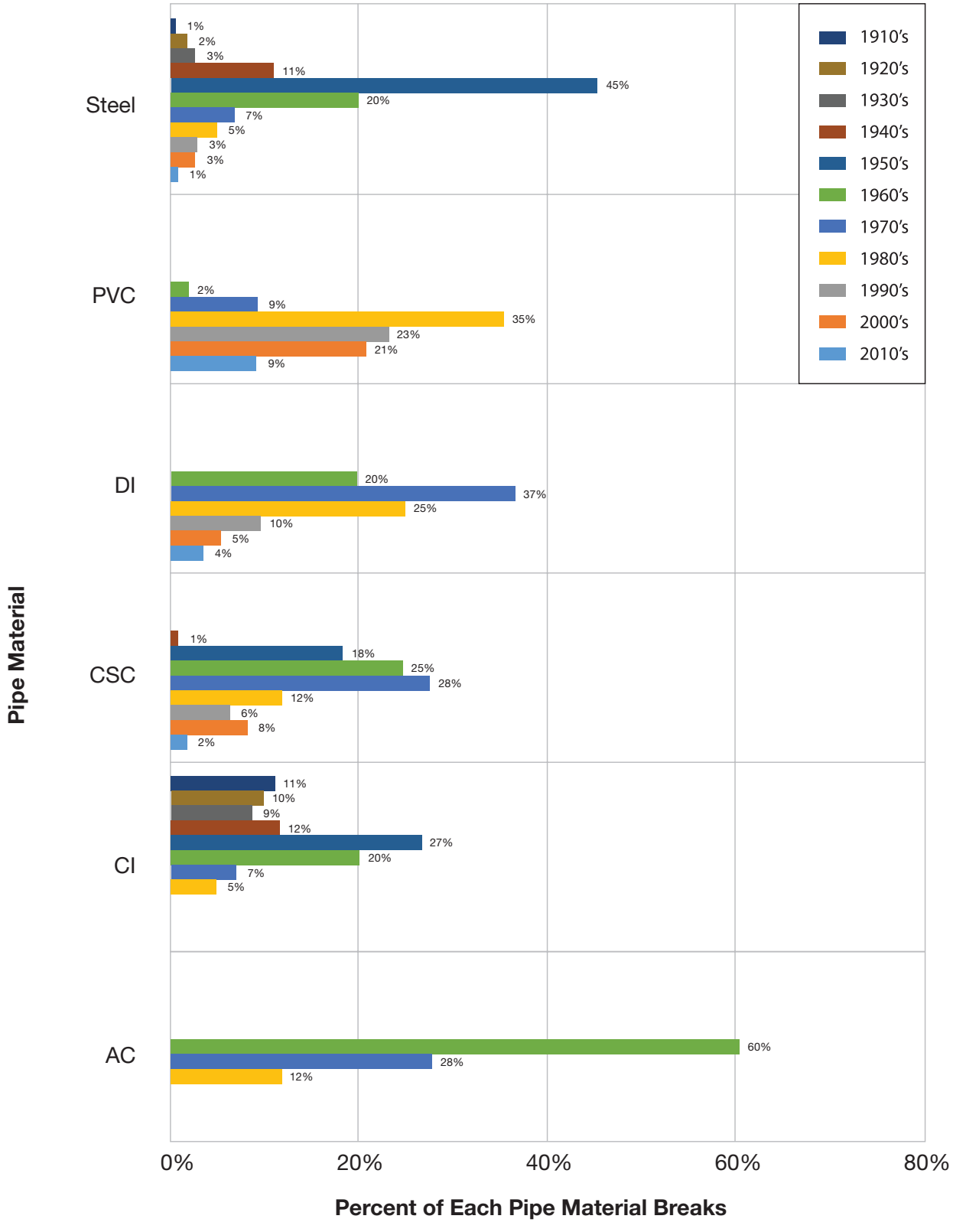


FIGURE 27: PERCENT OF RESPONDENTS SELECTING A MOST COMMON FAILURE

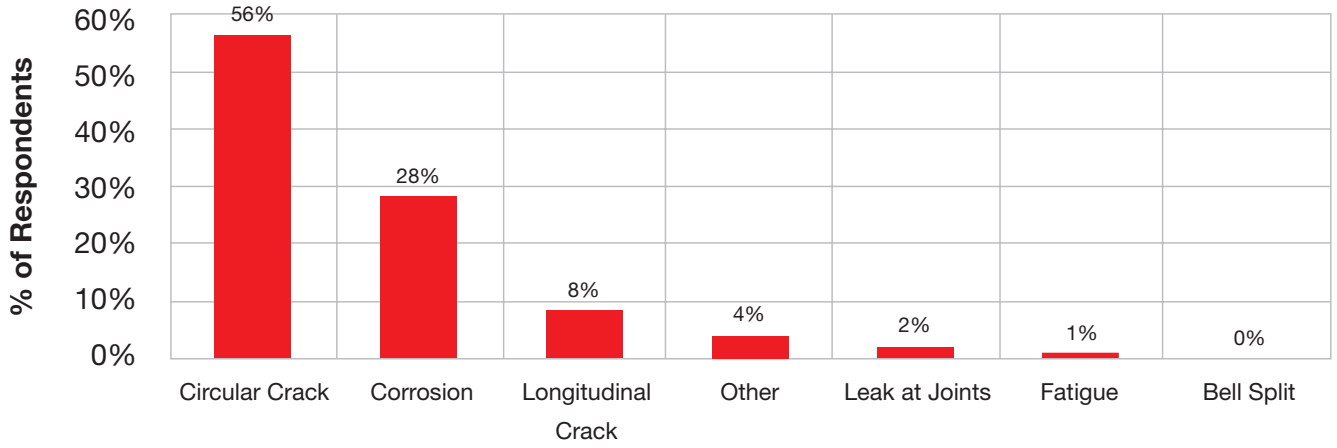
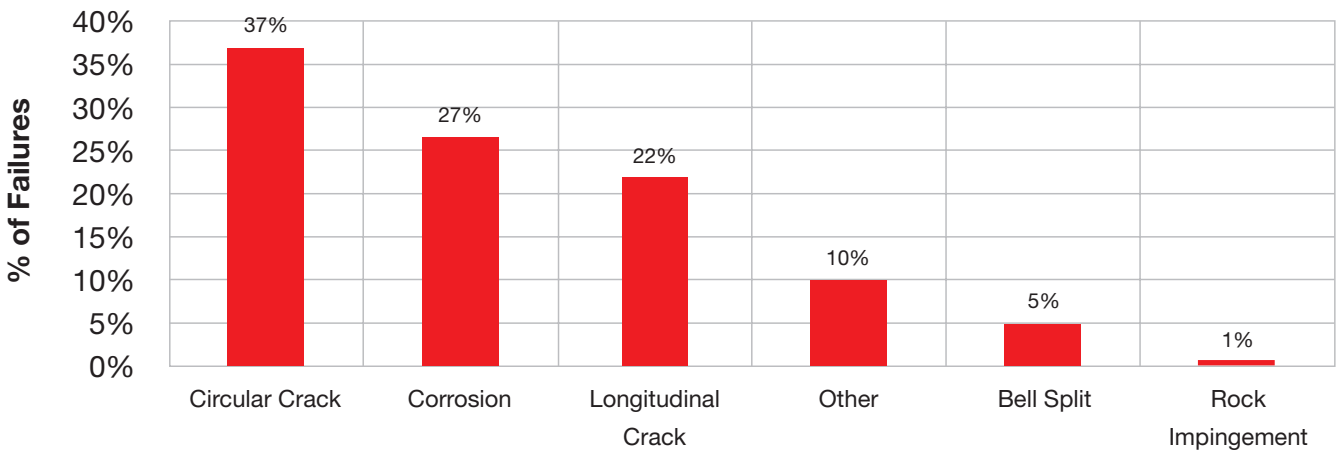


FIGURE 28: DISTRIBUTION OF FAILURE MODES FROM THE BASIC SURVEY



5.5. Pipe Cohorts and Vintage

As mentioned in section 3.0, the survey did not track the many subclasses of pipe that have been installed because many utilities do not have that information. Individual utilities should try to add to their database as much as they can about what is referred to as a pipe cohort and other details about their installation. Copeland, et al. (2015) provides a good example of data to record. A pipe cohort is a group of pipes with similar characteristics. This concept is useful in pipe management because defining different pipe cohorts can be helpful in identifying pipes that have different risk characteristics (see Figure 29).

FIGURE 29: TIMELINE OF PIPE TECHNOLOGY IN THE US IN THE 20TH CENTURY

Pipe Material	Joint Type	Internal Corrosion Protection	External Corrosion Protection	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010
Steel	Welded	None	None												
Steel	Welded	Cement	None												
Pit Cast Iron	Lead	None	None												
Spun Cast Iron	Lead	None	None												
Spun Cast Iron	Lead	Cement	None												
Spun Cast Iron	Leadite	None	None												
Spun Cast Iron	Leadite	Cement	None												
Spun Cast Iron	Rubber	Cement	None												
Ductile Iron	Rubber	Cement	None												
Ductile Iron	Rubber	Cement	PE												
Asbestos Cement	Rubber	None	None												
Reinforced Concrete	Rubber	None	None												
Prestressed Concrete	Rubber	None	None												
PVC	Rubber	None	None												

- Pipe Material Availability
- Periods of Active Installation and Widespread Use
- Extended Potential Lead Joint Leaching Periods in Iron Pipes

Adapted from Figure 8.3, Sustainable Solutions Corporation, 2017

Changes in pipe manufacturing, such as the introduction of new pipe-making technologies, are a major criterion when identifying pipe cohort concerns (e.g., longevity of a pipe and risk of breakage). For instance, pit cast gray iron pipe and centrifugally cast gray iron pipe of the same diameter should likely be considered in different pipe cohorts, because the significant differences in manufacturing cause the pipes to behave differently. Other factors that can affect pipe longevity and breakage include transportation and installation methods (WaterRF, 2013).

Another pipe cohort is cast iron with leadite joints. There are at least two reasons for high failure rates associated with leadite joints: "First, leadite has a different coefficient of thermal expansion than cast iron and results in additional internal stresses that can ultimately lead to longitudinal splits in the pipe bell. Secondly, the sulfur in the leadite can facilitate pitting corrosion resulting in circumferential breaks on the spigot end of the pipe near the leadite joint. The failure rate in the industry for leadite joint pipe is significantly higher than for lead joint pipe even though the pipe may not be as old." (EPA, 2002, p3)

6.0 Corrosive Soils and Corrosion Prevention Methods

The detailed survey asked respondents if they have one or more regions in their service area with soils that tend to be corrosive. A total of 75% of the respondents reported that they do have at least one area with corrosive soils. This corresponds to the results found in the 2012 survey. The survey also asked if they utilized any kind of corrosion protection methods. A total of 80% of the respondents reported that they do utilize some kind of corrosion protection. The respondents were also asked to describe the method(s) they used. The most common answer was polywrap installation. Table 6 lists most of the methods mentioned ordered from most common (rank 1) to least common (rank 5).

TABLE 6: TYPICAL CORROSION PREVENTION METHODS

Rank	Corrosion Prevention Methods
1	Polywrap
2	Anodes or cathodic protection
3	V-bio polywrap
4	Impressed current
5	Dielectric coatings

Water utilities often do not know the specific cause of external corrosion observed on their water mains, and consequently, the chosen preventative measure may not work effectively. Historically, these choices are based on data from other industries (e.g., gas and oil) and may not be suitable for the water industry. Corrosion of metallic pipes can be caused by a variety of mechanisms, each of which requires a different solution. Determining which corrosion mechanism is at work is not a simple matter, because the resulting pipe damage looks similar for all of them. The failure to properly identify corrosion sources may produce prevention systems that are ineffective or do not last. For example, it is not effective to install an anode on a main that has a bacteriological corrosion problem. Similarly, an anode bag installed to reduce corrosion caused by a stray impressed current would be quickly used up and would provide only short-term protection. Also, polywrap does not protect a pipe from all corrosion types and may get damaged during the installation (Romer, 2005).

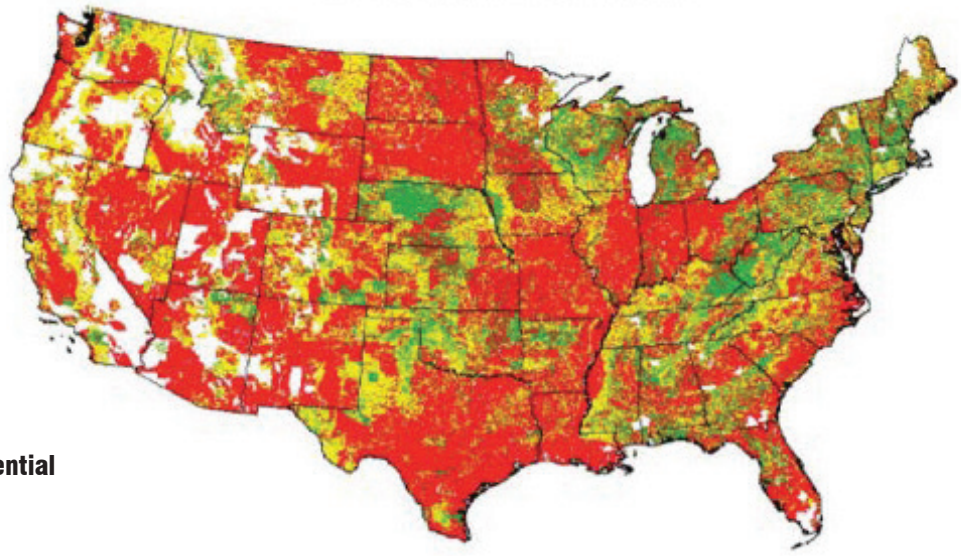
6.1. Effect of Corrosive Soils on Break Rate

The USDA Natural Resources Conservation Service provides results of soil surveys across the US. One of the aspects of the soil surveys is a “risk of corrosion” analysis that pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel. The soil is rated as either “low,” “moderate,” or “high” based on measurements of moisture, particle size, acidity, and electrical conductivity. This is not a precise analysis and additional factors may be neglected. Nevertheless, it is a reasonable estimate of soil corrosiveness in lieu of better data. The USDA soil survey website (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx) allows the user to select an area of interest (AOI) and then produces a plot coloring low risk areas in green, moderate risk areas in yellow, and high risk areas in red. An overview of soil across the US is given in Figure 30.

Soil risk can change over a distance of a few blocks. This is illustrated in Figure 31 which shows a screen capture of soil risk colors inside the boundaries of a town in California. This town has all three regions present; low (green), moderate (yellow), and high (red). Soil analysis data is not available in regions with a light gray color.

It was desired to relate water main break rates to soil corrosivity. Since most cities have a combination of low, moderate, and high regions, a numerical ranking was developed that provided an overall level of soil corrosiveness. To do that, pictures of each area served by the utilities in the basic survey were created. Next a program was developed that counted the number of reddish, greenish, and yellowish pixels in each photo. To provide a numerical ranking, pixels that were low risk were given a value of 1, moderate pixels were given the value 2, and high risk pixels were given the value 3. The pixel values were summed and then divided by the total number of red, yellow, and green pixels. The computed value is called a corrosion index. Cities with a corrosion index near 1 have low corrosion risk while those close to 3 have high corrosion risk. For the area in Figure 31, the computed corrosion risk was 2.1 or slightly above a moderate level.

FIGURE 30: US CORROSIVE SOILS MAP (CONUS POTENTIAL FOR STEEL CORROSION)



Source: *Data collected from Soil Survey Staff, Natural Resources Conservation Service, U.S. Department of Agriculture Soil Survey Geographic Database.*

Corrosion index values were computed for 281 cities in the US. Some US cities had little or no data for the soil inside their boundaries preventing computation of a corrosion index. For analysis, the corrosion index values were broken down into seven ranges and the number of utilities in each range is plotted in Figure 32. The average corrosion index for all the US utilities in the basic survey was 2.4 or close to midway between moderate and high corrosion risk. That is, most utilities in the US have a moderate to high soil corrosion risk which is consistent with the detailed survey report that showed 75% of utilities have one or more areas with corrosive soils.

FIGURE 31: CORROSIVE SOIL RISK PLOT

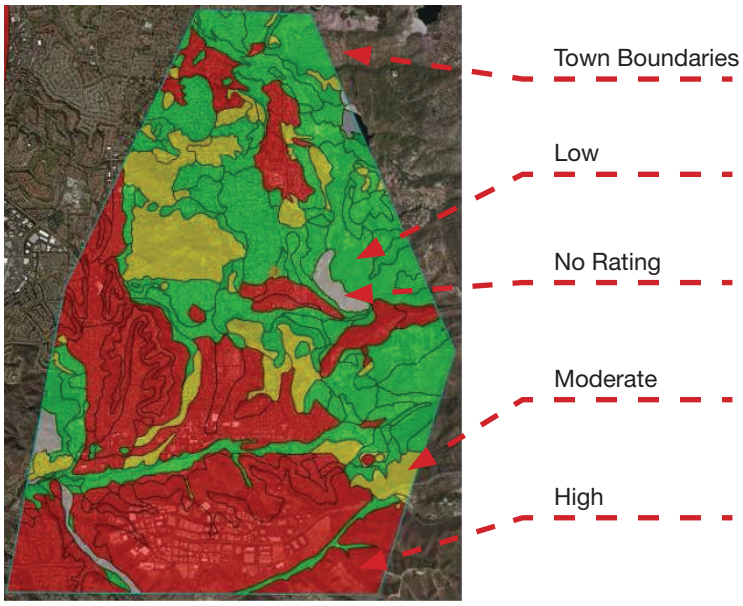
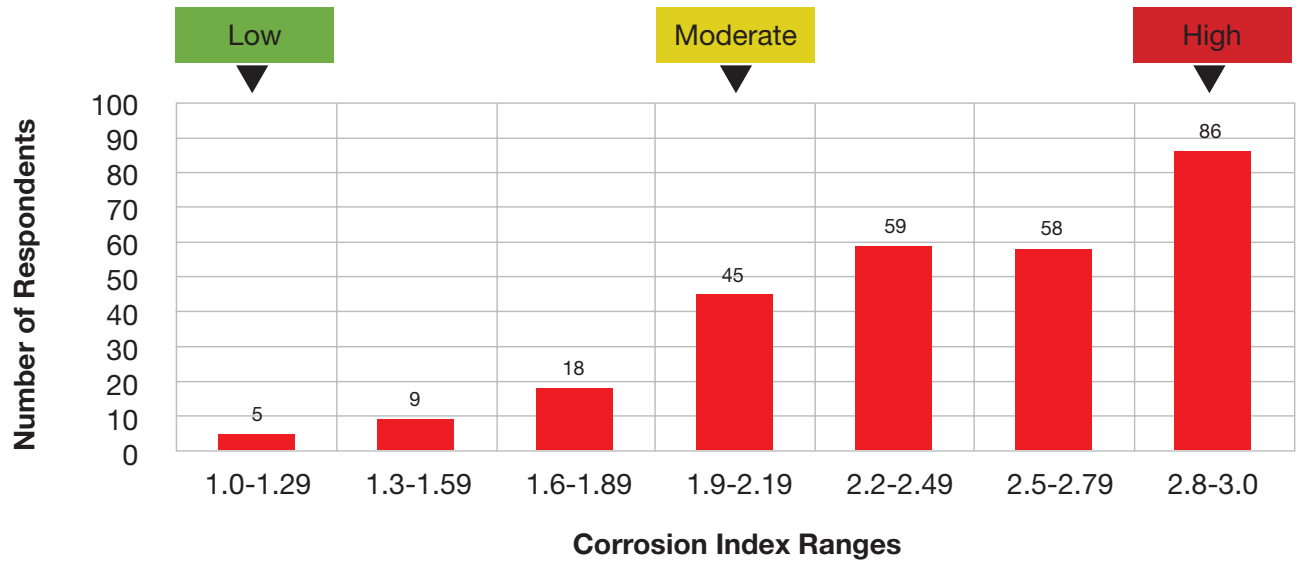
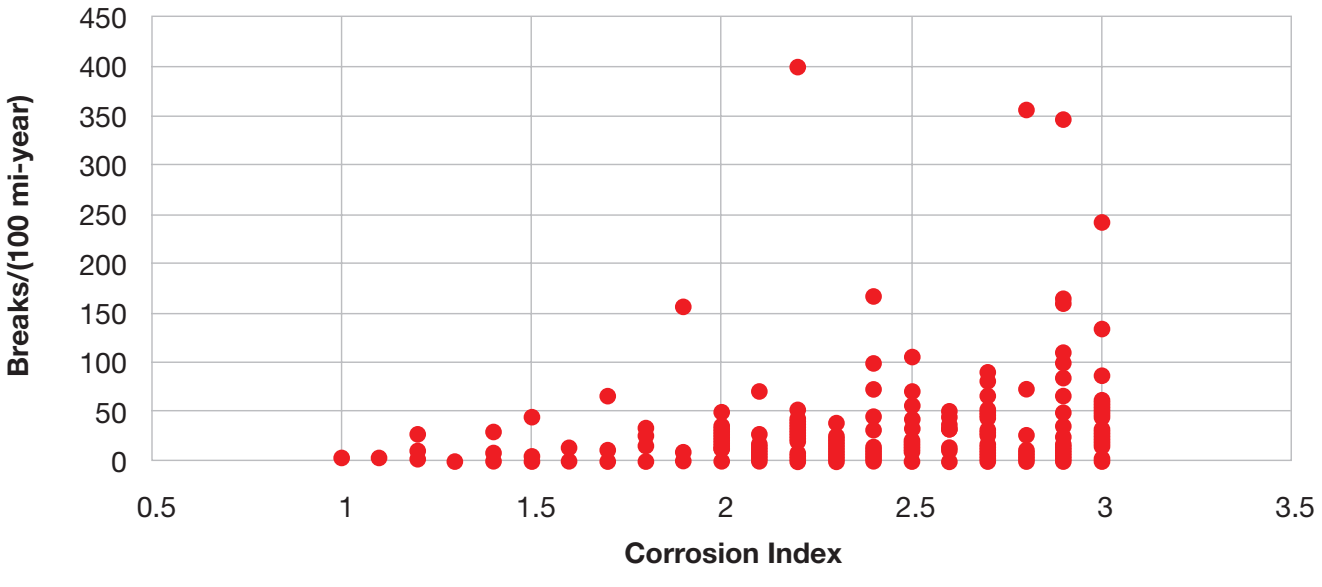


FIGURE 32: NUMBER OF UTILITIES VERSUS THEIR CORROSION INDEX



It is reasonable to expect break rates would increase when pipe is installed in corrosive soils. To examine this, plots were made of a utility's corrosion index versus break rate. Figure 33 illustrates this for cast iron pipe. There is a trend of higher break rates with increasing corrosion index, but the wide scatter in the data makes analysis difficult. The high break rates in Figure 33 are associated with small utilities that have a small amount of pipe. Consider a utility with 1 mile of cast iron pipe with 2 breaks during the past year. That would translate to a break rate of 200 breaks/(100 miles)/year. If that utility had no breaks the following year, the break rates drop to zero.

FIGURE 33: INDIVIDUAL UTILITY BREAK RATES FOR CAST IRON PIPE VERSUS THEIR CORROSION INDEX

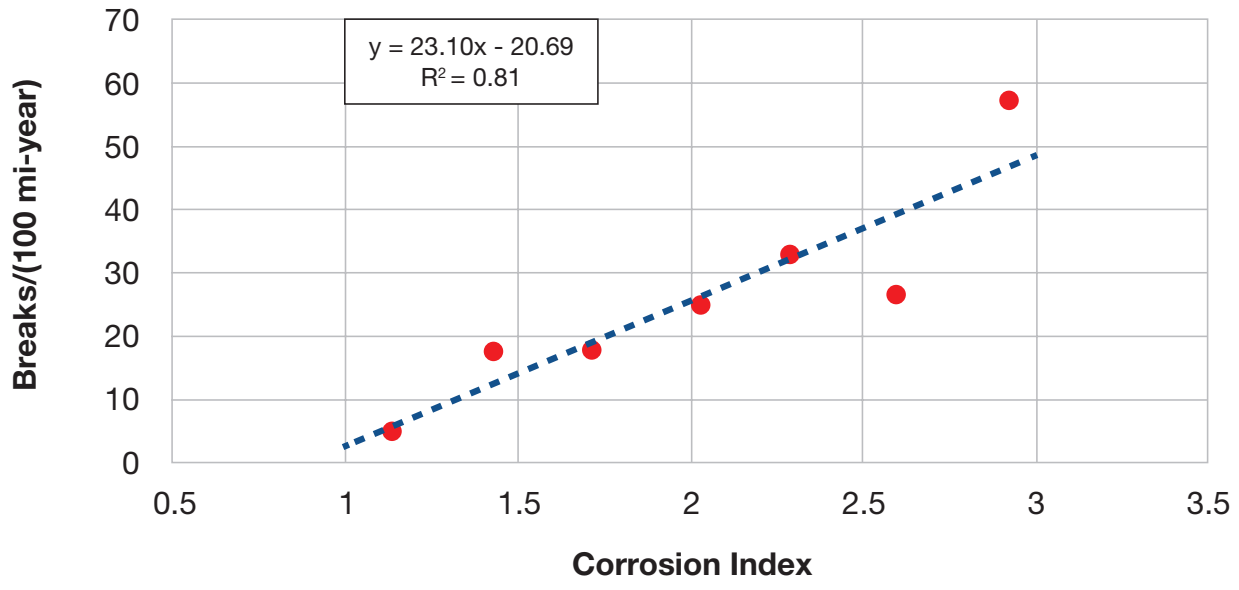


To get a realistic estimate of break rates, we need to add the number of breaks of a pipe type from several utilities and divide by the sum of the length of that pipe type to compute break rates. The corrosion index data was broken down into the same seven categories used in Figure 32. The results are listed in Table 7. The break rates versus corrosion index data are plotted in Figure 34 for cast iron pipe and Figure 35 for ductile iron pipe. The figures also contain a regression equation fit and a correlation coefficient. Correlation coefficients close to 1.0 indicates an excellent correlation and zero indicate no correlation. Both cast and ductile iron results in reasonably good fits to the data.

TABLE 7: BREAKDOWN OF CORROSION INDEX VALUES INTO SEVEN CATEGORIES

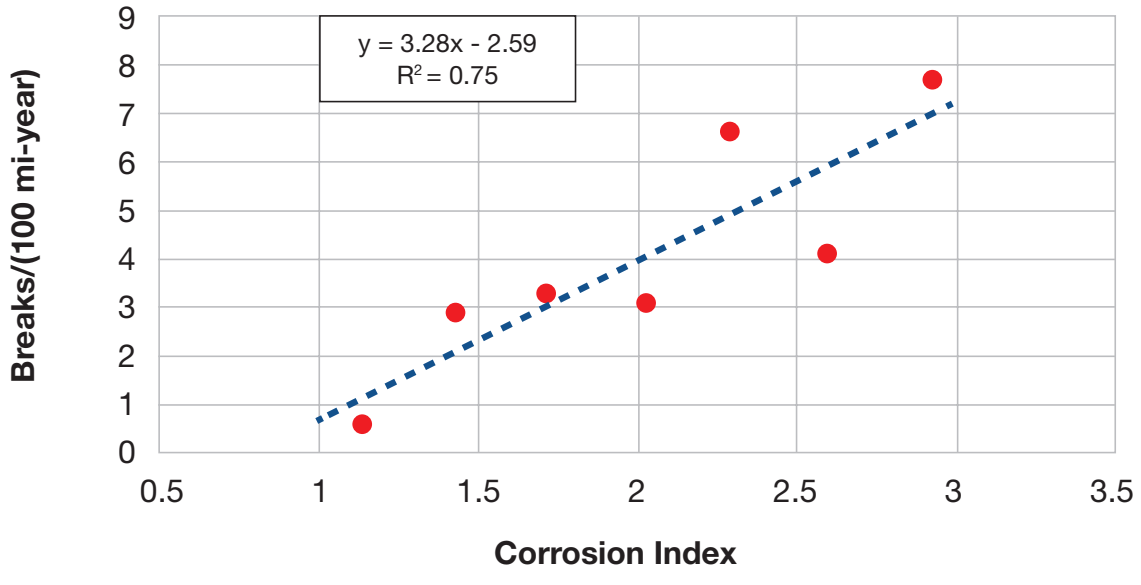
Category	Corrosion Index Range	# of Utilities	Average Corrosion Index	Break Rates (breaks/(100 mi-year))	
				Cast Iron	Ductile Iron
1	1.0 - 1.29	5	1.14	4.93	0.57
2	1.3 - 1.59	9	1.43	17.59	2.89
3	1.6 - 1.89	18	1.72	17.76	3.27
4	1.9 - 2.19	45	2.03	24.96	3.09
5	2.2 - 2.49	59	2.29	32.79	6.63
6	2.5 - 2.79	58	2.60	26.39	4.09
7	2.8 - 3.0	86	2.93	57.20	7.69

FIGURE 34: CAST IRON PIPE BREAK RATE VERSUS CORROSION INDEX



Using the equations in Figure 34 with x=1 for a low corrosion risk and x=3 for a high corrosion risk, one can show that a cast iron pipe in a high corrosion soil is expected to have over 20 times the break rate of one in a low corrosion soil. Similarly, ductile iron pipe in a high corrosion soil has over 10 times the break rate than one in a low corrosion soil. Very poor correlations were found for the other material types in this survey.

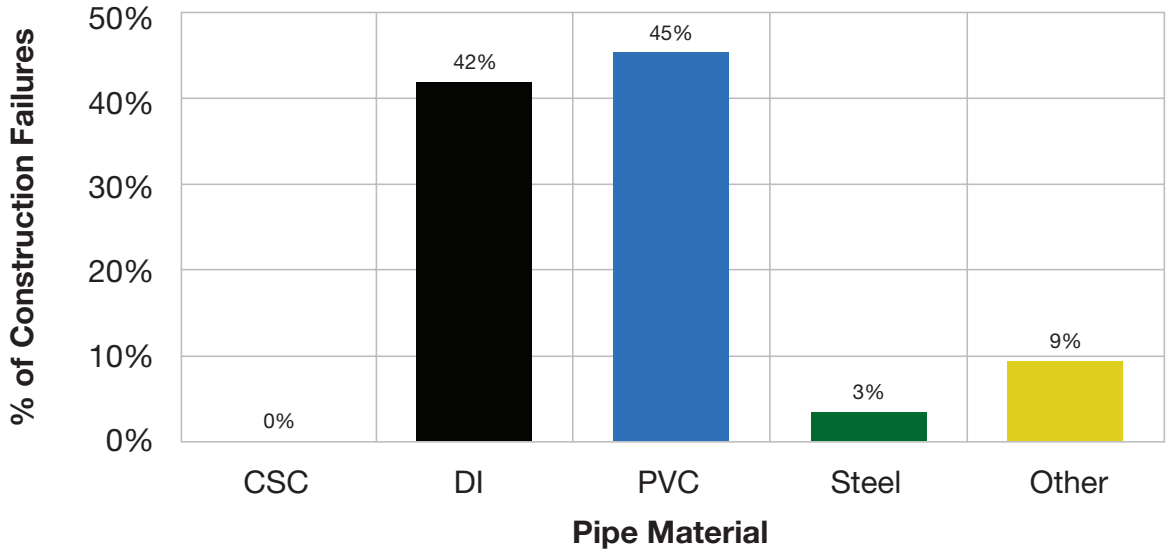
FIGURE 35: DUCTILE IRON PIPE BREAK RATE VERSUS CORROSION INDEX



7.0 Construction Related Failures

The detailed survey asked respondents to report failures related to construction activities. Figure 36 illustrates the percentage of total construction failure related to a particular pipe material. Ductile iron and PVC pipes have the majority of construction related failures at a nearly equal frequency. Figure 14 shows that DI and PVC are the two pipe materials that are also most commonly being installed today. This points to the need to improve construction practices for underground infrastructure regarding installation, location services and inspection.

FIGURE 36: PERCENT OF TOTAL REPORTED CONSTRUCTION RELATED FAILURES FROM THE DETAILED SURVEY



8.0 Condition Assessment Methods

The detailed survey asked if utilities utilize condition assessment methods to monitor the condition of their water mains. 45% of the respondents reported that they do use some kind of condition assessment process but normally limited this effort to larger diameter transmission system pipes. A large percentage of those reported using some visual assessment along with electromagnetic, acoustic, tapping coupons, and other means.

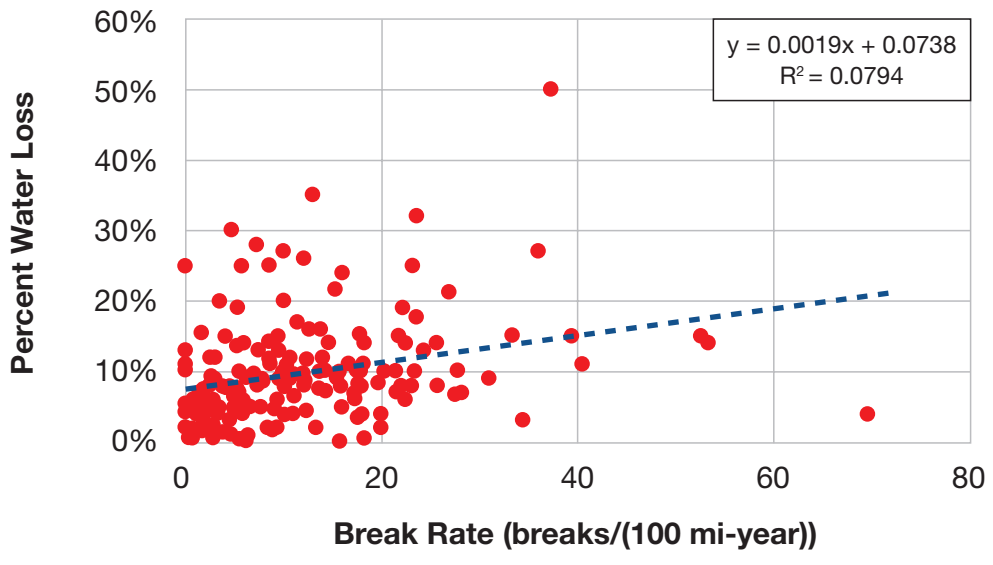
9.0 Water Loss Due to Leakage

Water loss due to leakage is reaching critical levels where in some cases 20% to 30% of water is leaking from water mains (New Jersey 101.5, 2017). The basic survey asked what percentage of water volume input to the system is water loss (due to leakage). A total of 201 utilities were able to provide a water loss value. The reported average leakage from the basic survey was 10% with a standard deviation of 7.7%. It is recognized that there are multiple ways to express and account for water loss (see Taylor, 2008). Water loss can be due to unbilled authorized consumption such as flushing water mains and fire-fighting, unauthorized consumption, and real losses due to leakage. The term non-revenue water comprises all of those losses. It was not anticipated that most of our respondents would have a recent detailed water audit that would provide just the water leakage amount. Thus, the 10% value may include authorized losses. For example, a recent analysis of utilities in Indiana which had a 100% participation rate showed that non-revenue water averaged 19% to 24% of the potable water supplied. The study also noted that a significant number of the state's water pipes are reaching the end of their useful lives (Indiana Finance Authority, 2017). More accurate audits of water utilization would be beneficial to understanding water losses and their cause.

It was postulated that there may be a correlation between water main break rates and water losses. Figure 37 plots individual overall break rates (breaks/(100 miles)/year) versus the reported utility loss rate. A linear regression to the data yields the equation in the figure which is illustrated in the dotted line in Figure 37. This plot omits a few small utilities with failure rates greater than 100 that skew the equation fit considerably. There is considerable scatter in the data and the correlation coefficient is very small indicating essentially no correlation. However, the trend of high leakage values with increasing break rates might be inferred. Perhaps if more accurate leakage values were used, a better correlation might be obtained.

Leaks can occur from pipe damage caused by third parties or corrosion in the pipes, as well as from joints in the distribution system. There are two ways in which water utilities can assess leakage. One way is through conducting a system-wide water audit, which estimates water consumption and water loss. The process enables water utilities to develop performance indicators to assess water loss, benchmark themselves with other water utilities, and set performance metrics. Another way in which water utilities can assess leakage is through conducting leakage investigations on all or part of the water system, using technologies to find the leaks. Many of these technologies can track the sound of a leak, allowing the utility to identify the exact point of the leakage and make needed repairs. There is also increasing use of various "smart technologies," typically tied to newer "smart meters," that can also aid in leak identification" (WaterRF, 2013).

FIGURE 37: PERCENT WATER LOSS VERSUS UTILITY BREAK RATES



10.0 Plans for Replacing Water Mains

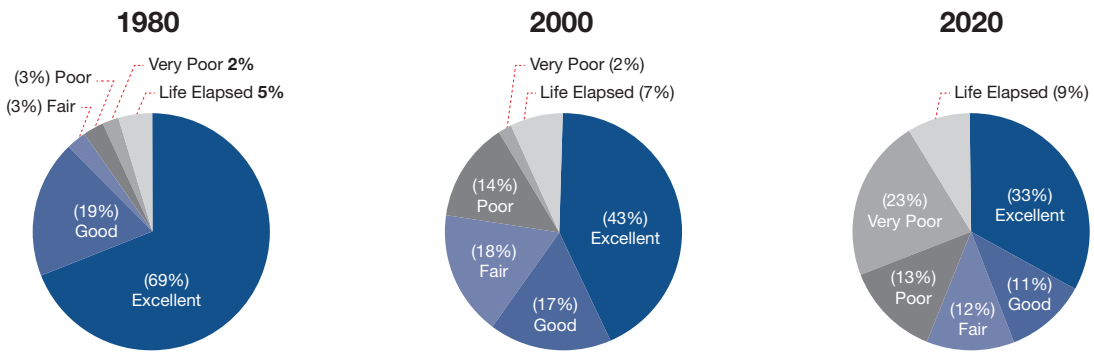
The detailed survey respondents were asked questions about expected pipe life and pipe replacement and the answers are summarized in Table 8. The typical age of failing water mains had an average response of 50 years (up from 47 years in 2012) which is well below what most manufacturers say should be expected. The average expected life of a newly installed pipe is 84 years (up from 79 years in 2012). Given the quantitative nature of these questions, the typical age of failing water mains and expected pipe life have not changed significantly over the last six years. The basic survey asked if utilities have a pipe replacement program and 77% said they did. However, the detailed survey asked utilities if they had a regular pipe replacement program and only 58% of the respondents stated they did and of those that did, the average amount replaced each year was 0.8% of their total installed length. Respondents were asked for the percentage of their water mains that are beyond their useful life but lacked funds to replace them. The average response was 16% of water mains are beyond their useful life. In the 2012 survey the same question was asked and the response was 8.4%. This would indicate that the backlog of needed pipe replacement is growing.

It is of interest to compare these results with a study done by the EPA (EPA, 2002). The report classified water main pipe condition into six categories: "Excellent," "Good," "Fair," "Poor," "Very Poor," and "Life Elapsed." The study examined data for the years 1980 and 2000 and provided forecasted data for 2020. Figure 38 below is reproduced from the EPA report and estimates that the condition of 9% of pipes will be categorized as "Life Elapsed" and 23% as "Very Poor" by the year 2020. Of note is the projected growth in the "Very Poor" category during this period as shown in Figure 38. This is consistent with the results of this survey. The rapid rate of growth of pipes in the "Very Poor" category will make it very difficult for utilities to keep pace and replace them before they reach end of life or their "Life Elapsed" condition. An AWWA study (AWWA, 2012) echoes this trend as illustrated in Table 9. Table 9 shows aggregate costs to cover both replacement and growth in water mains in the USA.

TABLE 8: QUESTIONS ABOUT REPLACEMENT OF FAILING WATER MAINS

Questions	Average or Response
Typical age of failing water main	50 years
Expected life of new water mains	84 years
Percentage with plan to replacing water mains	77%
Percentage regularly replacing water mains	58%
Percentage of total water main length replaced annually	0.8%
Percentage of water mains beyond useful life but lack funds to replace (overall response)	16%

FIGURE 38: ASSESSMENT OF PIPE CONDITION WITH TIME (FROM EPA, 2002)



Percentage of Pipe by Classification

TABLE 9: AGGREGATE NEEDS FOR INVESTMENT IN WATER MAINS THROUGH 2035 AND 2050 BY REGION OF THE UNITED STATES (AWWA, 2012)*

	2011 - 2035 Totals			2011 - 2050 Totals		
Region	Replacement	Growth	Total	Replacement	Growth	Total
Northeast	$92,218	$16,525	$108,744	$155,101	$23,200	$178,301
Midwest	$146,997	$25,222	$172,219	$242,487	$36,755	$279,242
South	$204,357	$302,782	$507,139	$394,219	$492,493	$886,712
West	$82,866	$153,756	$236,622	$159,476	$249,794	$409,270
Total	$526,438	$498,285	$1,024,724	$951,283	$802,242	$1,753,525

** (2010 $M)*

Table 9 represents an estimate of pipe material investment (in millions of dollars) which is needed in each region based on an AWWA report (AWWA 2012). Investment is needed in two areas - replacement (where existing users pay for the pipe at the end of its useful life) and growth (where system expansion needs to occur due to population growth). These two drivers impact each region differently. Over the coming 40-year period, through 2050, these needs exceed $1.7 trillion. Replacement needs account for about 54% of the national total, with about 46% attributable to population growth and migration over that period.

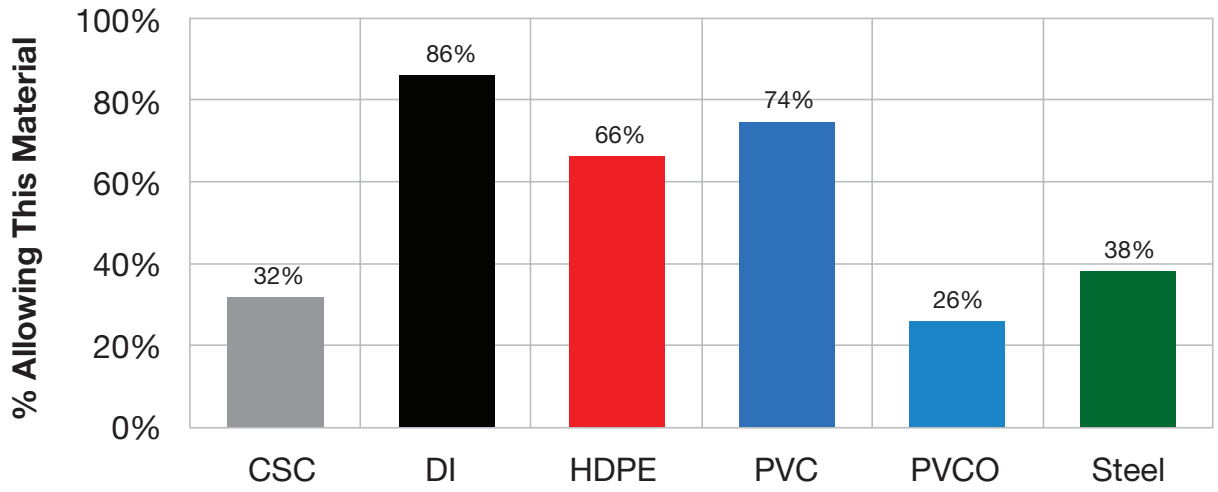
America's water main investment needs impact the nation's regions in different ways. The South and West will face the steepest investment challenges but this will be paid for through growth, unlike the Northeast and other parts of the country facing population decline or only modest growth, which means it will be difficult for them to pay for the needed upgrades (AWWA, 2012).

The US Conference of Mayors 2013 report, "Municipal Procurement: Procurement Process Improvements Yield Cost-Effective Public Benefits," provides expert advice on developing a business case for pipe material selection when evaluating pipe replacement strategies. It reads:

> "The conventional approach to water pipe replacement decision making has been to merely replace the pipe with roughly the same product regardless of price, and based on manufacturer's recommendations. In fact, this replacement ideology and tradition is still heavily imprinted upon the thinking of even modern engineers. Communities in the United States, a century ago, used thick cast iron pipes that are now failing. The majority of these pipes are failing for one basic reason – corrosion. Failure to recognize this systemic performance problem in metallic pipes has allowed traditional procurement practice to make suboptimal materials procurement decisions…"
>
> "An important step in effectively managing assets is to create an open procurement and selection process which allows for all appropriate materials to be considered and accurately and fairly compared. Any improvement in this area can represent a huge cost savings for rate payers considering the perpetual high cost of underground infrastructure replacement. Procurement habituation in pipe material consideration combined with a failure to take advantage of the open bidding process impedes competitive cost savings. Closed procurement processes lead to unnecessary costs, and may diminish public confidence in a local government's ability to provide cost effective services."
>
> *Source: US Conference of Mayors, 2013*

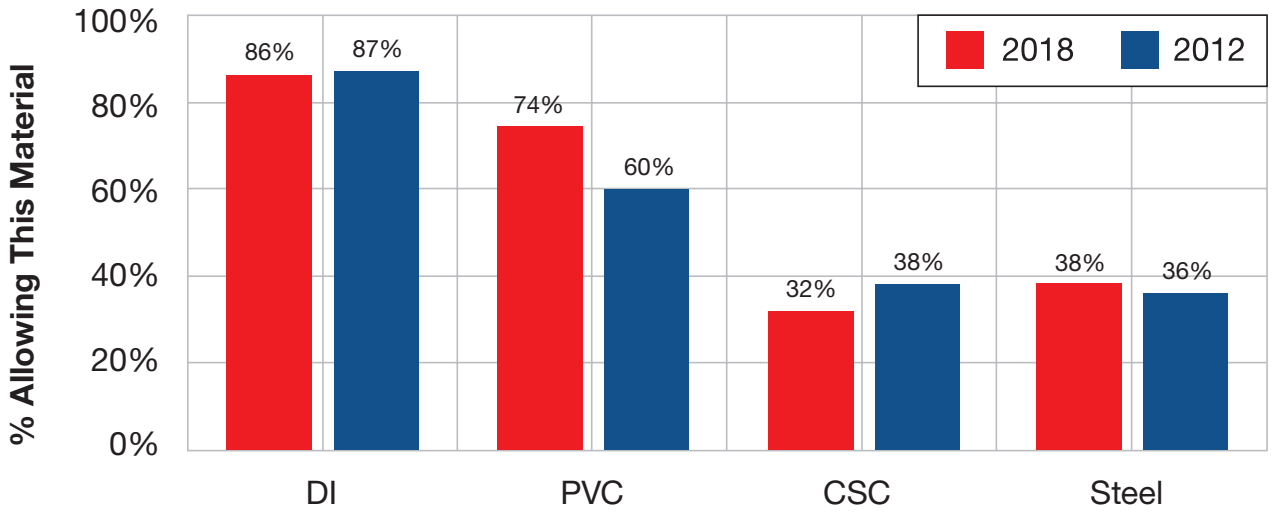
11.0 Approved Pipe Materials

FIGURE 39: RESPONDENTS ALLOWING INSTALLATION OF THESE WATER MAIN MATERIALS



The detailed survey also asked respondents what water main pipe materials are currently approved for use at their utility. Figure 39 illustrates the percentage of respondents that allow a particular pipe material to be installed. HDPE pipe at 66% allowance for use in water systems represents a high degree of acceptance for trenchless applications such as pipe bursting and directional drilling, whereas for open cut installations PVC and ductile iron pipe are the predominantly accepted materials (see Table 10). Figure 40 compares the pipe materials approved for use by utilities in the 2018 survey with the data obtained in the 2012 survey. Figure 40 shows a 23% increase in the acceptance of PVC water pipe by North American utilities since 2012. Specifically, PVC pipe approval among survey respondents increased from 60% of water utilities allowing its use in 2012 to 74% of utilities allowing its use in 2018. The number of utilities approving of ductile iron, concrete steel cylinder, and steel pipes for use in water systems remains essentially the same.

FIGURE 40: COMPARISON WITH 2012 SURVEY FOR ALLOWED MATERIALS



12.0 Preferences for Pipe Installation

The detailed survey asked respondents about experiences with three techniques of repairing, replacing, and installing water main pipes. They were relining deteriorated pipes, replacing pipes with a pipe bursting technique, and installation of new pipes using directional drilling. Table 10 summarizes their responses. The rating scale in Table 10 is from 1 to 5 with 1 being “Not Satisfied” to 5 being “Very Satisfied.” Not many respondents have utilized pipe bursting, but an increasing number are looking at using both pipe relining and pipe bursting techniques. A majority of respondents have utilized directional drilling and are very happy with the results, but it is usually only used where open cut replacement is problematic. Open cut replacement remains the most commonly used method of pipe replacement.

TABLE 10: QUESTIONS ABOUT REPLACEMENT OF FAILING WATER MAINS

	Pipe Relining	Pipe Bursting	Directional Drilling	Open Cut
% of respondents that have used this technique	35%	10%	62%	100%
Most common materials installed	HDPE, CIPP, cement lining, epoxy	PVC, HDPE, DI	HDPE, PVC, DI	PVC, DI, CSC, Steel
Average Rating 1 to 5	3.8	3.8	4.4	4.7
% of respondents that will use this technique in the future	58%	44%	93%	100%
Comments	High cost, used when open cut not feasible, only for large diameter pipe, many not happy with it	High cost, useful in some situations, need to excavate for service lines	Worked well particularly for river and street crossings, more expensive	Standard installation method

13.0 Infrastructure Asset Management

Infrastructure asset management is an approach which can help utilities bring together the concepts, tools, and techniques to manage assets at an acceptable service level at the lowest life-cycle cost. Asset management practices applied to underground infrastructure help utilities understand the timing and costs associated with replacement activities. The knowledge gained from these efforts also helps in the development of effective pipe material selection through comparative financial analysis called "life cycle costing" as part of replacement strategies and funding plans. Understanding the longevity of a pipe improves the ability for management to make better infrastructure investment decisions with improved affordability results for customers.

Traditionally, there has been a lack of analysis which would combine both underground pipe performance and affordability. Existing practices tended to ignore the effect of environmental conditions on different pipe materials. Yet, every engineer understands how the complexity of underground infrastructure has increased along with the array of choices. The ability to change old habits and consider new materials requires additional analysis, and improved design and installation practices. This enhanced analysis of pipe design, selection and installation sets forth the longevity and life-cycle costs critically influencing water service affordability and sustainability for the next 100-200 years.

There have been many studies on water main failure rates in the US, Canada, Australia, and Europe over the last three decades. These studies mainly compared the number of pipe breaks by general pipe type and by length. While these studies have been very helpful to the water industry, the new driver has been the need to take into consideration the reduction of repair and replacement costs and improvement of water service affordability in underground pipe decisions. This new level of fiscal accountability and demand for transparent utility management back to their owners and stakeholders has increased the need for additional evidence to demonstrate the improved decision-making. Dig-up reports and pipe performance and longevity studies form the next body of evidence needed to corroborate water main break surveys and studies. The simple formula in a life cycle cost framework is essentially that "a pipe which has a long life at a low cost is the most affordable." Engineers are to make available every alternative that can answer the simple question of longevity and cost at each relevant point within the underground network providing service. A key issue in the life cycle cost framework is the expected life of a pipe.

Accurate pipe service and performance life estimates are critical to the effective management of underground infrastructure. This study provides accurate break data which can be used to improve life cycle costing analysis of water pipelines. Pipe break rate data is fact-based quantitative information which can help to precisely assess the durability, performance and longevity of pipe networks. Water main break rates are a critical decision making metric used in infrastructure asset management repair and replacement planning. Some of the data provided in this study, however, such as the average age of failing water mains and average expected pipe life, is qualitative in nature, i.e., subjective since it is based on perception rather than on quantitative data like break rates. While this can be helpful to utility officials, it lacks needed precision. A similar problem exists with the AWWA 2012 *Buried No Longer* report, which provides estimated service lives of different pipe materials based on a mixture of data which includes perceptions of service life versus quantitative data; and therefore is only of limited value for use in pipe material comparisons, asset management replacement planning, life cycle cost projections, and pipe service life estimates.

There is a large body of information on the importance of asset management and particularly as it relates to water systems. The reader is encouraged to refer to the following excellent documents that are available:

- *Asset Management for Water and Wastewater Utilities* https://www.epa.gov/sustainable-water-infrastructure/asset-management-water-and-wastewater-utilities
- *What is Asset Management?* https://www.michigan.gov/documents/deq/deq-ess-mfs-formsguidance-DWassetmngmntguide_426744_7.pdf
- *Life Cycle Assessment of PVC Water and Sewer Pipe and Comparative Sustainability Analysis of Pipe Materials* http://www.sustainablesolutionscorporation.com/paper-unibell.html

13.1. Life Cycle Cost Analysis and Life Cycle Assessment

According to Dr. Sunil Sinha, Professor of Civil and Environmental Engineering and Director of the Sustainable Water Infrastructure Management (SWIM) Center at Virginia Tech, "In order to meet the important challenges of the 21st century, a new paradigm for the planning, design, construction, and management of water pipeline infrastructure is required, one that addresses the conflicting goals of diverse economic, environmental, and societal interests." (Sinha, 2018) The new paradigm must include life cycle costs analysis (LCCA). LCCA helps in justifying the selection process of a particular system, product or activity based on the total life cycle cost rather than the initial design and installation cost. It enables a transparent selection process. Life cycle cost analysis helps in the identification of high cost areas during the life cycle of the asset and helps in minimizing the costs. Attributing costs to each phase in an asset's life cycle and understanding the full cost to deliver services is important for determining costs for various service levels, maintenance and renewal decision making and rate setting. For example, in a model utilizing utility cost data, PVC was found to have an overall lower total cost of ownership because each cost element (initial pipe cost, installation cost, condition assessment cost, pipe repair cost, rehabilitation cost, replacement cost, indirect and recurring costs and disposal costs) for PVC pipe was lower than ductile iron pipe (Khurana, 2017).

Life cycle assessment (LCA) is a tool used to measure the environmental impacts of different products or systems during their life cycle. By measuring the environmental impacts throughout the life cycle, life cycle assessment provides a complete picture related to sustainability and helps in providing true environmental tradeoffs in the product selection. For example, in a 2017 study following an ISO framework, PVC was found to have a lower carbon footprint than ductile iron pipe (Sustainable Solutions, 2017).

Life cycle cost analysis provides justification from the economic point of view to make better investment decisions, whereas life cycle assessment provides justification related to sustainability issues. It is important to integrate both life cycle cost analysis and life cycle assessment to provide a holistic picture to the decision maker.

14.0 Conclusion

This comprehensive water main break report for 2018 surveyed a statistically significant number of utilities that have collected data on underground infrastructure. The study was focused on material usage in water mains across the USA and Canada and was successful in getting 281 participants to respond to a basic survey and 98 utilities to respond to a detailed survey. The central focus was to obtain average values for water main break rates across North America. These results were presented in Figure 20, but are repeated in Figure 41. PVC has the lowest break rate of all the pipe materials considered. Lower break rates mean lower costs and improved longevity. Compared with the 2012 survey results, break rates for asbestos cement and cast iron pipes have increased significantly and should therefore be cause for concern for policy makers and utility officials alike.

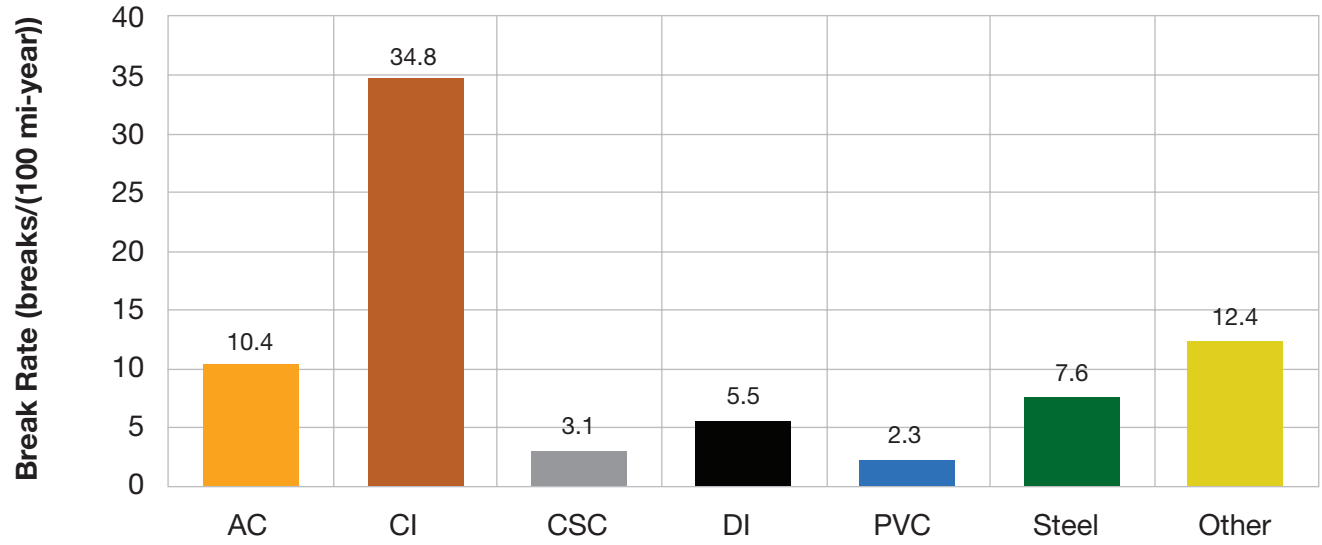
It is hoped that this study will be helpful to utility managers in comparing their experiences with the survey results and thereby make better decisions regarding possible changes in their asset management and procurement practices. Through greater understanding of the risks and issues surrounding the performance of our underground water infrastructure, utilities will be better able to manage our pipe networks and ensure their cost-effectiveness and sustainability.

14.1. Significant Results From This Study

Highlights of the water main break report also include:

- Pipe failure rate data for seven commonly used pipe materials
- Pipe break rates as a function of utility size
- Data on the distribution of pipe failures with pipe age for each material
- Data on the distribution of pipe failure modes for each material
- Analysis of the impact of soil corrosiveness on break rates
- The computation of a national corrosion index value for utilities
- A revised correlation of people served per mile of installed water main
- Average and maximum daily water demand correlations
- Current pipe material usage with a regional breakdown
- Pipe age and size distribution
- Average and maximum operation pressure data
- Most common pipe failure age and modes
- Percentage of utilities that allow installation of certain pipe materials
- Data on water main replacement rates and condition assessment
- Average water loss rate and correlation with break rates
- Preferences about pipe replacement methods

FIGURE 41: BREAK RATES OF EACH PIPE MATERIAL FROM THE BASIC SURVEY



14.2. Acknowledgements

This work was completed with support from Uni-Bell PVC Pipe Association and the Water Finance Research Foundation. Utah State University would like to thank the more than 300 water utilities that participated in this survey.

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KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Krista E. Citron and Jeffrey Newcomb

20. Refer to Kentucky American's response to the Attorney General's First Request, Items 28 (a) and (b).

    a. If the Commission were to approve of Kentucky American's request to expand its QIP, provide the proposed estimated annual QIP rate and equivalent annual dollar amount for the average residential customer for each of the next five years.

    b. Provide the annual QIP rate and equivalent annual dollar amount that the average residential customer has paid for each year since the inception of the QIP Rider.

Response:

Please see KAW_R_AGDR2_NUM020_092123_Attachment 1.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

21. Refer to Kentucky American's response to the Attorney General's First Request, Item 31. Explain in detail whether Kentucky American has a plan(s) to address the unaccounted-for water loss stemming from the 270 Special Connections. Provide a copy of the plan(s). If no plan is in place to address this issue, explain in detail why not.

Response:

KAWC has not implemented a formal plan for addressing water loss for the 270 special connections. Beginning in 2023, KAWC implemented a small investigative trial involving fire service lines, to assess the level of potential water loss related to those special connections. Please reference the response to PSC 3-36 for a summary of findings related to the initial trial assessment. KAWC chose to start with the fire service trial to validate both the new metering equipment and procedures necessary to accurately assess flow on these connections. Fire service lines are readily accessible by below ground vaults or mechanical rooms that facilitate KAWC access directly to the fire service pipe to attach the metering equipment. By contrast, special connections that serve fire lines, private hydrants and domestic service are connected directly to the KAWC system with underground piping. KAWC is still in the process of assessing the most effective approach to access and assess these special connections.

Due to the complexity of how and where special connections are tied into the KAWC system, more evaluation is needed to identify how below ground access points could be installed to access below ground piping for temporary metering. Once fully developed, KAWC intends to implement a formal approach to these assessments. As part of the formal process, KAWC does intend to install permanent monitoring meters at a few large special connections, such as the Kentucky Horse Park, to help monitor water loss, however this approach may not work with all special connections, especially large customers such as the University of Kentucky which has many different connections with KAWC. Lastly, as discussed in the response to AG 1-31, an assessment needs to be conducted to evaluate the feasibility of total special connection metering at the point of connection with the KAWC system and which special connections may benefit from this approach. This work effort may include field surveys, GPS mapping reviews, onsite field investigations and coordination with special connection customers. Once these issues are better understood, a formal plan that incorporates all 270 special connections will be implemented.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

22. Refer to Kentucky American's response to the Attorney General's First Request, Items 30(a) and (b). Consider these questions as ongoing requests throughout the pendency of this case.

Response:

a. The short-term contract continues to work as expected. See performance data in the table below.

	2022 (in-house) May - July	2023 (outsourced) May - July	2023 vs 2022 (Decrease)/Increase
Total Locates Received	15,569	15,769	200
Late Locates including projects	4,573	341	(4,232)
Late Locates excluding projects	604	195	(409)
Total damages	32	15	(17)
Mismarked damages	19	8	(11)

Please note that large projects that require multiple trips and/or require coordination with contractors in terms of project progress result in late locates when reported against the standard locate completion time established by the One Call system. The table above provides a comparison of locates on projects as opposed to normal locate completion. As noted in KAWC's response to AG 1-30(a), there was a reasonable learning curve for the vendor as it adopted KAWC mapping, service order technologies, and data at the start of the contract.

b. KAWC did reassign internal staff to perform other duties during this trial. While cost savings related to reduced overtime pay are expected in the future, utilizing a third-party vendor has allowed KAWC to redeploy existing employee resources to focus on unaccounted-for water, customer service, meter reading, and other work activities that do have a direct future impact to improving customer service levels and reducing operational costs.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

23. Refer to Kentucky American's response to the Attorney General's First Request, Item 32(b).

    a. Explain in detail why there is such a large difference in the water loss percentage for 2023 thus far, ranging from a low of 14.69% in June, up to a high of 31.78% in April.

    b. Continue to provide updated water loss percentages for 2023 throughout the pendency of this case.

Response:

a. Water loss is calculated using several inputs that may fluctuate monthly. For example, the number of billing usage days in a month, the usage days billed to KAW from its purchased water suppliers, the amount of water used by others (e.g., fire departments, fire system testing, street sweeping, etc.) that is accurately or not reported to KAW monthly, total system delivery, variations in system pressure needed to supply required demand, number of leaks, and weather can all impact this result. These fluctuations are a normal occurrence and one reason why the 12-month rolling average is a better indicator of water loss.

b. See table below for most recent water loss data.

2023 Water Loss by Month	
January	20.10%
February	16.55%
March	21.90%
April	31.78%
May	27.50%
June	14.69%
July	23.30%
Aug	Data not available until EOM

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

24. Refer to Kentucky American's response to the Attorney General's First Request, Item 32(c). Provide a citation to all Commission precedent that Kentucky American relies upon for its pending request for deviation from the 15% unaccounted-for water loss requirement pursuant to 807 KAR 5:066, Section 6(3).

Response:

As explained in the response to AG 1-32(c), KAWC relies on the plain language of 807 KAR 5:066, Section 6(3), which states that a utility may request an alternative level of reasonable unaccounted-for water.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Kathryn Nash

25. Refer to Kentucky American's response to the Attorney General's First Request, Item 33(b).

    a. Kentucky American asserts that the Help to Others ("H2O") program has had an unusually high balance of funds for the past two years. Explain what happens to the balance of funds at the end of the year. Ensure to discuss whether the unused balance is rolled over to the next year, or if it is returned to the shareholders or customers who donated the funds, etc.

    b. If the unused balance is rolled over from year to year, provide the balance at the end of each year from 2018 – 2022, and include the most updated current balance of the H2O program for 2023.

    c. Due to the unused balances over the past two years, does Kentucky American envision extending the increased grant allowance of $250, instead of $125, past December 2023? If not, explain why not.

    d. Kentucky American asserts that, "[i]n compliance with PSC Order the Company must fund the program annually with a minimum donation of $74,264 regardless of the customer demand for funds." Provide the case citation that Kentucky American is referring to in the aforementioned statement.

Response:

a. Any balance of funds remaining in the H2O Help to Others program account at the end of the year rolls over to the following year for H2O program use.

b. The program administrator, Dollar Energy Fund, has indicated the following balances in the H2O Help to Others fund as of September 30 for each year listed:
   2018: $5,673
   2019: $2,480
   2020: $25,739
   2021: $65,262
   2022: $80,360

   The current balance as of September 12, 2023, is $80,360.

c. KAW will review the balance of the account before the end of the year and make a determination at that time regarding whether or not to extend the increased grant allowance past December 2023.

d. Please see KAW's Response to Item No. 4 of Commission Staff's Second Request for Information in Case No. 2019-00366, in which KAW stated:

> In Case No. 2018-00358, KAW erroneously included $11,764 of Low Income Program Expense in its revenue requirement. The amount, which was included in the Miscellaneous Expense Workpaper 3-20, should have been removed from the filing. Kentucky American Water forwarded to Dollar Energy Fund in November 2019 a donation of $11,764 to be used for the H20 Help to Others Program. This was in addition to the $62,500 donation forwarded by the Company to Dollar Energy Fund earlier that month for the same program. Kentucky American Water will continue contributing $74,264 annually for low-income bill payment assistance ($62,500 + $11,764) until new water rates are established by the Commission.

The $62,500 amount was originally agreed to in the unanimous stipulation reached by the parties in KAW's 2015 rate case (Case No. 2015-00418) which stipulation the Commission approved in its August 23, 2016 Order in that case.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb and William A. Lewis

26. Refer to Kentucky American's response to the Attorney General's First Request, Items 34.

a. Explain whether there are any open cases/investigations concerning Kentucky American's request to utilize Backflow Solutions, Inc. ("BSI") to serve as a third-party administrator of the cross-connection control annual certification process. If so, provide the corresponding case citation(s).

b. In the final Order in Case No 2022-00425,[6] the Commission stated the following, in part:

> Based upon a review of the tariff filing and being otherwise sufficiently advised, the Commission finds that Kentucky-American's proposed revisions are not fair, just or reasonable, and should be denied for the following reasons. The proposed revisions appear to move the testing and approval from Kentucky-American, to a scheme required by Kentucky-American. Customers would then be subject to costs and expenses charged by a third party, with such charges not being subject to Commission jurisdiction. Such concern is amplified by the fact that Kentucky-American has indicated that a customer's service would be terminated if they did not follow the proposed procedure. The current tariff language allows customers to choose their own third party for testing. While they still may be able to do so under the proposed tariff, another layer has been added which could subject customers to additional fees.[7]

Explain in detail whether the pending request addresses any of the Commission's aforementioned concerns, and if so, provide a detailed explanation of each concern that has been addressed and how. If not, explain in detail why not.

c. Explain in detail how the pending request is different in any way than the request the Company made in Case No. 2022-00425.

Response:

a. Beyond the pending request in the Case No. 2023-00191, which is an open case, the only other case of which the Company is aware concerning Kentucky-

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[6] Case No. 2022-00425, *Electronic Tariff Filing of Kentucky-American Water Company to Revise its Cross-Connection Policy* (Ky. PSC Dec. 22, 2022), Order at 3.
[7] *Id*. at 3.

American's request to utilize Backflow Solutions, Inc. ("BSI") to serve as a third-party administrator of the cross-connection control annual certification process is Case No. 2022-00425, which is a case that was closed and removed from the Commission's docket on December 22, 2022.

b. The request in Case No. 2022-00425, and here in this proceeding, is about administration of a cross-connection backflow prevention program, how customers pay for that administration, and which customers pay for that administration. As noted in the cited language of the Order, the Commission expressed concern that the proposal "appear[s] to move the testing and approval from Kentucky-American… to a third party." The tariff filing in Case No. 2022-00425 did not include formal data requests from the Commission or from the Attorney General as this rate case does. The proposal would not take the choice of testing away from customers. Customers would still be free to hire any qualified contractor they wish, but BSI is the proposed contractor for administration, including the time-intensive data entry of the cross-connection backflow prevention certifications. Currently, the company has one employee dedicated to doing the data entry, and all customers share in the cost of that employee. Not all customers have to perform cross-connection backflow prevention certifications, and the proposal would have those who do have cross-connection(s) pay for the administration outsourced to BSI for their certifications rather than the entire customer base if the contractor chooses to charge for the administration fee. KAW does not know whether a contractor will do that, and, if so, how it will do that. The fee would never appear on a KAW bill. The Company maintains this proceeding is an appropriate forum for the request that offers the Commission and interested parties the opportunity to further consider Kentucky-American's proposed revisions to its cross-connections policy. The filing of this request in a rate proceeding opens up the conversation around the administration of a cross-connection backflow prevention program. The Commission's Final Order in Case No. 2022-00425 does not preclude Kentucky-American from making the request in this case. The Company also still believes the request is in the interest of customers and the protection of the public water system, and my testimony describes how BSI helps address the challenges and opportunities for improvement of the current certification process.

c. Please see Kentucky-American's response to AG 1-34. The Company would also point out the difference in type of proceeding for the request. Case No. 2023-00191 is a rate case application while Case No. 2022-00425 was a tariff filing.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

27. Refer to Kentucky American's response to the Attorney General's First Request, Item 35(a). As originally requested, provide the monetary amount that Kentucky American included in the revenue requirement for all payment processing fees (e.g. cash, check, debit card, credit card, e-check, direct debit, etc.), with a breakdown between each payment type.

Response:

As stated in the Company's response to AG 1-35, part a, the amount that Kentucky-American included in the revenue requirement was for electronic payment processing of credit cards in the amount of $349,284. However, it has come to the Company's attention that the e-check payment processing fee in the amount of $73,359 was omitted, and Kentucky-American will update the revenue requirement when it files the base period update. Please see table below for a breakdown by each payment type:

Payment Type	**Amount by Payment Type**
Credit Cards (including debit card payments)	$349,284
E-check	73,359
Cash/Check via Third-party locations	5,406
Lock box (including direct debit)	28,374
Total	**$456,423**

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

28. Refer to Kentucky American's response to the Attorney General's First Request, Item 35(c). Kentucky American asserts that regardless of the customer's payment method, there is a cost to process the customer's payment.

    a. Provide a detailed list of all accepted payment methods with Kentucky American's associated cost to process each type of payment (e.g. cash, check, debit card, credit card, e-check, direct debit, etc.)

    b. Provide a detailed list of all payment methods that Kentucky American accepts with the corresponding associated fee that the customer is required to pay in order to utilize that specific payment type.

Response:

a – b. Please see KAW_R_AGDR2_NUM028_092123_Attachment.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

29. Refer to Kentucky-American's response to the Attorney General's First Request, Item 35(d). Provide a detailed list of the third-party locations in which customers can pay their water bills with no additional fees.

Response:

Please refer to KAW_R_AGDR2_NUM029_092123_Attachment for the listing of the Kentucky-American and third-party locations for Kentucky-American customers to pay their water bills with no additional fees charged to the customer.

Kentucky-American Water Company
Case No. 2023-00191
KAW_R_AGDR2_NUM029_092123
Customer Payment Locations

Name	Address Line 1	Address	City	State	ZIP Code	Phone	Hours
AMERICAN WATER	9226 MAIN ST	STE A	LIVINGSTON	KY	40445	(859) 269-2386	Monday Thru Friday 09:00 AM to 04:00 PM, Saturday Closed, Sunday Closed.
CITY NATIONAL BANK #110	318 EAST MAIN ST		LEXINGTON	KY	40507	(859) 367-3700	Monday Thru Friday 08:00 AM to 05:00 PM, Saturday and Sunday Closed.
CITY NATIONAL BANK #111	3750 PALOMAR CENTRE DR		LEXINGTON	KY	40513	(859) 367-3770	Monday Thru Friday 08:00 AM to 05:00 PM, Saturday 09:00 AM to 12:00 PM, Sunday Closed.
CITY NATIONAL BANK #112	3616 WALDEN DR		LEXINGTON	KY	40517	(859) 367-3760	Monday Thru Friday 08:00 AM to 05:00 PM, Saturday 09:00 AM to 12:00 PM, Sunday Closed.
CITY NTL BANK KING'S DAUGHTERS MED CTR	617 23RD ST	STE 104	ASHLAND	KY	41101	(606) 467-6100	Monday Thru Friday 08:30 AM to 05:00 PM, Saturday and Sunday Closed.
CORK N BOTTLE	4350 CANE RUN RD		LOUISVILLE	KY	40216	(502) 449-1738	Monday Thru Saturday 09:00 AM to 11:59 PM, Sunday 01:00 PM to 09:00 PM.
DURHAMS GROCERY	606 LANCASTER ST		STANFORD	KY	40484	(606) 365-2113	Monday Thru Saturday 07:00 AM to 09:00 PM, Sunday 08:00 AM to 09:00 PM.
FAST STOP OF LEXINGTON	1392 TRENT BLVD		LEXINGTON	KY	40517	(859) 272-0715	Monday Thru Sunday 07:00 AM to 11:00 PM.
FRAMES N THINGS	219 S WALNUT ST	STE 6	CYNTHIANA	KY	41031	(859) 234-5873	Monday Thru Friday 10:00 AM to 05:00 PM, Saturday 10:00 AM to 02:00 PM, Sunday Closed.
K-MART #3029	3071 DIXIE HWY		ERLANGER	KY	41018	(859) 331-7080	Monday Thru Sunday 08:00 AM to 10:00 PM.
K-MART #7255	420 EAST HIGHWAY 80		SOMERSET	KY	42501	(606) 679-7366	Monday Thru Sunday 08:00 AM to 10:00 PM.
KENTUCKY AMERICAN WATER	2300 RICHMOND ROAD		LEXINGTON	KY	40502	(859) 269-2386	Monday Thru Friday 09:00 AM to 04:00 PM, Saturday Closed, Sunday Closed.
KROGER #186	2219 HOLIDAY MANOR CT.		LOUISVILLE	KY	40222	(502) 425-6960	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #224	2200 BROWNSBORO RD		LOUISVILLE	KY	40206	(502) 897-1133	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #250	501 LONE OAK RD		PADUCAH	KY	42003	(270) 443-8806	Monday Thru Sunday 08:00 AM to 09:00 PM.
KROGER #292	7509 TERRY LANE		LOUISVILLE	KY	40258	(502) 935-8954	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #309	9812 LINN STATION RD		LOUISVILLE	KY	40223	(502) 423-0943	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #327	2710 W BROADWAY		LOUISVILLE	KY	40211	(502) 778-3346	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #331	1805 N MAIN ST		LONDON	KY	40741	(606) 864-4311	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #332	4211 S 3RD ST		LOUISVILLE	KY	40214	(502) 368-3065	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #336	2308 E 4TH ST		OWENSBORO	KY	42303	(270) 926-1433	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #338	3275 IRVIN COBB DR		PADUCAH	KY	42003	(270) 442-2043	Monday Thru Sunday 08:00 AM to 08:00 PM.
KROGER #339	2440 BARDSTOWN RD		LOUISVILLE	KY	40205	(502) 459-9805	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #346	3039 BRECKENRIDGE LN		LOUISVILLE	KY	40220	(502) 452-6445	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #347	4101 TATES CREEK CENTRE DRIVE		LEXINGTON	KY	40517	(859) 273-1100	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #350	5533 NEW CUT RD		LOUISVILLE	KY	40214	(502) 361-7446	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #352	150 W LOWRY LN STE 190		LEXINGTON	KY	40503	(859) 278-6228	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #355	515 N 12TH ST		MIDDLESBORO	KY	40965	(606) 248-3410	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #356	12501 SHELBYVILLE RD		MIDDLETOWN	KY	40243	(502) 244-7957	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #359	1650 BRYAN STATION RD		LEXINGTON	KY	40505	(859) 293-5969	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #359	53 DONNERMEYER DR		BELLEVUE	KY	41073	(859) 491-4210	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #360	6900 BARDSTOWN RD		LOUISVILLE	KY	40291	(502) 239-2115	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #361	1808 ALEXANDRIA DR		LEXINGTON	KY	40504	(859) 276-3556	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #362	111 TOWNE DR		ELIZABETHTOWN	KY	42701	(270) 737-1707	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #363	844 S COLLEGE ST		HARRODSBURG	KY	40330	(859) 734-0078	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #364	9950 BERBERICH DR		FLORENCE	KY	41042	(859) 372-3460	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #366	5001 MUD LN		LOUISVILLE	KY	40229	(502) 962-7744	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #367	635 CHESTNUT DR		WALTON	KY	41094	(859) 669-1600	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #368	1309 US 127 S SUITE H		FRANKFORT	KY	40601	(502) 875-0124	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #369	399 CAMPBELLSVILLE BYP STE 100		CAMPBELLSVILLE	KY	42718	(270) 465-6065	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #371	3650 BOSTON RD		LEXINGTON	KY	40514	(859) 223-8088	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #376	4501 OUTER LOOP		LOUISVILLE	KY	40219	(502) 969-2855	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #379	9080 TAYLORSVILLE RD		LOUISVILLE	KY	40299	(502) 491-8805	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #381	1525 MADISON AVE		COVINGTON	KY	41011	(859) 431-1607	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #387	291 N HUBBARDS LN STE 130		LOUISVILLE	KY	40207	(502) 895-8332	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #389	5929 TIMBER RIDGE DR		PROSPECT	KY	40059	(502) 292-2464	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #392	4303 WINSTON AVE		COVINGTON	KY	41015	(859) 655-0700	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #394	2034 S HIGHWAY 53		LAGRANGE	KY	40031	(502) 222-0269	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #397	300 BRIGHTON PARK BLVD		FRANKFORT	KY	40601	(502) 695-4860	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #400	4009 POPLAR LEVEL RD		LOUISVILLE	KY	40213	(502) 454-3914	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #402	1661 BYPASS RD HWY 1958		WINCHESTER	KY	40391	(859) 745-4959	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #403	1509 E BROADWAY ST		CAMPBELLSVILLE	KY	42718	(270) 465-7024	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #407	3101 RICHMOND RD		LEXINGTON	KY	40509	(859) 268-6006	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #408	102 WEST JOHN ROWAN BLVD		BARDSTOWN	KY	40004	(502) 348-2977	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #409	1732 HIGHWAY 192 W		LONDON	KY	40741	(606) 878-1254	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #409	3105 NORTH BEND RD		HEBRON	KY	41048	(859) 962-4900	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #410	375 CROSSROADS BLVD		COLD SPRING	KY	41076	(859) 448-1170	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #411	179 W COLLEGE AVE		STANTON	KY	40380	(606) 663-2873	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #414	3141 PARK AVE		PADUCAH	KY	42001	(270) 444-0596	Monday Thru Sunday 08:00 AM to 09:00 PM.

Name	Address Line 1	Address	City	State	ZIP Code	Phone	Hours
KROGER #420	381 MARKET SQUARE DR		MAYSVILLE	KY	41056	(606) 759-7962	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #423	130 PAVILION PKWY		NEWPORT	KY	41071	(859) 292-5640	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #434	1751 PATRICK DR		BURLINGTON	KY	41005	(859) 586-4450	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #435	808 N 12TH ST		MURRAY	KY	42071	(270) 759-3021	Monday Thru Sunday 08:00 AM to 09:00 PM.
KROGER #454	9001 US HWY 42		UNION	KY	41091	(859) 334-9400	Monday Thru Sunday 08:00 AM to 09:00 PM.
KROGER #466	7685 MALL RD		FLORENCE	KY	41042	(859) 795-5800	Monday Thru Sunday 08:00 AM to 08:00 PM.
KROGER #475	1700 DECLARATION DRIVE		INDEPENDENCE	KY	41051	(859) 898-1600	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #477	2150 DIXIE HWY		FORT MITCHELL	KY	41017	(859) 292-1800	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #509	711 CAMPBELL LN		BOWLING GREEN	KY	42104	(270) 783-0701	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #522	1213 SKYLINE DR		HOPKINSVILLE	KY	42240	(270) 885-7606	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #535	350 WEST US 31 BYPASS		BOWLING GREEN	KY	42101	(270) 796-5987	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #563	545 ISLAND FORD RD		MADISONVILLE	KY	42431	(270) 821-1059	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #585	2945 SCOTTSVILLE RD		BOWLING GREEN	KY	42104	(270) 780-9887	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #705	890 RICHMOND PLAZA		RICHMOND	KY	40475	(859) 624-1092	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #707	9440 BROWNSBORO RD		LOUISVILLE	KY	40241	(502) 425-8542	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #708	170 BELLERIVE BLVD		NICHOLASVILLE	KY	40356	(859) 219-1058	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #710	2549 US HIGHWAY 227		CARROLLTON	KY	41008	(502) 732-5380	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #712	810 INDIAN MOUND DR		MT STERLING	KY	40353	(859) 497-4314	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #713	995 S MAIN ST		NICHOLASVILLE	KY	40356	(859) 881-9037	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #717	3040 DOLPHIN DR		ELIZABETHTOWN	KY	42701	(270) 737-4715	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #718	1670 STARLITE DR		OWENSBORO	KY	42301	(270) 926-1607	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #719	1019 CUMBERLAND FALLS HWY		CORBIN	KY	40701	(606) 526-1717	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #721	4750 HARTLAND PKWY		LEXINGTON	KY	40515	(859) 273-2557	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #728	185 ADAM SHEPHERD PKWY		SHEPHERDSVILLE	KY	40165	(502) 543-7242	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #729	3616 BUECHEL BYPASS		LOUISVILLE	KY	40218	(502) 456-6522	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #730	705 E MAIN ST		LEBANON	KY	40033	(270) 692-3591	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #733	200 SKYWATCH DR		DANVILLE	KY	40422	(859) 236-3987	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #734	300 TRADEMORE CENTER		MOREHEAD	KY	40351	(606) 784-7529	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #737	1060 CHINOE RD STE 190		LEXINGTON	KY	40502	(859) 335-4706	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #739	12450 LAGRANGE ROAD		LOUISVILLE	KY	40245	(502) 241-1311	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #743	12611 TAYLORSVILLE RD STE 102		LOUISVILLE	KY	40299	(502) 261-0251	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #745	50 STONEGATE CTR		SOMERSET	KY	42501	(606) 678-0202	Monday Thru Sunday 08:00 AM to 10:00 PM.
KROGER #752	3165 S 2ND ST		LOUISVILLE	KY	40208	(502) 368-6075	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #753	1265 GOSS AVE		LOUISVILLE	KY	40217	(502) 634-0724	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #757	181 S HIGHWAY 27		SOMERSET	KY	42501	(606) 678-5147	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #758	234 EASTBROOKE PKWY		MT WASHINGTON	KY	40047	(502) 538-1240	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #760	14889 N US HIGHWAY 25 E		CORBIN	KY	40701	(606) 528-8630	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #763	520 N 35TH ST		LOUISVILLE	KY	40212	(502) 776-3713	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #764	9501 WESTPORT RD		LOUISVILLE	KY	40241	(502) 425-0065	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #766	200 E BRANNON RD		NICHOLASVILLE	KY	40356	(859) 971-4300	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #767	3175 BEAUMONT CENTRE CIR		LEXINGTON	KY	40513	(859) 219-1091	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #768	1600 LEESTOWN RD		LEXINGTON	KY	40511	(859) 259-0933	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #770	2630 FREDERICA ST		OWENSBORO	KY	42301	(270) 684-9411	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #774	212 KROGER WAY		VERSAILLES	KY	40383	(859) 873-7704	Monday Thru Sunday 08:00 AM to 08:00 PM.
KROGER #777	311 BOONE STATION RD		SHELBYVILLE	KY	40065	(502) 647-5739	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #779	106 MARKETPLACE CIRCLE		GEORGETOWN	KY	40324	(502) 863-4807	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #780	10645 DIXIE HWY		LOUISVILLE	KY	40272	(502) 937-5205	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #783	711 MARTIN LUTHER KING JR BLVD		ASHLAND	KY	41101	(606) 325-8231	Monday Thru Sunday 08:00 AM to 10:00 PM.
KROGER #784	704 EUCLID AVE		LEXINGTON	KY	40502	(859) 687-3260	Monday Thru Sunday 08:00 AM to 08:00 PM.
KROGER #785	4915 DIXIE HWY		LOUISVILLE	KY	40216	(502) 448-8247	Monday Thru Sunday 08:00 AM to 08:00 PM.
KROGER #796	370 DIEDERICH BLVD		ASHLAND	KY	41101	(606) 325-8911	Monday Thru Sunday 08:00 AM to 09:00 PM.
KROGER #873	U.SOUTH HIGHWAY 62 E		POWDERLY	KY	42367	(270) 338-6661	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #900	181 S HIGHWAY 127		RUSSELL SPRINGS	KY	42642	(270) 866-3121	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #901	3158 DIXIE HWY		ERLANGER	KY	41018	(859) 344-0222	Monday Thru Sunday 08:00 AM to 11:00 PM.
KROGER #903	568 BYPASS RD		BRANDENBURG	KY	40108	(270) 422-5464	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #913	1300 ANDERSON CROSSING DR		LAWRENCEBURG	KY	40342	(502) 839-1323	Monday Thru Friday 07:00 AM to 10:00 PM, Saturday Closed, Sunday 07:00 AM to 10:00 PM.
KROGER #916	1187 N HWY 27		WHITLEY CITY	KY	42653	(606) 376-2700	Monday Thru Sunday 07:00 AM to 10:00 PM.
KROGER #946	70 MARTHA LAYNE COLLINS BLVD		COLD SPRING	KY	41076	(859) 781-8808	Monday Thru Sunday 08:00 AM to 11:00 PM.
LEXINGTON MARKET EAST END	503 EAST 3RD ST		LEXINGTON	KY	40508	(859) 252-0051	Monday Thru Friday 09:00 AM to 08:00 PM, Saturday 10:00 AM to 08:00 PM, Sunday 10:00 AM to 06:00 PM.
MARATHON FOOD MART	1840 BRYAN STATION RD		LEXINGTON	KY	40505	(859) 299-3161	Monday Thru Saturday 06:00 AM to 11:00 PM, Sunday 07:00 AM to 11:00 PM.
PATEL VALERO	101 MAIN ST		WEST POINT	KY	40177	(203) 609-4011	Monday Thru Sunday 07:00 AM to 07:00 PM.
PRIME STAR 3	512 E WOODFORD ST		LAWRENCEBURG	KY	40342	(502) 859-3535	Monday Thru Sunday 05:00 AM to 11:00 PM.
RUSSELL FORK PHARMACY	10363 REGINAL BELCHER HWY		ELKHORN	KY	41522	(606) 754-7085	Monday Thru Friday 09:00 AM to 05:00 PM, Saturday and Sunday Closed.

Name	Address Line 1	Address	City	State	ZIP Code	Phone	Hours
SCOTT'S FOOD MART	1810 BERRY BLVD		LOUISVILLE	KY	40216	(502) 368-1398	Monday Thru Sunday 07:30 AM to 09:30 PM.
WAL-MART STORES INC #00106	1405 MIDDLE ROAD		FULTON	KY	42041	(270) 472-1426	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00143	310 WEST 5TH STREET		BENTON	KY	42025	(270) 527-1605	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00204	500 US HIGHWAY 62 WEST		PRINCETON	KY	42445	(270) 365-7692	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00257	901 U.SOUTH HIGHWAY 60 EAST		MORGANFIELD	KY	42437	(270) 389-1828	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00282	1550 NASHVILLE ROAD		FRANKLIN	KY	42134	(270) 586-9281	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00294	1725 WEST EVERELY BROTHERS BLV		CENTRAL CITY	KY	42330	(270) 754-4512	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00299	150 WALTON AVENUE		BOWLING GREEN	KY	42104	(270) 781-7903	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00333	1701 NORTH MAIN		BEAVER DAM	KY	42320	(270) 274-9608	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00410	809 NORTH 12TH STREET		MURRAY	KY	42071	(270) 753-2195	Monday Thru Friday 08:00 AM to 09:00 PM, Saturday and Sunday Closed.
WAL-MART STORES INC #00430	1225 PARIS ROAD		MAYFIELD	KY	42066	(270) 247-0358	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00431	3220 IRVING COBB DRIVE		PADUCAH	KY	42003	(270) 444-6941	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00445	1801 ELIZABETHTOWN ROAD		LEITCHFIELD	KY	42754	(270) 259-5622	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00491	5130 HINKLEVILLE ROAD		PADUCAH	KY	42001	(270) 444-0066	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00493	305 LETTON DRIVE		PARIS	KY	40361	(859) 987-2817	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00497	500 TAYLORSVILLE ROAD		SHELBYVILLE	KY	40065	(502) 633-0705	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00507	1000 BYPASS NORTH		LAWRENCEBURG	KY	40342	(502) 839-5178	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00519	591 JOSEPH DRIVE		HARRODSBURG	KY	40330	(859) 734-5721	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00526	3706 DIANN MARIE ROAD		LOUISVILLE	KY	40241	(502) 326-9166	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00545	240 MANCHESTER SQUARE		MANCHESTER	KY	40962	(606) 598-6123	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00552	350 WHITESBURG PLAZA		WHITESBURG	KY	41858	(606) 633-0152	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00569	809 JAMESTOWN STREET		COLUMBIA	KY	42728	(270) 384-4745	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00571	112 OSBORNE WAY		GEORGETOWN	KY	40324	(502) 867-0547	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00584	20 FERGUSON BOULEVARD		DRY RIDGE	KY	41035	(859) 824-0575	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00589	11901 STANDIFORD PLAZA ROAD		LOUISVILLE	KY	40229	(502) 968-6800	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00591	805 US 27 SOUTH		CYNTHIANA	KY	41031	(859) 234-3232	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00653	300 CLINIC DRIVE		HOPKINSVILLE	KY	42240	(270) 886-1900	Monday Thru Friday 08:00 AM to 09:00 PM, Saturday and Sunday Closed.
WAL-MART STORES INC #00655	420 FACTORY OUTLET DRIVE		HANSON	KY	42413	(270) 821-6388	Monday Thru Friday 08:00 AM to 09:00 PM, Saturday and Sunday Closed.
WAL-MART STORES INC #00665	725 CAMPBELLSVILLE BYPASS		CAMPBELLSVILLE	KY	42718	(270) 789-0707	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00689	177 WASHINGTON DRIVE		SOMERSET	KY	42503	(606) 679-9204	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00692	100 WALTON AVENUE		DANVILLE	KY	40422	(859) 236-9572	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00693	1589 KENTUCKY / HIGHWAY 15 SO		JACKSON	KY	41339	(606) 666-4907	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00694	1195 BARRETT BOULEVARD		HENDERSON	KY	42420	(270) 826-6036	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00696	477 VILLAGE DRIVE		PRESTONSBURG	KY	41653	(606) 886-6681	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00701	5031 FREDERICA STREET		OWENSBORO	KY	42301	(270) 685-2060	Monday Thru Friday 08:00 AM to 09:00 PM, Saturday and Sunday Closed.
WAL-MART STORES INC #00702	1859 BYPASS ROAD		WINCHESTER	KY	40391	(859) 744-5070	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00709	100 WAL-MART DRIVE		ELIZABETHTOWN	KY	42701	(270) 763-1600	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00711	2345 HAPPY VALLEY ROAD		GLASGOW	KY	42141	(270) 678-1003	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00719	820 EASTERN BYPASS		RICHMOND	KY	40475	(859) 624-4330	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00720	301 LEONARDWOOD DRIVE		FRANKFORT	KY	40601	(502) 875-5533	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00729	3795 EAST JOHN ROWAN BOULEVARD		BARDSTOWN	KY	40004	(502) 349-6007	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00736	120 SAM WALTON DRIVE		RUSSELLVILLE	KY	42276	(270) 726-2880	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00739	US HIGHWAY 441 HIGHWAY 25E		MIDDLESBORO	KY	40965	(606) 248-9087	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00760	1002 OLD US 60 EAST		HARDINSBURG	KY	40143	(270) 756-6012	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #00825	1283 US HIGHWAY 27 NORTH		STANFORD	KY	40484	(606) 365-2153	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01048	589 HIGHWAY WEST 92		WILLIAMSBURG	KY	40769	(606) 549-4075	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01053	1015 NEW MOODY LANE		LA GRANGE	KY	40031	(502) 222-4260	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01113	1851 WEST HIGHWAY 192		LONDON	KY	40741	(606) 878-6119	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01139	200 WALMART WAY		MOREHEAD	KY	40351	(606) 784-3262	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01140	499 INDIAN MOUND DRIVE		MOUNT STERLING	KY	40353	(859) 497-9401	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01165	1165 WAL-MART WAY		RADCLIFF	KY	40160	(270) 352-2720	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01170	10445 DIXIE HIGHWAY		LOUISVILLE	KY	40272	(502) 935-3233	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01189	301 PARKWAY PLAZA		BARBOURVILLE	KY	40906	(606) 546-5454	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01190	120 JILL DRIVE		BEREA	KY	40403	(859) 986-2324	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01210	1024 NORTH MAIN STREET		NICHOLASVILLE	KY	40356	(859) 885-3299	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01233	470 NO. MAYO TRAIL		PAINTSVILLE	KY	41240	(606) 789-8920	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01234	1461 EAST HIGHWAY 90 BYPASS		MONTICELLO	KY	42633	(606) 348-3331	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01247	120 DANIEL BOONE PLAZA		HAZARD	KY	41701	(606) 439-1882	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01259	60 SOUTH STEWART ROAD		CORBIN	KY	40701	(606) 523-1770	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01269	1915 SOUTH HURSTBOURNE PARKWAY		LOUISVILLE	KY	40220	(502) 499-1050	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01505	254 CASSIDY BOULEVARD		PIKEVILLE	KY	41501	(606) 432-6177	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01510	7625 DOERING DRIVE		FLORENCE	KY	41042	(859) 282-8333	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01675	180 LEBANON TRADE CENTER		LEBANON	KY	40033	(270) 692-1880	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #01743	201 WALTON ROAD		HARLAN	KY	40831	(606) 573-2206	Monday Thru Sunday 08:00 AM to 09:00 PM.

Name	Address Line 1	Address	City	State	ZIP Code	Phone	Hours
WAL-MART STORES INC #01961	6711 ALEXANDRIA PIKE		ALEXANDRIA	KY	41001	(859) 635-8800	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #02628	4051 NICHOLASVILLE ROAD		LEXINGTON	KY	40503	(859) 971-0572	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #02638	12504 U.SOUTH ROUTE 60		ASHLAND	KY	41102	(606) 929-9510	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #02654	1650 EDMONTON ROAD		TOMPKINSVILLE	KY	42167	(270) 487-0780	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #02783	500 WEST NEW CIRCLE ROAD		LEXINGTON	KY	40511	(859) 381-9370	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #02967	3450 VALLEY PLAZA PARKWAY		FORT WRIGHT	KY	41017	(859) 341-7900	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #02968	200 FLOYD DRIVE		CARROLLTON	KY	41008	(502) 732-0645	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #03294	7101 CEDAR SPRINGS BOULEVARD		LOUISVILLE	KY	40291	(502) 231-4880	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #03362	14800 FORT CAMPBELL BOULEVARD		OAK GROVE	KY	42262	(270) 640-4744	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #03363	3151 STATE ROUTE 54		OWENSBORO	KY	42303	(270) 683-5553	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #03610	7100 RAGGARD ROAD		LOUISVILLE	KY	40216	(502) 447-4677	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #03894	2350 GREY LAG WAY ROAD		LEXINGTON	KY	40509	(859) 263-0999	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #04118	545 CONESTOGA PKWY	LOT 1	SHEPHERDSVILLE	KY	40165	(502) 281-5005	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #04413	4230 SARON DRIVE		LEXINGTON	KY	40515	(859) 272-1272	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #04450	12981 SHELBYVILLE ROAD		MIDDLETOWN	KY	40243	(502) 244-2551	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #04461	275 WALTON DRIVE		LOUISA	KY	41230	(606) 673-4427	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #04523	201 BLANKENBAKER PARKWAY		LOUISVILLE	KY	40243	(502) 244-2904	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #04524	5360 DIXIE HIGHWAY		LOUISVILLE	KY	40216	(502) 447-4757	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #04607	3735 PALOMAR CENTER DRIVE		LEXINGTON	KY	40513	(859) 224-0840	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #05059	3106 CANTON ST		HOPKINSVILLE	KY	42240	(270) 962-4121	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #05135	102 GATEWAY CROSSINGS BOULEVAR		RADCLIFF	KY	40160	(270) 351-6300	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #05183	3800 RUCKRIEGEL PARKWAY		JEFFERSONTOWN	KY	40299	(502) 266-2685	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #05236	1201 MORGANTOWN ROAD		BOWLING GREEN	KY	42101	(270) 780-9996	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #05297	143 THIERMAN LANE		SAINT MATTHEWS	KY	40207	(502) 893-8088	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #05417	175 OUTER LOOP		LOUISVILLE	KY	40214	(502) 361-0225	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #05418	2020 BASHFORD MANOR LANE		LOUISVILLE	KY	40218	(502) 451-6766	Monday Thru Sunday 08:00 AM to 09:00 PM.
WAL-MART STORES INC #06931	4840 OUTER LOOP		LOUISVILLE	KY	40219	(502) 313-6351	Monday Thru Sunday 08:00 AM to 09:00 PM.
WALMART STORES INC #07290	6501 VETERANS MEMORIAL PARKWAY		CRESTWOOD	KY	40014	(502) 241-6271	Monday Thru Sunday 08:00 AM to 09:00 PM.
WEST MAIN FOODMART	647 W MAIN ST		LEXINTON	KY	40508	(859) 252-0904	Monday and Tuesday 06:30 AM to 11:00 PM, Wednesday 06:00 AM to 11:00 PM, Thursday and Friday 06:30 AM to 11:00 PM, Saturday 07:00 AM to 11:00 PM, Sunday 08:00 AM to 11:00 PM.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

30. Refer to Kentucky-American's response to the Attorney General's First Request, Item 35(e). Kentucky American confirms that to its knowledge all other investor-owned utilities in Kentucky charge a fee to customers who pay their utility bill using a credit card.

    a. Provide an explanation as to why Kentucky-American believes that all other investor-owned utilities in Kentucky charge a fee for a customer to use a credit card to pay the utility bill.

    b. Confirm that the monetary amount to process a credit card or e-check is greater than the monetary amount to process cash or check. If not confirmed, explain in detail why not.

Response:

a. Kentucky-American is not aware of investor-owned utilities in Kentucky that do not charge a fee to customers who pay their bill using a credit card. It is common utility industry practice to charge a fee for a customer to use a credit card to pay their utility bill, as evidenced by the National Association of State Utility Consumer Advocates ("NASUCA") resolution (Resolution 2012-07) cited in the Direct Testimony of Jeffrey Newcomb.

b. Confirmed. Please refer to Kentucky-American's response to AG 1-35, part d.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

31. Refer to Kentucky American's response to the Attorney General's First Request, Item 37(e).

    a. Confirm that Kentucky American is including $116,000 in the revenue requirement to cover the proposed low-income rate. If not confirmed, provide the amount included in the revenue requirement to cover the proposed low-income rate.

    b. If the participation rate were higher than Kentucky American's estimates, explain whether the amount included to cover the proposed low-income rate could be higher than $116,000. If so, explain whether there is a proposed cap on the amount that would be included in the revenue requirement to cover the proposed low-income rate.

    c. If Kentucky American's H2O program, to which customers and the Company's shareholders voluntarily donate funds, has had a high balance of unused funds for the past two years, explain why the Company is proposing a low-income rate in the pending case.

Response:

    a. Kentucky American is not including $116,000 in the revenue requirement to cover expected discounts associated with the proposed Universal Affordability Tariff. There are zero dollars added to the revenue requirement to cover either the administrative cost of the program or to cover expected discounts. The $116,000 figure is the amount of expected discount built into residential base rates to recoup the expected levels of discounts offered to low-income customers from other residential customers. This amount is approximately $.02 per thousand gallons.

    b. See response to a. There are zero dollars added to the revenue requirement to cover either the administrative cost of the program or to cover expected discounts. There are no caps associated with participation in the proposed program. If participation is higher or lower than expected, the actual level of discounts will be included in proof of revenue and base rate calculations in any future rate cases.

    c. See response to Commission Staff's Third Request for Information, Item 20a.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

32. Refer to Kentucky American's response to the Attorney General's First Request, Item 38(b). Kentucky American states that it plans to utilize a third-party vendor to conduct income verification for the proposed low-income rate, but no costs are currently included in the revenue requirement. However, administrative costs will be included in the revenue requirement and recovered from customers in the future. Provide the estimated monetary amount for all administrative costs of the proposed low-income rate that the customers will be forced to pay for through rates.

Response:

As provided in Kentucky-American's response to Commission Staff's Third Request, Item 21(b) the estimated annual cost to administer the program by customer is $1.65.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell

33. Refer to Kentucky American's response to the Attorney General's First Request, Item 39(b). As originally requested, confirm or deny that Kentucky American's current meters are providing reliable service to its customers. If denied, explain in detail why.

Response:

If this question referred to a single asset, a simple response would be feasible. However, with the question referring to more than 140,000 separate meter and endpoint assets (spread out across more than 2,300 miles of main), it is difficult to make a blanket statement that each of these assets is, at any moment in time, in good working order. It is reasonable to expect that some of these assets may be experiencing issues at any given point in time, as stated in response to AG 1-39, part b. As noted in AG 1-39, part b, the Company has processes designed to both address issues with individual meters as they arise and to proactively schedule regular meter replacement and testing.

KAWC is proposing to replace its existing AMR technology with AMI technology, as part of its normal, scheduled, periodic meter replacement cycle, because the Company believes it is in the long-term best interest of customers. AMI is expected to provide a variety of benefits, including improved customer service, metering, safety, and operational efficiency, while also delivering a solution that is among the least cost of the reasonable alternatives evaluated by the Company.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell

34. Refer to Kentucky American's response to the Attorney General's First Request, Item 39(e). Kentucky American states that, "there are some field service representative labor benefits and associated vehicle benefits that are captured in the Cost Benefit Analysis in 2024 and 2025."

    a. Provide the monetary amount of savings associated with the proposed Advanced Metering Infrastructure ("AMI") that Kentucky American included in the proposed revenue requirement, if any.

    b. Provide a breakdown of the monetary amount of savings associated with the proposed AMI that Kentucky American included in the proposed revenue requirement, if any.

Response:

a & b. There were no discrete adjustments made to the revenue requirement components. As noted in the response to AG 1-39e, the Company did contemplate the benefits created by AMI when determining appropriate Field Service Representative staffing levels.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell, Larry Kennedy

35. Refer to Kentucky American's response to the Attorney General's First Request, Item 40(b).

    a. Kentucky American asserts that as of December 31, 2022, the net book value of the Company's existing meters are $30,826,926, but the future accrual requirement is $36,441,998. Explain the different in the two amounts.

    b. Due to the fact that Kentucky American's existing meters still have such a large balance that the customers will be required to pay for, instead of accelerating a full replacement of all existing meters to AMI meters, explain why it is not more reasonable to replace current meters with AMI technology only when the current meters fail or are to be retired.

Response:

a. The difference between the net book value and the future accrual requirement is the net salvage amount. The net book value amount is inclusive of the recovery of net salvage amount of negative 15%. The future accrual requirement includes 15% net salvage applied to the original cost in the future accrual requirement.

b. The Company is planning to complete AMI transition as meters are coming due for scheduled retirement, and not on a more accelerated basis. For further information, please see Exhibit A to the Application, including the Summary of Plan on page 3, the Conclusion on page 21, and the Periodic Meter Replacement Program discussion on pages 10-13.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Dave Hill

36. Refer to Kentucky American's response to the Attorney General's First Request, Item 51. Explain what AMI remote "partial shut off" technology is, and how it will be used if approved by the Commission.

Response:

Partial shut off technology is available in Badger Technology meters. The valve is integrated into the meter itself. The valve can be actuated remotely if the meter is attached to a Badger AMI endpoint. The partial shut off valve reduces water flow to a trickle of water, limiting water use to life sustaining activity, for example filling a glass of water after several minutes, etc.

American Water has no plans currently to install these types of "partial shut off" meters.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

37. Refer to Kentucky American's response to the Attorney General's First Request, Item 11. Provide all funds received by Kentucky American from local government agencies for construction projects that required KAW to relocate or replace existing mains. Provide the information for each year from 2018 – 2023.

Response:

2018 – $20,176 from Fayette County Public Schools for Athens-Boonesboro Elementary Main Relocation;

2018- $56,212.29 from Commonwealth of Kentucky (KYTC) for new I-75 Interchange at Georgetown

2019 - $64,567 from Scott County Board of Education for Creekside Elementary School Main Relocation

2019- $23,821 from Lexington Bluegrass Airport for Airport Car Rental Main Relocation

2019- $141,011.06 from Commonwealth of Kentucky (KYTC) for Brannon Road Main Relocation

2019- $449,870.29 from Commonwealth of Kentucky (KYTC) for New Circle Road Main Relocation

2020- $98,819.99 from University of Kentucky for Rose Street Main Relocation

2021- $209,581.59 from Commonwealth of Kentucky (KYTC) for Georgetown Bypass Relocation

2021- $143,626.14 from Commonwealth of Kentucky (KYTC) for New Circle Road Main Relocation

2023- $79,706 Invoiced (not received to date) from Commonwealth of Kentucky for BCTC Newtown Campus Main Relocation

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

38. Refer to Kentucky American's response to the Attorney General's First Request, Item 18. Provide a breakdown of all affiliate charges to Kentucky American by direct charges, allocated costs, pass-through charges, etc.

Response:

Please see KAW_R_AGDR1_NUM057_081823_Attachment 5 for a breakdown of American Water Works Service Company, Inc. direct charges, allocated costs and overheads to Kentucky American for the 12 months ending December 31, 2022.

Please see KAW_R_AGDR2_NUM038_092123_Attachment for a breakdown of the direct charges from American Water Capital Corp. and AW Insurance charges to Kentucky American for the 12 months ending December 31, 2022.

Kentucky-American Water Company
Response to KAW_R_AGDR2_NUM038_092123

American Water Capital Corp.

Fiscal Year 2022

Sum of Amount in local currency

Row Labels	Account Description	1	2	3	4	5	6	7	8	9	10	11	12	Grand Total
52526100	Credit Line Fees I/C	5,909	5,770	5,965	5,589	5,496	5,765	5,854	5,480	5,525	3,818	3,940	3,572	62,683
81015000	Interest LTD Interco	652,344	652,344	652,344	652,344	668,413	689,427	689,427	689,427	689,427	689,427	689,427	689,427	8,103,778
81016000	Int exp-debt dis-ins	497	497	497	497	497	987	759	759	759	759	759	759	8,026
81315000	Interest STD Interco	17,662	(14,389)	6,133	10,305	19,754	15,153	32,078	41,675	39,216	64,782	29,309	43,912	305,589
82015000	Amort Dbt Dsc&Ex I/C	27,092	27,092	27,092	27,064	27,297	27,761	27,766	27,766	27,766	27,766	27,766	27,766	329,994
82016000	Amort Dbt E-Insde CL	1,383	1,383	1,383	1,383	1,383	1,383	1,383	1,383	1,383	4,991	1,981	2,007	21,429
Grand Total		**$704,887**	**$672,696**	**$693,414**	**$697,182**	**$722,841**	**$740,475**	**$757,268**	**$766,491**	**$764,076**	**$791,543**	**$753,183**	**$767,444**	**$8,831,500**

American Water Insurance

Fiscal Year 2022

Row Labels	Account Description	1	2	3	4	5	6	7	8	9	10	12	Grand Total
16520000	Prepaid Insurance	350,234	502,263	48	134,365	11,744	12,719	134,388	1,064	5,580	139,692	358	1,292,455
Grand Total		$350,234	$502,263	$48	$134,365	$11,744	$12,719	$134,388	$1,064	$5,580	$139,692	$358	$1,292,455

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

39. Refer to Kentucky American's response to the Attorney General's First Request, Item 36. Provide copies of the two special contracts with Harrison County Water Association and Nicholas County Water District.

Response:

Please refer to the following attachments:

KAW_R_AGDR2_NUM039_092123_Attachment 1
KAW_R_AGDR2_NUM039_092123_Attachment 2
KAW_R_AGDR2_NUM039_092123_Attachment 3

THIS AGREEMENT, made and entered into this the 12th day of November, 2000, by and between Harrison County Water Association, Inc., hereinafter referred to as "Customer", and KENTUCKY-AMERICAN WATER COMPANY, a Kentucky corporation with offices at 2300 Richmond Road, Lexington, Kentucky 40502, hereinafter referred to as "Company",

W I T N E S S E T H:

WHEREAS, Customer desires to purchase a supply of potable water from Company, and

WHEREAS, Company can meet the specific request of Customer,

NOW, THEREFORE, the parties hereto do hereby agree as follows:

1. From and after the 20th day of September, 2000, Customer shall have the right to purchase from Company, and Company shall be obligated to sell to Customer, an amount of potable water not to exceed 150,000 gallons in any twenty-four hour period and at a rate not in excess of 150 gallons per minutes. Customer hereby acknowledges that this quantity and flow is adequate for its present and future needs within the term of this contract, as determined and recommended by its consulting engineer.

2. Delivery of the water purchased by Customer and sold by Company shall be at point or points to be determined under the existing rules and regulations of Company as approved by the Public Service Commission of the Commonwealth of Kentucky and as the same may be changed from time to time. The total quantity of water purchased by Customer from all points shall not exceed the limitations of quantity and flow as set forth in the preceding paragraph. Company shall not be responsible for the quality of

water purchased by Customer past the point or points of actual delivery as determined herein.

3. Customer acknowledges that Company will make an investment for the metering equipment, vault and the approximately 2500 feet of line to connect from metering equipment to Customer's system, and that investment is based upon the estimated water purchases by Customer. This investment, as of the date of this agreement, is estimated to be approximately $120,000. Customer agrees that it will purchase water at Company's rates in sufficient quantities over the first three (3) years of the term of this contract to equal the Company's actual investment. At the end of each of the first six, six-month periods of this agreement, starting at the beginning of the agreement, Customer agrees to pay to Company an amount equal to the difference between one-sixth of the amount of the Company's investment and the total of the six months' actual water purchases for that period, but only in the event the six months' actual water purchases for that period are less than one-sixth of the Company Investment. Water purchases shall be calculated at the published tariffs of Company as approved by the Public Service Commission of the Commonwealth of Kentucky.

4. Customer shall pay for the quantity of water purchased by it and sold by Company at the approved and published tariffs of Company as the same may change from time to time and as approved by the Public Service Commission of the Commonwealth of Kentucky.

5. Customer must build, maintain and control such storage and transmission facilities as are necessary for it to meet any demands in excess of the quantities of water or rates of delivery herein agreed to be sold by Company. Company reserves the right to install such quantity and flow restrictive devices as wil

physically limit customer to the quantities and flows specified herein.

6. Customer will install, at its sole expense, appropriately approved backflow devices which Customer must certify to Company as approved and which must be inspected by a certified plumber annually and certified in writing to Company as then currently approved and properly working, all at the cost of Customer.

7. In the event any type of water curtailment practice, procedure, regulation or law is utilized by Company or is imposed upon Company, Customer agrees to abide by all recommendations of Company and to institute such regulations, requirements, policies or laws as will restrict its customers in a fashion similar to all customers of the Company.

8. Company shall endeavor to maintain a minimum normal system hydraulic gradient of 1,050 feet at the metered connection for the maximum delivery rate specified in paragraph 1; however, Company's obligation to supply water pursuant to this Agreement is solely an obligation that it shall undertake to use reasonable care and diligence in order to prevent and avoid interruptions and fluctuations in the supply of water agreed to herein. Company cannot and does not guarantee, covenant or warrant that interruptions and fluctuations will not occur, or that because of emergencies due to breaks, leaks, defects, construction or necessary repair in its facilities, or caused by fires, strikes, acts of God, or other causes, there may not be periods during which the supply of water may be curtailed or interrupted. In the event of such interruptions or fluctuations, no liability of any nature shall be imposed upon Company.

9. In the event all or any part of the waterworks plant and facilities of Company which are used in meeting its obligations

under this Agreement are acquired by a municipal corporation or any other entity, then and in that event Company shall be relieved of all of its obligations hereunder and, in such event, this Agreement shall be binding upon the municipality or any other entity making such acquisition.

10. It is understood and agreed between Customer and Company that Company does not, by this Agreement, undertake or contract to provide fire protection for those individuals, partnerships and corporations to whom Customer is going to sell water furnished by Company. Customer acknowledges that it is fully aware that if its customers desire fire protection or sufficient quantities of water for fire extinguishment, that it must provide the same by the construction and maintenance of appropriate facilities to render such service and protection.

11. This Agreement shall terminate forty(40) years after the date of execution hereof. Customer shall have the right to extend this Agreement for a term of 30 years beyond the original termination date by notifying Company in writing of its decision to do so prior to six months before the termination date of this Agreement.

12. Pursuant to 807 KAR 5:011(13), Company will file a copy of this executed contract with the Public Service Commission of the Commonwealth of Kentucky.

13. Customer may pledge this contract to Farmers Home Administration to further secure a loan made to improve the water distribution system of Customer.

14. This Agreement constitutes the entire agreement of the parties and all prior conversations and writings are merged herein.

15. This Agreement shall be construed according to the laws of the Commonwealth of Kentucky.

This Agreement has been executed by the parties hereto, by their appropriate authorized representatives, and a certified copy of the resolutions of the governing authorities of each is attached hereto, in the city of Lexington, Fayette County, Kentucky, on this the 12th day of November, 2001.

HARRISON COUNTY WATER ASSOCIATION, INC.

BY: William R Toadvine
William R. Toadvine, President

KENTUCKY-AMERICAN WATER COMPANY

BY: [signature] PRESIDENT

PUBLIC SERVICE COMMISSION
OF KENTUCKY
EFFECTIVE

SEP 28 2001

PURSUANT TO 807 KAR 5:011,
SECTION 9 (1)
BY: Stephanie Bell
SECRETARY OF THE COMMISSION

WATER PURCHASE CONTRACT

This contract for the sale and purchase of water is entered into as the 7th day of November, 2005 between:

The City of Millersburg
P.●. Box 265
Millersburg, KY 40348

hereinafter referred to as the "Seller

The Harrison County Water Association

Cynthiana, KY 41031

Hereinafter referred to as the "Purchaser"

WITNESSETH

Whereas, the Purchaser is organized and established under the provisions of KRS Chapter 74 of the Code of the Kentucky Revised Statutes, for the purpose of constructing and operating a water supply distribution system and to accomplish this purpose the Purchaser requires an additional supply of treated water, and

Whereas, the Seller owns and operates a water supply distribution system with a capacity currently capable of serving the present customers of the Seller's system and the quantity of water stipulated in the contract to be taken by the Purchaser, and

Whereas, by Resolution No. 2005-003, enacted on the ~~1st~~ 7th day of ~~August~~ November, 2005 by the Seller, the sale of water to the Purchaser in accordance with the provisions of said Resolution was approved, and the execution of this contract carrying out the said water purchase contract by the Mayor, and attested by the City Clerk, was duly authorized by the Millersburg City Council and

Whereas by action of the Board of Directors of the Purchaser, enacted on the 7th day of November, 2005 the purchase of water from the Seller in accordance with the terms set forth in the said water purchase contract was approved, and the execution of this contract by the Harrison County Water Association, and attested by the Secretary was duly authorized:

Now, therefore, in consideration of the foregoing and the mutual agreements hereinafter set forth:

A. The Seller agrees:

___1. (Quantity and Quality) To furnish the Purchaser at the point of delivery hereinafter specified, during the term of this contract or any renewal or extension thereof, potable water meeting applicable purity standards of the Kentucky Department of Natural Resources – Division of Water in a quantity of averaging 40,000 gallons per day. The Purchaser agrees to a minimum purchase of an average of 20,000 gallons per day only if water is available to meet the Purchaser's operating requirements.

___2. (Point of Delivery and Pressure) That water will be furnished at a reasonably constant pressure at a minimum of 50 PSI from an existing 6 inch main supply at a point located on KY 1878 (Ruddles Mills-Millersburg Road).
If a greater pressure than that normally available at the point of delivery is required by the Purchaser, the cost of providing such greater pressure shall be borne by the Purchaser. Emergency failures of pressure or supply due to main supply line breaks, power failure, flood, fire and use of water to fight fire, earthquake or other catastrophe shall excuse the Seller from this provision for such reasonable period of time as may be necessary to restore service.

___3. (Billing Procedure) The metering equipment shall be read on the last day of the month. An appropriate official of the Purchaser at all reasonable times shall have access to the meter for the purposes of verifying its readings. If any meter fails to register for any period of time, the amount of water furnished during such period shall be deemed to be the amount delivered in the corresponding period immediately prior to the failure, unless Seller and Purchaser shall agree upon a different amount.

The Seller will furnish the Purchaser at the above address not later than the 10th day of each month, with an itemized statement of the amount furnished to the Purchaser during the preceding month.

___ 4. (Successor to the Seller) That in the event of any occurrence rendering the Seller incapable of performing under this contract, any successor of the Seller, whether the results of legal process, assignment, or otherwise, shall succeed to the rights of the Seller hereunder.

B. The Purchaser Agrees:

___1. (Rates and Payment Date) To pay the Seller, not later than the 20th day of each month, for water delivered as a rate of $2.25 per thousand gallons of water purchased

___2. (Metering Equipment) The Purchaser agrees to furnish, install, and maintain at its own expense at the point of delivery, the necessary metering equipment, including a meter house or pit, and required devices of standard type for properly measuring the quantity of water delivered to the Purchaser. Such metering equipment shall be calibrated whenever requested by either party but not more frequently than once every twelve months. A meter registering not more than two percent (2%) above or below the test result shall be deemed to be accurate. The previous readings of any meter disclosed by test to be inaccurate shall be corrected for the six months previous to such test in accordance with the percentage of inaccuracy found by such test.

C. It is further mutually agreed between the Seller and the Purchaser as follows:

___1. (Terms of Contract) That this contract shall extend for a term of fifteen (15) years from the delivery date of any water as shown by the first bill submitted by the Seller to the Purchaser and thereafter may be renewed or extended for such term or terms, as may be agreed upon by the Seller and the Purchaser.

___ 2. (Delivery of Water) That thirty (30) days prior to the estimated date of completion of construction of the Purchaser's meter, pumps, and lines involved in this project, the Purchaser will notify the Seller in writing the date for the initial delivery of water.

___ 3. (Water for Testing) When requested by the Purchaser the Seller will make available to the contractor at the point of delivery, or other point reasonably close thereto, water sufficient for testing, flushing and trench filling the system of the Purchaser during construction, irrespective of whether the metering equipment has been installed at the time, at a flat rate charge of $2.25 per thousand gallons which will be paid by the contractor, or on his failure to pay, the Purchaser.

___ 4. (Failure to Deliver) That the Seller will, at all times, operate and maintain its system in an efficient manner and will take such action as may be necessary to furnish the Purchaser the quantities specified in this contract. Temporary or partial failures to deliver water shall be remedied with all possible dispatch. In the event of an extended shortage of water, or the supply of water available to the Seller is otherwise diminished over an extended period of time, the supply of water to the Purchaser, and therefore to the Purchaser's consumers, shall be reduced or diminished in the same ratio or proportion as the supply to the Seller's consumers is reduced or diminished.

___5. (Modification of Contract) That the provisions of this contract pertaining to the scheduled rates to be paid by the Purchaser for water delivered are subject to modification at the end of every three (3) year period. Any increase or decrease in rates shall be based upon a demonstrable increase in the costs of performance hereunder, but such costs shall not include the increased capitalization of the Seller's system. Other provisions of this contract may be modified or altered by mutual agreement.

___ 6. (Regulatory Agencies) That this contract is subject to such rules, regulations, or laws as may be applicable to similar agreements in this State and the Seller and Purchaser will collaborate in obtaining such permits, certificates, or the like, as may be required to comply therewith

___ 7. (Successor to the Purchaser) That in the event of any occurrence rendering the Purchaser incapable of performing under this contract, any successor of the Purchaser, whether the result of legal process, assignment, or otherwise, shall succeed to the rights of the Purchaser hereunder.

In witness whereof, the parties hereto, acting under authority of their respective governing bodies, have caused this contract to be duly executed in two (2) counterparts, each of which shall constitute an original.

Seller:

City of Millersburg

By Sam Chanslor
Sam Chanslor

Title: Mayor

Attest:
Carolyn R. Sears Clerk

Purchaser:

Harrison County Water Association
William L. Isaacs

Title: Chairman

Attest:
Secretary/Treasurer

UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL DEVELOPMENT

WATER PURCHASE CONTRACT

This contract for the sale and purchase of water is entered into as of the 12th day of MAY 1999 between the City of Millersburg P.O. Box 265, Millersburg, KY 40348, hereinafter referred to as the "Seller" and the Nicholas County Water District, 1639 Old Paris Road. Carlisle. KY 40311, hereinafter referred to as the "Purchaser",

WITNESSETH:

Whereas, the Purchaser is organized and established under the provisions of KRS Chapter 74 of the Code of Kentucky Revised Statues, for the purpose of constructing and operating a water supply distribution system serving water users within the area described in plans now on file in the office of the Purchaser and to accomplish this purpose, the Purchaser will require a supply of treated water, and

Whereas, the Seller owns and operates a water supply distribution system with a capacity currently capable of serving the present customers of the Seller's system and the established number of water users to be served by the said Purchaser as shown in the plans of the system now on file in the office of the Purchaser, and

Whereas, by Resolution No. _____ enacted on the 12th day of May, 1999, by the Seller, the sale of water to the Purchaser in accordance with the provisions of the said Resolution _____ was approved, and the execution of this contract carrying out the said water purchase contract _____ by the Chairman _____, and attested by the Secretary, was duly authorized and

Whereas, by action of the Board of Commissioners of the Purchaser, enacted on the 12th day of May, 1999, the purchaser of water from the Seller in accordance with the terms set forth in the said water purchase contract was approved, and the execution of this contract by the Nicholas County Water District, and attested by the Secretary was duly authorized:

Now, therefore, in consideration of the foregoing and the mutual agreements hereinafter set forth,

A. The Seller Agrees:

1. (Quality and Quantity) To furnish the Purchaser at the point of delivery hereinafter specified, during the term of this contract or any renewal or extension thereof, potable water meeting applicable purity standards of the Kentucky Department of Natural Resources - Division of Water in as such quality as may be required by the Purchaser not to exceed 1,500,000 gallons per month.

2. (Point of Delivery and Pressure) That water will be furnished at a reasonably constant pressure calculated at minimum of 50 PSI from an existing 6-inch main supply at a point located on US Route 68 at the eastern City Limits of Millersburg _____.
If a greater pressure than that normally available at the point of delivery is required by the Purchaser, the cost of providing such greater pressure shall be borne by the Purchaser. Emergency failures of pressure or supply due to main supply line breaks, power failure, flood, fire and use of water to fight fire, earthquake or other catastrophe shall excuse the Seller from this provision for such reasonable period of time as may be necessary to restore service.

3. (Metering Equipment) To furnish, install, operate, and maintain at its own expense at point of delivery, the necessary metering equipment, including a meter house or pit, and required devices of standard type for properly measuring the quantity of water delivered to the Purchaser and to calibrate such metering equipment whenever requested by the Purchaser but not more frequently than once every twelve (12)

months. A meter registering not more than two percent (2%) above or below the test result shall be deemed to be accurate.

SEE PARAGRAPH 4.B.2 BELOW

The previous readings of any meter disclosed by test to be inaccurate shall be corrected for the (6) six months previous to such test in accordance with the percentage of inaccuracy found by such test. If any meter fails to register for any period, the amount of water furnished during such period shall be deemed to be the amount of water delivered in the corresponding period immediately prior to the failure, unless Seller and Purchaser shall agree upon a different amount. The metering equipment shall be read on

Last day of the month. An appropriate official of the Purchaser at all reasonable times shall have access to the matter for the purpose of verifying its readings.

4. (Billing Procedure) To furnish the Purchaser at the above address not later than the 10th day of each month, with an itemized statement of the amount furnished the Purchaser during the preceding month.

B. The Purchaser Agrees:

1. (Rates and Payment Date) To pay the Seller, not later than the 20th day of each month, for water delivered in accordance with the following schedule of rates:

A. $ NA for the first _____ gallons, which amount shall also be the minimum rate per month.

B. $ NA cents per 1,000 gallons for water in excess of _____ gallons but less than _____ gallons.

C. $_____ cents per 1,000 gallons for water in excess of _____ gallons.

D. $ 2.25 cents per 1,000 gallons for all water purchased.

2. (Connection fee) to pay as an agreed cost, a connection fee to connect to Seller's system with the system of the purchaser, the sum of -0- dollars which shall cover any and all costs of the Seller for installation of the metering equipment and installation will be provided by the Purchaser (with approval) of the Seller. Upon completion of installation start up, calibration and one year warranty, the facility shall become the property of the Seller.

C. It is further mutually agreed between the Seller and the Purchaser as follows:

1. (Terms of Contract) That this contract shall extend for a term of 40 (forty) years from the date of the delivery of any water as shown by the first bill submitted by the Seller to the Purchaser and thereafter may be renewed or extended for such term or terms, as may be agreed upon by the Seller and Purchaser.

2. (Delivery of Water) That 30 (thirty) days prior to the estimated date of completion of construction of the Purchaser's water supply distribution system, the Purchaser will notify the Seller in writing the date for the initial delivery of water.

3. (Water for Testing) When requested by the Purchaser the Seller will make available to the contractor at the point of delivery, or other point reasonably close thereto, water sufficient for testing, flushing, and trench filling the system of the Purchaser during construction.

Irrespective of whether the metering equipment has been installed at the time, at a flat charge of $2.25/ 1,000 gallons which will be paid by the contractor or, on his failure to pay, by the Purchaser.

4. (Failure to Deliver) That the Seller will, at all times, operate and maintain its system in an efficient manner and will take such action as may be necessary to furnish the Purchaser with quantities of the water required by the Purchaser. Temporary or partial failures to deliver water shall be remedied with all possible dispatch. In the event of an extended shortage of water, or the supply of water available to the Seller is otherwise diminished over an extended period of time, the supply of water to Purchaser's

consumers shall be reduced or diminished in the same ratio or proportion as the supply to Seller's consumers is reduced or diminished.

5. (Modification of Contract) That the provisions of this contract pertaining to the scheduled of rates to be paid by the Purchaser for water delivered are subject to modification at the end of every 3 (three) year period. Any increase or decrease in rates shall be based on a demonstrable increase in the costs of performance hereunder, but such costs shall not include increased capitalization of the Seller's system. Other provisions of this contract may be modified or altered by mutual agreement.

6. (Regulatory Agencies) That this contract is subject to such rules, regulations, or laws as may be applicable to similar agreements in this State and the Seller and Purchaser will collaborate in obtaining such permits, certificates, or the like, as may be required to comply therewith.

7. (Miscellaneous) That the construction of the water supply distribution system by the Purchaser is being financed by a loan made or insured by, and/or grant from, the United States of America acting through Rural Development of the United States Department of Agriculture, and the provisions hereof pertaining to the undertakings of the Purchaser are conditioned upon the approval, in writing of the State Director of Rural Development.

8. (Successor to the Purchaser) That in the event of any occurrence rendering the Purchaser incapable of performing under this contract, any successor of the Purchaser, whether the result of legal process, assignment, or otherwise, shall succeed to the rights of the Purchaser hereunder.

In witness whereof, the parties hereto, acting under authority of their respective governing bodies, have caused this contract to be duly executed in 3 (three) counterparts, each of which shall constitute an original.

Seller:

Sam Chanslor

City of Millersburg
Mayor Sam Chanslor

Attest:

Carolyn R. Sears

Carolyn R. Sears City Clerk

Purchaser

Nicholas County Water District

BY:

Chairman

Attest:

Sam Reynolds, Secretary, Treasurer

This contract is approved on behalf of Rural Development this the 19 day of November 2003.

BY:

Title:

TARIFF BRANCH
RECEIVED
6/19/2014
PUBLIC SERVICE COMMISSION OF KENTUCKY

FOR City of Millersburg, Kentucky
Name of Municipality

P.S.C. KY. NO. 1

Original SHEET NO. 1

City of Millersburg
(Name of Municipal Utility)

CANCELLING P.S.C. KY. NO.

SHEET NO.

RATES AND CHARGES

Wholesale Rate:

Nicholas County Water District:

Old Rate	$1.65 per 1,000 gallons
New Rate	$2.25 per 1,000 gallons

DATE OF ISSUE July 7, 2003
Month / Date / Year

DATE EFFECTIVE August 6, 2003
Month / Date / Year

ISSUED BY Sam Chandler
(Signature of Officer)

TITLE Mayor

BY AUTHORITY OF ORDER OF THE PUBLIC SERVICE COMMISSION
IN CASE NO. DATED

PUBLIC SERVICE COMMISSION
OF KENTUCKY
EFFECTIVE
AUG 6 2003
PURSUANT TO 807 KAR 5:011
SECTION
BY
EXECUTIVE DIRECTOR

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Dave Hill

40. Refer to Kentucky American's response to the Attorney General's First Request, Item 39. Do AMR meters require a meter reader to read the meters? If not, explain in detail how the meter usage is obtained to process an individual bill.

Response:

Automatic Meter Reading (aka AMR) can best be described as "drive by" meter reading. With AMR, a meter reader is usually in a car that is equipped with Mobile Meter reading equipment and software and can "automatically" read meters that are connected to a communications module, which American Water often refers to as an MIU. This MIU sends out an RF signal which contains the meter reading and other data. This signal can be heard by the Mobile Meter reading equipment and software, which registers the meter reading in our system and this reading is used for billing. Individual meter readers typically don't interact with individual meters and read the dials on the meter; this is done automatically through the process described above. Sometimes errors can occur which could necessitate a meter reader reading an individual meter and manually record the read, but this is done by exception.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

41. Refer to Kentucky American's response to the Attorney General's First Request, Item 54. Provide the average tenure for Kentucky American employees eligible for the Long-Term Performance Plan ("LTPP") for the years 2018 – 2022. Provide annual tenures separately by year.

Response:

Please see the below table for the average tenure of Kentucky American employees eligible for Long-Term Performance Plan ("LTPP") for the years 2018-2022.

As of	**12/31/2018**	**12/31/2019**	**12/31/2020**	**12/31/2021**	**12/31/2022**
Average Tenure	10.9	13.7	13.9	14.9	9.1

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Kathryn Nash

42. Refer to Kentucky American's response to the Attorney General's First Request, Item 56. During the time frame 2018 – 2022, did Kentucky American acquire/sell any utility systems or add any new unregulated systems to its portfolio? Identify each such occurrence and the year it transpired.

Response:

KAWC acquired the Eastern Rockcastle water system in 2018 and the North Middletown water and wastewater systems in 2019.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

43. Refer to Kentucky American's response to the Attorney General's First Request, Item 65. Provide the actual and weather normalized usage per customer totals for each year on Chart 11 of Mr. Rea's direct testimony.

Response:

The data provided in Chart 11 of Mr. Rea's direct testimony is usage per customer normalized both for weather and for COVID-19. See the table below for the data provided in Chart 11 of Mr. Rea's testimony. The figures are stated in annual thousand gallons per customer.

Year	Use Per Customer	Normalized Use Per Customer
2013	49.910	50.580
2014	50.915	50.913
2015	50.812	51.178
2016	50.937	50.090
2017	48.437	48.658
2018	47.299	47.455
2019	49.128	47.995
2020	49.761	48.693
2021	47.718	46.229
2022	48.263	47.138

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

44. Refer to Kentucky American's response to the Attorney General's First Request, Item 69. What is the planned in-service date for the sludge dewatering facilities? If the sludge dewatering system is not scheduled to be in service within 90 days of Project 112-020107, explain in detail the reason for the delay.

Response:

The preliminary in-service date for the sludge dewatering facilities is August 1, 2026, with detailed design and bidding anticipated to begin in 2025. Once the gravity thickeners are operational, the sludge from the gravity thickeners can be evaluated with seasonal changes for proper design of the dewatering facilities. Additionally, the construction of the gravity thickeners at the same time and in very close proximity to the proposed sludge dewatering facilities, would result in additional site conflicts during construction at the existing plant site.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

45. Refer to Kentucky American's response to the Attorney General's First Request, Item 72. Provide the percentage of service company charges that relate to in-home labor, outside consultants, and other operation and maintenance expenses.

Response:

The percentage of Kentucky-American's Service Company charges for labor and related, outside consultants, and other O&M is 60.2%, 11.5%, and 28.3%, respectively.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Harold Walker

46. Refer to Kentucky American's response to the Attorney General's First Request, Item 73. Explain in detail how the prepayment of charges for service company functions reduces the cost of the services provided.

Response:

The Service Company's billing terms match expenses with the receipt of payments from affiliates, which are the beneficiaries of the services provided. The Service Company makes no profit from the provision of services. A prepayment of the at-cost Service Company bill is a reasonable provision to support cash expenses and payroll incurred on behalf of Kentucky-American by the Service Company. Similar services provided by a private company always include a markup for profit on their services provided. Therefore, services provided by the Service Company reduce the cost of the services provided relative to similar services provided by a private company.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
ATTORNEY GENERAL'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell and Larry Kennedy

47. Refer to Kentucky American's response to the Attorney General's First Request, Item 89. Is it the Company's position that when each meter is replaced with an AMI meter, that the old meter will have accumulated depreciation expense during its service life to equate to the total cost of the old meter? Explain the response in detail.

Response:

The Company's position is that transition to a new technology has no bearing on the positions of the depreciation reserve for meter equipment. The Company is planning to install AMI enabled equipment, rather than AMR enabled equipment, as it completes normal, scheduled, periodic replacement of metering equipment. As noted in the response to AG 1-89, "the position of the current meter depreciation reserve is related to a number of factors, including depreciation rates established in prior proceedings using a single average service life and Iowa curve dispersion. The position would exist regardless of what technology was deployed moving forward."