

LEAD & COPPER RULE REVISIONS (LCRR) COMPLIANCE



Sponsored by



120Water™



WATER ONLINE

LEAD AND COPPER RULE REVISIONS (LCRR) COMPLIANCE

The U.S. EPA's Lead and Copper Rule Revisions (LCRR) require utilities to maintain an inventory of service line materials by October 16, 2024, posing information and operations challenges for water suppliers. Further, LCRR is a step toward a larger federal effort to remove all lead service lines that will be expanded by the proposed Lead and Copper Rule Improvements (LCRI), which the agency intends to promulgate by the LCRR deadline.

While policy evolves to safeguard the public, especially children, from the dangers of lead exposure — the World Health Organization, EPA, and the Centers for Disease Control and Prevention (CDC) all agree that there is no safe level of lead in a child's blood — utilities must keep pace with requirements, regardless of their size or (lack of) resources.

To that end, there are experts and technologies, including those presented within this e-book, to help guide utilities toward compliance.

Sponsored by



120Water™



WATER ONLINE

TABLE OF CONTENTS

LCRR:
To Inventory And Beyond

04

Building Trust Through
Effective Communication

10

Evaluating Predictive Models
For Lead Service Line
Inventory and Replacement

15

Increasing The
Likelihood of Accessing
Infrastructure Funding

23

Case Study:
Buffalo, NY, Starts Successful
Verification Program

27

Moving Toward A
Lead-Free Rural
Water System

32

Infrastructure Upgrade:
Expediting Lead Pipe Removal
Protects Communities

36

LCRR: TO INVENTORY AND BEYOND



Jonathan Cuppett
120Water

Discover the EPA's Lead and Copper Rule Improvements, understand challenges for small communities, and explore the role of digital transformation in managing evolving regulations.

NAVIGATING THE EPA'S LEAD AND COPPER RULE IMPROVEMENTS: WHAT YOU NEED TO KNOW

The Environmental Protection Agency (EPA) recently unveiled proposed enhancements to the Lead and Copper Rule, marking a significant milestone in safeguarding the quality of our drinking water. As communities across the United States grapple with the ramifications of aging infrastructure and environmental concerns, understanding the key changes and timelines outlined in the Lead and Copper Rule Improvements (LCRI) is paramount. Let's delve into the intricacies of the proposed improvements and what they mean for water systems nationwide.

In November 2023, the EPA released the proposed Lead and Copper Rule Improvements. The LCRI is expected to be finalized in October 2024, and water systems will be required to comply with all aspects of the LCRI starting in October 2027 (e.g., three years after the LCRI is finalized).

LCRR ASPECTS THAT REMAIN UNCHANGED BY LCRI

Despite the changes brought by the recently proposed LCRI, several aspects of the EPA's Lead and Copper Revision (LCRR) released in 2021 have been retained, including the following:

- Deadline for service line inventory: October 16, 2024.
- Customer notification requirements for lead service Lines (LSLs), galvanized requiring replacements (GRRs), and unknowns within 30 days of submission.
- Customer notification within 24 hours of a lead action level exceedance (15 ppb) starting October 16, 2024.

If you haven't already started your utility service line inventory, the time to act is now. Here are a few resources to get you going.

- [EPA Guidance Document](#) and [Inventory Template](#) - contains information to help water systems prepare and maintain a service line inventory.
- [Map: LCR Regulation by State](#): state-specific service line inventory guidance and resources containing key state statistics, links to relevant state-specific service line inventory resources, and FAQs specific to each state.
- [LCRR Reference Guide by 120Water](#) includes key aspects of building your service line inventory.

KEY POINTS OF THE LEAD AND COPPER RULE IMPROVEMENTS (LCRI)

Major Changes in LCRI:

- Remove all LSL (and GRR) “under your control” within 10 years (Oct. 2037). Remove regardless of P90 lead (Pb) levels.
- Lowers action level to 10 ppb (from 15 ppb), removes trigger level.
- Sampling at LSL sites (Tier 1 and 2): Sample for Pb in 1st and 5th liter and use higher results for 90th percentile calculation.
- Document control and access issues for service line replacement.
- Provide results to the customer for all samples within three calendar days – including supplemental monitoring.
- Connectors added to the LCRI Baseline Inventory.
- Install or optimize corrosion control after an Action Level Exceedance (Pb or Cu).
- Additional requirements for sampling in schools and childcare facilities.
- Additional requirements for chronic Pb ALEs (Filters to Everyone).
- More public communication and notification.

Potential Changes and Future Directions:

The EPA is currently soliciting feedback on whether specific components of the LCRI should be mandated before the October 2027 deadline. The final decision on these requirements will be made when the LCRI is formalized in October 2024. Notably, the EPA has pinpointed an area that may necessitate earlier attention: ensuring risk mitigation to customers through education, flushing instructions, and filter provision following full and partial replacements of lead service lines (LSL) and galvanized requiring replacement (GRR), as well as disturbances to LSLs, GRRs, and unknown service lines.

What Should Water Utilities Focus On?

The EPA is considering industry comments on the LCRI proposal and is expected to finalize the LCRI in October 2024. Water systems will be required to comply with all LCRI elements starting in October 2027. There are several areas that water should focus on between now and October 2027:

- Continue verifying unknown service lines, as there are many disadvantages to having unknowns starting in October 2027, including counting unknowns in the mandatory service line replacement calculations.
- Document connector (gooseneck) materials for inclusion in the October 2027 LCRI service line inventory.
- Develop procedures for customer-requested sampling programs.

- Begin/continue replacing LSL and GRR.
- Consider starting your school and childcare sampling program or investigate if your state offers sampling for this program.
- Develop communication procedures and strategies for the various public notification requirements and timelines.
- Evaluate how your compliance sampling sites may change based on the updated sampling tier classification.

NAVIGATING WATER REGULATIONS: EMPOWERING YOUR SYSTEM THROUGH DIGITAL TRANSFORMATION

There has been a lot of focus on developing service line inventories in the last year, and rightfully so. However, the best practice is to think beyond the initial service line inventory and see this as an opportunity to create the digital foundation at the core of your water system. Navigating the evolving world of water quality regulations, like the proposed Lead and Copper Rule Improvements

Where Does Rural Water Stand?

The National Rural Water Association (NRWA) shares the goal of eliminating harmful contaminants from the public's drinking water and environment. NRWA commends the EPA for continuing to modernize the Lead and Copper Rule as we learn more about the health impacts of lead and copper and current sector demands.

However, most communities regulated by the EPA under LCRI will be small (under 10,000 in population). Small and rural communities will have more difficulty complying with the new rules due to limited economies of scale and a lack of technical expertise.

NRWA, through our Regulatory Committee, has submitted our full comments on the rule to EPA. Small and rural systems will be facing a few key items, including affordability and the rising costs for lead service line replacement, managing specific requirements of service line replacement, burdensome and cost-prohibitive monitoring requirements, a lowering of the small system flexibility to systems serving < 3,300 people, and a tight time frame for public education and outreach.

Rest assured, we have submitted our suggestions on how these items can be addressed so that our small and rural systems perspective is included in this rulemaking.

The National Rural Water Association is a non-profit organization dedicated to training, supporting, and promoting water and wastewater professionals serving small and rural communities nationwide. NRWA provides training and technical assistance through 50 affiliated State Rural Water Associations with over 31,000 utility system members.

(LCRI) from the EPA, can feel like learning a new language. Digital transformation gives your water system a practical upgrade, equipping it to handle the latest changes and regulatory requirements in real time.

Think of digital transformation as sprucing up your water system. The LCRI introduces new requirements, and we want your system to adapt smoothly, like getting a reliable GPS for a road trip. It's not just about following the rules; it's about making life easier for your water system and the communities it serves. The ability to harness data in real time empowers water systems to meet existing standards and anticipate and prepare for future regulatory shifts, fostering a culture of resilience and adaptability.

When we talk about real-time data management, imagine it as having the most up-to-date map during your compliance journey. This isn't just for your local water system; it's about contributing to a nationwide effort. Everyone needs to be on the same page, and efficient data ensures your system is playing its part in the big picture. By digitizing and centralizing critical operational data, water systems can:

- Better manage assets and infrastructure lifecycles
- Predict and prevent main breaks before they happen
- Identify high-risk areas and make data-driven capital investment decisions
- Optimize operational efficiency to reduce costs
- Achieve regulatory compliance with streamlined reporting

- Enhance customer service with enhanced communications and notifications
- Increase transparency and public trust

The burden of good data management continues beyond local water systems. State and federal agencies are facing a massive amount of information and data coming their way, and having systems in place to organize, collate, interact with, and display data is critical for all parties involved to work together harmoniously.

120Water not only partners with local water systems large and small to manage their LCR compliance programs, but we also partner with state agencies to build out state dashboards and portals to assist with the data collection side of the house. Data flows seamlessly out of the standard 120Water platform into the State Dashboard, allowing for efficient review of inventories and beyond.

When looking ahead at LCRI and thinking through all the things that need to happen between now and 2027, 120Water software can help water systems:

- Continue to maintain and update inventories in real time, including capturing connector/gooseneck information directly in the platform for future submissions.
- Automate an unlimited amount of required communications and notifications with a few clicks of a button.

- Manage consumer sampling request programs and sampling kits so you can act fast when the time arises.
- Create a public-facing microsite in minutes to display your service line inventory in a map-based view for your customers, building transparency.
- Stand up a school sampling program with a dedicated Lead in Facilities application.

See how [Summerville, GA, uses the 120Water platform](#) as their system of record to maintain their inventory and LCR programs in real time.

RESOURCES:

- 120Water LCRI Webinars:
 - EPA LCRI: What's Next ([Replay Link](#))
 - LCRI Q&A: Ask the Expert! ([Replay Link](#))

ABOUT THE AUTHOR

Jonathan Cuppet is the director of water compliance for 120Water. Jonathan is a recognized subject matter expert with extensive experience and comprehensive expertise in navigating the evolving Lead and Copper Rule Revisions (LCRR) landscape. He is instrumental in monitoring federal and state compliance requirements and providing relevant regulatory insight.

BUILDING TRUST THROUGH EFFECTIVE COMMUNICATION



Arianne Shipley
120Water

Water utilities must adopt a proactive approach to communication that emphasizes awareness, transparency, and education to build trust and effectively address regulatory compliance, environmental issues, and public health concerns.

Water utilities are vital for providing clean and safe water, which is essential for our existence. However, having pipes and treatment plants in place is not enough. Water utilities must also build trust, promote transparency, and engage communities through effective communication strategies. This is especially important in today's connected world, where communication is key.

The LCR Revisions and Improvements includes testing and lead service line (LSL) replacement and updates to communications guidelines for water utilities. Consumers are highly sensitive to any information related to lead in their water, especially after the Flint, Michigan, crisis. Therefore, water utilities must do everything in their power to maintain trust between themselves and their customers.

This section will explore how water utilities can develop robust communication strategies tailored to their specific needs and provide guidance to help avoid some of the worst pitfalls of LCR-related communications.

THE FOUR KEY STEPS TO EFFECTIVE COMMUNICATION

1. Evaluation: Water utilities must evaluate their existing strategies before embarking on the journey to enhance communication. Understanding the strengths and weaknesses of current approaches lays the foundation for meaningful improvement. This initial step allows utilities to identify areas for enhancement and adapt their tactics to meet evolving needs and regulatory requirements.

2. Comprehensive Planning: Develop a holistic communication plan that prioritizes compliance with Lead and Copper Rule Revisions (LCRR) while focusing on trust-building initiatives. This plan should encompass regulatory updates, guidance on implementation, educational materials, training programs, and comprehensive communication channels.

3. Design and Implementation: Utilize customized campaigns or templates provided by platforms like 120Water to design communication materials. Leverage digital and print channels to disseminate information effectively. Implement robust software solutions to streamline distribution, tracking, and auditing processes.

4. Engagement and Transparency: Foster active engagement with stakeholders, including customers, community leaders, and regulatory bodies. Maintain transparency throughout the communication process, addressing concerns, providing updates, and soliciting feedback to build enduring relationships built on trust and loyalty.

BUILDING TRUST, ONE COMMUNICATION AT A TIME

As water utilities navigate the intricacies of regulatory compliance and community engagement, the foundation of trust remains paramount. Strategic communication, rooted in empathy and transparency, lays the groundwork for enduring relationships and positive outcomes. By embracing proactive communication strategies, water

utilities empower communities, foster trust, and uphold their commitment to delivering safe, reliable water to all.

Navigating LCRR Communication Requirements

The proposed LCRI present challenges and opportunities for water utilities. Understanding LCRI communication requirements is essential to maintaining trust and compliance. Proactive communication, frequent updates, and clarity in messaging mitigate fears and promote transparency. Engaging stakeholders early fosters collaboration and ensures effective implementation of LCRI mandates.

Thinking Like a Customer: Building Trust from Within

Your staff plays a pivotal role in bridging the gap between utility projects and community perspectives. Empowering staff to take a customer-centric approach fosters understanding, appreciation, and collaboration within your communities. By actively listening and transparently communicating, staff can better understand the needs and priorities of residents and tailor solutions accordingly. Through community initiatives and open dialogue, staff can build trust and collaboration while providing responsive service and effective problem-solving.

EMPOWERING THROUGH EDUCATION: BLENDING DIGITAL AND TRADITIONAL COMMUNICATION STRATEGIES

Educational initiatives lie at the heart of effective communication strategies. The more awareness and

knowledge water utilities provide their customers, the more empathy and confidence they gain to take meaningful action. Educational materials serve a dual purpose: addressing concerns and expectations while clarifying the significance of customer engagement. By prioritizing education and sharing the “why” behind initiatives, utilities cultivate informed communities capable of driving positive change.

Embracing Digital Marketing

In today’s digital age, water utilities need to leverage social media, email newsletters, optimized website content, webinars, and interactive tools to increase awareness, educate the public, and build relationships within the community. By utilizing these digital platforms, utilities can engage with audiences effectively, tailor messaging to different demographics, and address community needs with precision.

Integration of Social Media

Social media platforms serve as powerful tools for communication and engagement. If you are still trying to figure out where to begin, join the [Government Social Media Community](#). The key to success is engaging with your followers; for example, check out [Northeast Ohio Regional Sewer District](#), which has amassed over 60,000 X, formerly known as Twitter followers through its humor.

Elevating Communication Strategies with Printed Notifications

Despite the digital revolution, printed notifications remain a powerful tool for water utilities to communicate

with customers. The Marketing Rule of 7 highlights the importance of multiple “touches” to prompt action. Printed notifications, such as letters, postcards, and door hangers, ensure inclusive outreach by reaching customers regardless of digital access. By supplementing digital strategies with printed materials, utilities demonstrate their commitment to transparency and inclusivity.

RISK COMMUNICATION STRATEGIES

Water utilities must prioritize risk communication to address water quality and regulatory compliance issues effectively. Effective risk communication strategies should include timely and transparent communication, clear and accessible messaging, empathy and sensitivity toward stakeholders, and engagement and dialogue with the community.

Examples of these strategies include:

- Notifying affected customers of water quality issues.
- Using plain language to explain findings.
- Acknowledging community concerns.
- Hosting public meetings.

AWWA developed a great resource called [Trending in an Instant: A Risk Communication Guide for Water Utilities](#), which includes additional best practices and recommendations for developing risk communication strategies.

COMMUNITY ENGAGEMENT TECHNIQUES

Community engagement is essential for water utilities to build trust, foster collaboration, and promote informed decision-making. Some techniques to engage stakeholders effectively include:

- **Community Forums and Workshops:** Host forums, workshops, or focus groups to share perspectives, ask questions, and discuss water-related issues. Mora McLaughlin from Pittsburgh Water and Sewer Authority (PWSA) shared they “put a lot of groundwork into community meetings to present on lead, sometimes four or five in a neighborhood before construction started.”
- **Advisory Committees and Task Forces:** Establish committees or task forces composed of diverse stakeholders to facilitate collaborative decision-making and communication. For example, check out the [PWSA Community Lead Response Advisory Committee](#).
- **Educational Outreach Programs:** Develop educational programs to raise awareness about water-related issues and promote environmental stewardship. For example, the [San Antonio Water System](#) and the [City of Mansfield, Texas](#), collaborate with schools to implement educational programs.

MEASUREMENT AND EVALUATION METRICS

Measuring the effectiveness of communication strategies is crucial for evaluating performance, allocating resources, understanding the audience, improving strategies, and demonstrating ROI. Understanding what metrics matter to your organization is half the battle. 120Water's Platform, for example, tracks customer notification letters and surveys. Other metrics to consider are:

- Audience reach: Measure the number of individuals reached across different communication channels.
- Engagement metrics: Track audience interaction and interest levels.
- Customer feedback and surveys: Assess satisfaction, comprehension, and perceived value of communication efforts.
- Response rates: Measure the effectiveness of calls-to-action and campaign initiatives.
- Compliance and regulatory reporting: Ensure adherence to regulatory communication requirements.
- Qualitative assessment: Gather insights into stakeholder perceptions, attitudes, and preferences.
- Continuous improvement: Utilize data and feedback to refine tactics and tailor messaging to audience needs.

BOLD COMMUNICATION STRENGTHENS PUBLIC TRUST

If communication is new to your organization, first understand you don't have to reinvent the wheel. Later sections highlight Buffalo Water's [Get Water Wise](#) customer engagement program. Learn how other utilities are communicating and implement what you can. For example, Salt Lake City Public Utilities recently rolled out its new lead and copper [website](#) and [survey](#) that's easy to navigate. However, if you lean toward DIY communications, check out Silver Creek Water's [service line verification video](#).

Another great resource is the [AWWA Lead Communications Guide and Toolkit](#), which includes adaptations for small water systems.

Taking your first steps into the communication space can be overwhelming. Still, as industry leader Kelley Dearing Smith, vice president of communication and marketing at Louisville Water Company, states, "It's time for bold and effective communication...the [LCRR] is an opportunity to strengthen public trust. Regardless of whether you have a dedicated communications department, we all have the responsibility to engage with our communities and tell the story of drinking water and how we minimize the risk of lead getting into the drinking water."

ABOUT THE AUTHOR

Arianne Shipley is the senior manager of water utility marketing with 120Water. She has over 15 years of experience as a water utility professional and public communication consultant with a proven track record of developing award-winning communication, education, and outreach programs and initiatives.

EVALUATING PREDICTIVE MODELS FOR LEAD SERVICE LINE INVENTORY AND REPLACEMENT



Jared Webb
BlueConduit



Dunrie Greiling
BlueConduit

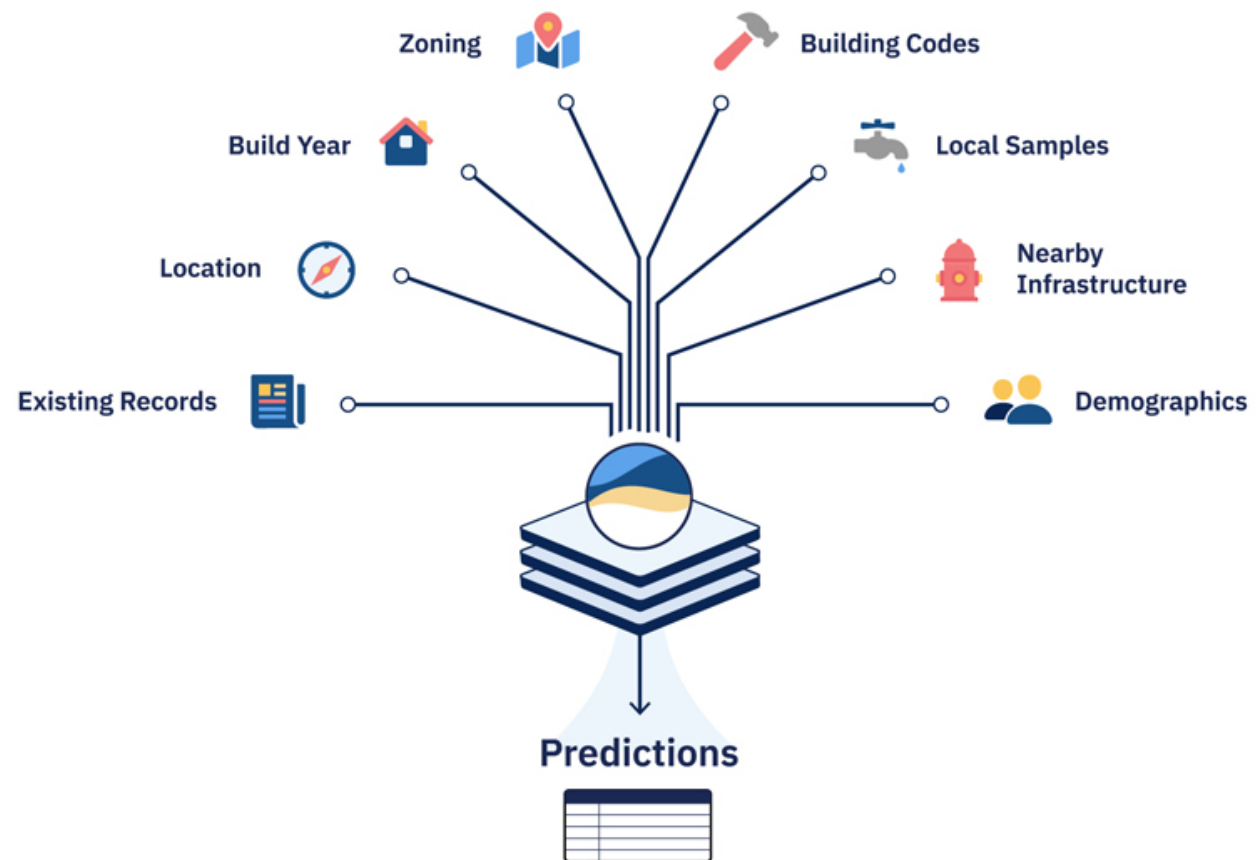
Get an accurate service line material prediction for Lead and Copper Rule (LCR) compliance by avoiding modeling pitfalls.

The U.S. EPA has included predictive modeling as a service line material investigation method. The approach sounds straightforward: Use the information you know to make predictions about what you don't yet know. Utilities can then use those predictions to prioritize lines for excavation and replacement.

If you are not a trained data scientist, how do you pick an approach? This article will cover what predictive modeling is and give you questions to ask to help you choose wisely.

WHAT IS PREDICTIVE MODELING FOR LEAD SERVICE LINES?

Utilities do not have complete or even accurate service line materials records. In the absence of comprehensive records, utilities have turned to data science to predict unknown service line materials. They can then use those predictions to prioritize lines for excavation and replacement.



A predictive model uses known information to predict what is unknown: service line materials, in this case.

A model can use many inputs, including the utility's historical records and information about the local built environment such as build year, zoning, location, demographics, information on nearby infrastructure like fire hydrants, and local water samples.

The process is iterative: Where lead is and is not found guides the model to make better predictions.

QUESTION THE DATA

How Do Models Handle Biased Data?

Biases can emerge when certain types of homes or neighborhoods occur too often or not at all in the records used for prediction. For example, if most historical records are for a particular neighborhood within the city, the model will likely perform well in that neighborhood, but will be less accurate for other city neighborhoods.

These biases can come from:

- ease of access
- inspecting only where you expect to find lead
- recent work in the area
- residents' participation.

We have seen that historically disadvantaged communities

tend to be in older, more urban areas where construction and reconstruction records are scant compared to newer, more suburban areas.

With statistical prediction, it's "garbage in, garbage out." In short, a model that has been trained on biased data will provide inaccurate, biased results. While sophisticated techniques to debias data exist, the best and most straightforward approach is to collect representative data (e.g., data from across the city chosen randomly rather than by convenience) to feed the model.

If your modeling approach does not include obtaining or ensuring representative data, that's a red flag.

Does The Model Accept Historical Records As Truth?

Unfortunately, the paper records that utilities have often do not reflect the reality of what's in the ground. Although tap cards and other records may have been accurate when they were created, they have not been consistently updated after the fact.

Inspections show that many of our utilities' historical records are inaccurate. (The record does not match the material in the ground or home.)

If the model or modeling team trusts these records without verifying their reliability, the model will make inaccurate predictions from these records.

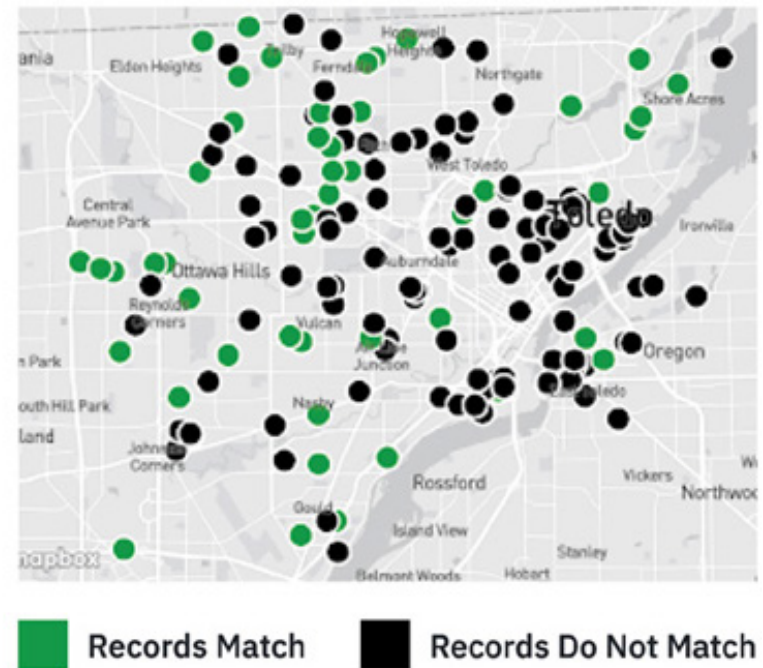
Ask how the predictive model will treat historical records. Be wary if they are accepted uncritically as truth.

Historical Records are NOT Verified Records

Recognize that old service line records have mixed reliability and large gaps.

What Data Does The Model Use Beyond Historical Records?

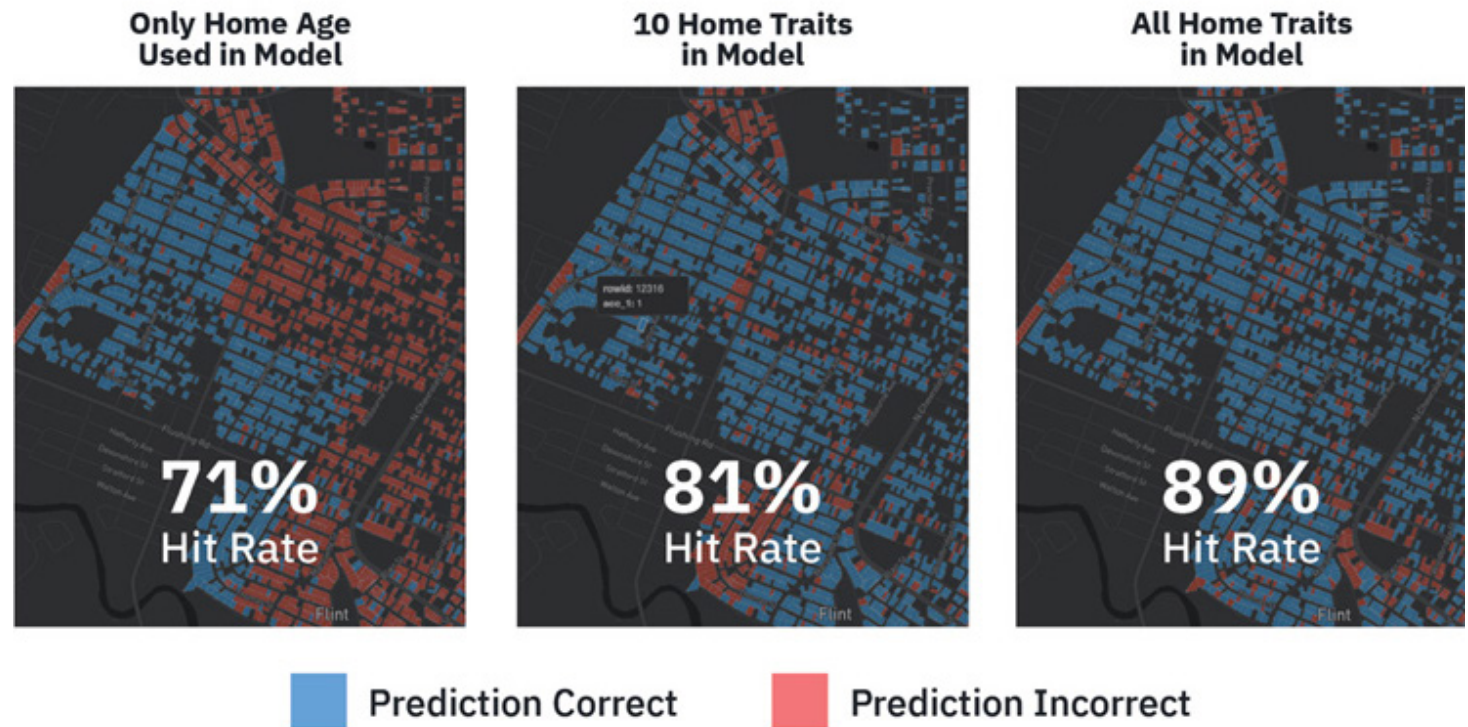
Some water utilities and engineering consultants make predictions about service line materials using only home age or home age and building codes. However, home age and other inputs — including verified service line material records; zoning; building codes; location and timing of infrastructure updates (e.g., water main and hydrant



replacements); and census data about demographics — predict more accurately than home age alone. While no single feature is necessarily predictive, it's important to see who is living in affected areas so that utilities can incorporate environmental justice into their planning, funding, and communications.

Ask whether the model uses information beyond the historical records brought by the utility. If not, red flag.

Predictive Models: Home Age is NOT Enough



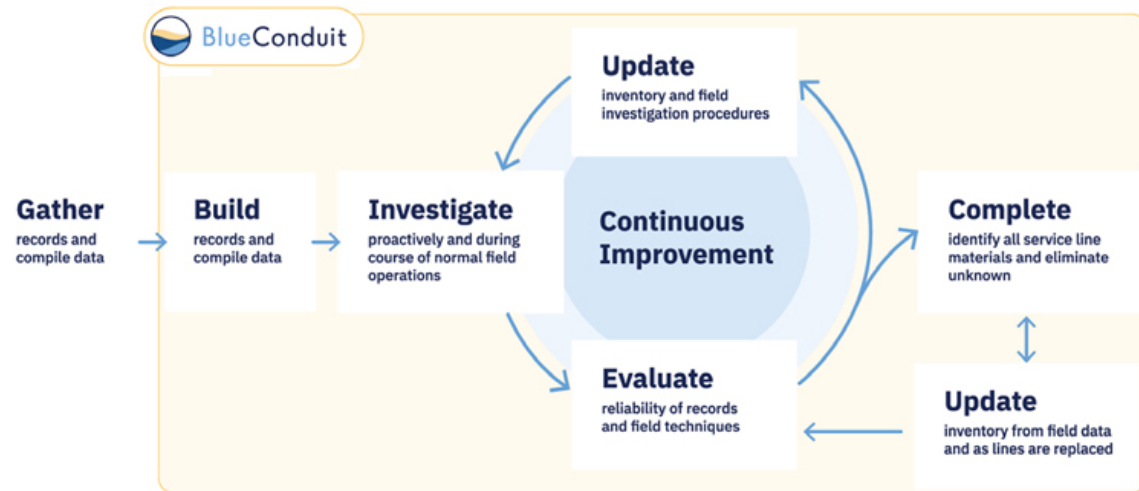
How Does The Modeling Process Incorporate New Information?

A statistical model that is run once but is trained on representative data will work well. A model that is updated with new information will show continuous improvement.

As new data from inspections and replacements are gathered, the model will adapt to that data and make more informed predictions to locate lead service lines in the area.

Beware the “one and done” approach. Ask how often the model outputs will update.

Inventory Lifecycle



Replace Lead Service Lines

Replacing lead service lines can occur anytime in the steps shown

How Do You Define Success?

We have heard results described this way: “We dug only where the model predicted a high probability of lead and had a great hit rate.” That is...frustrating. We want to get all of the lead out of the ground, not just the “high probability” lead.

One way to measure a predictive model is by its precision or hit rate. Is there lead where it predicts lead?

Reminder: A model’s hit rate is just one of many indicators of success.

Another way to measure a model is recall. Recall measures how much lead a predictive model is able to locate out of all the lead in the ground.

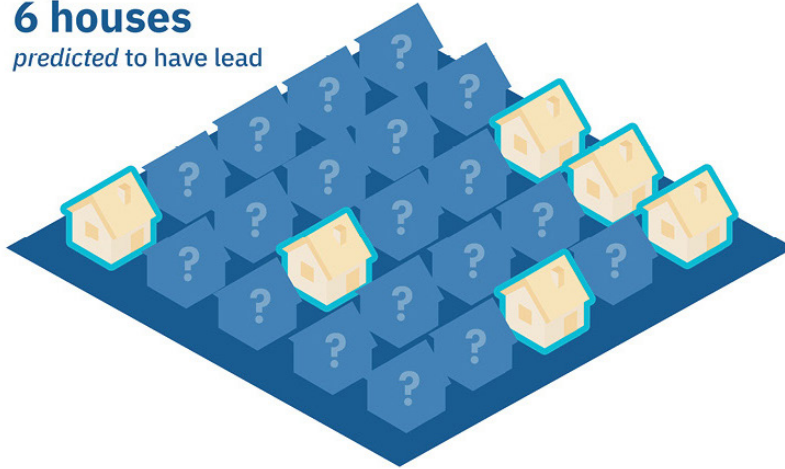
It’s a trade-off — models with better recall may have poorer hit rates. The full recall of a model is only calculable once every service line has been inspected. However, with a representative sample of service line materials, a model’s recall can be estimated with high confidence.

Be wary of sky-high hit rates without other success metrics or context. Ask about recall as well as hit rate.

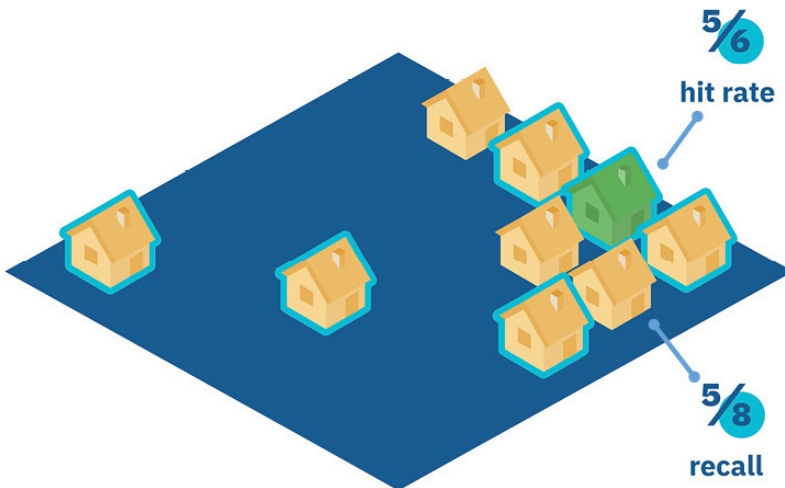
Prediction

6 houses

predicted to have lead



Verified



BlueConduit's Experience In Predictive Modeling

1.8+
million

Service lines
analyzed

2016

Originated ML approach
to LSL in Flint

2019

Company
founded

\$300+
million

in savings

100+
Water systems

6 years
Experience in
ML prediction

Compared To What?

An easy way to make a model look smart is to compare it against something less so. A red flag is when the comparison for the model is random guessing. “Our model did better than a computer picking random addresses to test for lead.”

It is doubtful any utility would replace service lines via random guessing. They would use something more intelligent than that, such as “Go in order from oldest to newest home within this time range” or another approach informed by their experience.

Ask what success is evaluated against, and be wary if it is compared to a strategy that you wouldn’t use yourself.

See blueconduit.com/resources/ for more about our model, its predictions, and outcomes.

ABOUT THE AUTHORS

Jared Webb is BlueConduit’s chief data scientist. His responsibilities include processing and analyzing customers’ data, managing relationships with technical service partners, and producing output of machine learning results. He has been a member of Dr. Schwartz’s and Dr. Abernethy’s team since 2016 and has served as chief data scientist since the formation of BlueConduit. Jared received his undergraduate and masters in applied mathematics from Brigham Young University, where he focused on the mathematical foundations of machine learning models.

Dunrie Greiling is BlueConduit’s chief product officer. She combines her training in science (biology PhD, University of Michigan) with her two decades of experience in tech startups. Prior to joining BlueConduit, she worked in science-based software and device companies in many roles — as an employee, as a consultant, and as an advisor and entrepreneur-in-residence.

INCREASING THE LIKELIHOOD OF ACCESSING INFRASTRUCTURE FUNDING



Glenn Barnes
Director of Water Finance Assistance

The [Bipartisan Infrastructure Law](#) has brought a “once-in-a-generation” investment from the federal government to the water and wastewater sector, with billions of dollars available for needed capital projects. As a utility, you may think it’s reasonable to assume that funding will be available when you request it. Sadly, that may not be the case.

UNPRECEDENTED FUNDING LANDSCAPE FOR DRINKING WATER

Over the next five years, the drinking water sector will receive an additional \$11.7 billion for infrastructure projects, \$15 billion for lead service line inventory and replacement, and \$9 billion for emerging contaminants like PFAS. Significant amounts of this funding will be offered as grants to small and disadvantaged communities. This is indeed an unprecedented level of funding for drinking water, but more is needed to cover the anticipated need.

Lead service line replacements alone are estimated to cost between \$28 billion and \$47 billion. EPA's most recent Drinking Water Infrastructure Needs Survey and Assessment shows \$472.6 billion is needed to maintain and improve the nation's drinking water infrastructure over the next 20 years, and those numbers were calculated before COVID, before last year's high inflation, and before new regulatory requirements like the Lead and Copper Rule revisions. This funding is not guaranteed, especially as more utilities than ever apply for the money.

PROACTIVE APPROACH TO ACCESS FUNDING

You must be proactive to put your utility in the best position to access funding. Otherwise, you run the risk of missing out. The best way to increase the likelihood of getting your application funded is to tailor the application to the funding program's ranking criteria.

Most Bipartisan Infrastructure Law money is channeled to utilities through the State Revolving Fund (SRF) program.

Every state runs its own program, as well as the District of Columbia and Puerto Rico. Each of these programs scores its applications differently. Once all applications have been received and scored, programs fund the applications that receive the highest scores.

Tailoring Applications for Funding Success

What do we mean by tailoring the application to the ranking criteria? Let's look at an example from Massachusetts. Their Drinking Water SRF program asks applicants to prepare a five to 10 page narrative that addresses the following topics:

- A detailed discussion of the problem to be solved by the project.
- Identify the project area using a site plan and/ or locus map.
- A detailed discussion of the severity of the existing public health issues due to the problem.
- The total system population and the population affected by the project. Discuss how the affected population is calculated.
- A description of the relative importance of the component(s) involved.
- A discussion of all interactions with regulatory bodies pertaining to the problem, including the need to comply with existing enforcement orders or sanitary survey requirements.

- A discussion of options considered, including interconnections, blending to improve water quality, rerouting water mains, treatment, and new source(s), including the no-action option.
- A description of the backup systems currently in place to replace the component(s) on a temporary or permanent basis.
- A description of all planning efforts performed to arrive at the recommended plan.
- A detailed discussion of the work to be completed.
- A description of the energy efficiency measures to be implemented and anticipated energy savings.
- A description of any renewable energy components and an estimate of energy generation.
- A description of any “new technologies” being used and approved by MassDEP.
- A discussion of the status of the project as it currently exists.

STATE-SPECIFIC VARIATIONS IN SCORING

There can be a significant difference in how states score funding applications. Virginia, for example, awards the bulk of its points in the scoring criteria based on how the project will improve public health, while next door, North Carolina awards more points based on affordability

considerations and whether the project will consolidate a non-viable utility.

RESOURCE: STATE REVOLVING FUND SWITCHBOARD

The best resource for ranking criteria and all necessary information about SRF programs is the State Revolving Fund Switchboard, created by the Southwest Environmental Finance Center. Navigate to the site, click on your state, and links are provided to all key documents for the Drinking Water and Clean Water SRF programs.

CRAFTING A SUCCESSFUL APPLICATION

Strategic Tailoring Using Headers

An application tailored to the scoring criteria would address each topic in order. A best practice would be to include headers that clarify which topic is being addressed. For example, the header for the topic “A detailed discussion of the problem to be solved by the project” should be something like “Discussion of the problem to be solved by the project.” Make it easy for the reviewers to understand what you are addressing in the application!

Leveraging State-Specific Insights

Armed with a clear understanding of state-specific ranking criteria, you are better equipped to craft a successful application. Utilize this knowledge to maximize your chances of securing funding in the midst of this unprecedented investment in our nation’s infrastructure.

The Power of Storytelling in Your Application

Incorporating storytelling into a funding application can be a powerful way to communicate the essence and impact of a project to funding decision makers. Storytelling enables applicants to illustrate vividly how the proposed initiative resonates within the community. Rather than relying solely on numbers and technical details, storytelling allows applicants to articulate the project's narrative, emphasizing its capacity to catalyze positive change and enhance community well-being.

Bo Jones, director of Water Sewer Utilities at the city of Smyrna, Georgia, advises to “talk about the citizen base, the age of your community, infrastructure and historical context and the impact your project will have.” His first-hand experience led him to conclude that if you get too far into the details/weeds of the project, its impact and meaning will get lost, and the people in charge of awarding that money may not see the ultimate value.

When asked about giving advice, he says, “Be authentic, be real, and talk about your project in a way that anyone can see and understand what you're trying to do and how it will improve the overall health and well-being of your community.”

RESOURCES

1. *Funding Sources for Developing Service Line Inventories*
-[https://r20.rs6.net/tn.jsp?f=001djunHhgWaR-HEe_IlfP05yqbYJfBeAyolb0ksL69WIAAnPOSN91\[...\]&ch=IGz3k-Cg_](https://r20.rs6.net/tn.jsp?f=001djunHhgWaR-HEe_IlfP05yqbYJfBeAyolb0ksL69WIAAnPOSN91[...]&ch=IGz3k-Cg_)

ABOUT THE AUTHOR

Glenn Barnes is director of Water Finance Assistance, a training and technical assistance organization dedicated to helping you serve your community better and sustain your utility for years by building your financial and managerial capacity. Glenn leads workshops and webinars and works directly with water utilities on various financial and managerial topics, including accessing infrastructure funding, rate setting, data-driven decision-making, workforce issues, and affordability. Water Finance Assistance partners with 120Water to fund lead service line replacement.

CASE STUDY: BUFFALO, NY, STARTS SUCCESSFUL VERIFICATION PROGRAM

Utility recommends
“Just start somewhere” and improve as you go.



120Water

Buffalo Water draws water primarily from Lake Erie for 275,000 residents through approximately 75,000 service line connections, some of which are more than 100 years old.



INTRO TO LCRR

In 2021, the EPA announced the Lead and Copper Rule Revisions (LCRR), a major update to the Lead and Copper Rule. By October 16, 2024, all public water systems must complete a lead service line (LSL) inventory that digitally documents the material of every service line in their systems — and a plan to maintain that inventory.

Verifying service line materials can be a daunting undertaking, especially when the system is old and the staff is small. Here's what Buffalo Water is doing.

BUFFALO'S COMPLIANCE PROGRAM AND CHALLENGES

Buffalo Water had long understood the value of converting paper records into searchable electronic data as part of its lead and copper compliance program. In 2015, they started migrating service and tap card information into their underground asset management system.

For most cities of Buffalo's age and size, updated customer and service line data has been a big challenge. Buffalo has grappled with missing data, hard-to-read handwritten records, weeding out vacant lots from data files, and properly accounting for double service lines.

Being proactive on this front revealed their data gaps early on. It established a digital home for the inventory so that the utility could actively work toward an accurate, updated inventory that complied with state and federal

requirements. While they didn't start with a perfect record-keeping system, they knew they needed to jump in.

ROLL: A CITY CAMPAIGN TO REPLACE, NOT REPAIR, LEAD SERVICE LINES USING GRANT MONEY

Buffalo Water ROLL (Replacing Old Lead Lines) launched in 2019, establishing that LSLs and lines with lead connections would no longer be repaired. Instead, when such a line experienced a break or leak, Buffalo Water would replace the entire line for free, using state and federal grant money. This was a huge benefit to customers because, in Buffalo, customers own their service lines and the connections to the main, making them responsible for the cost of line replacement and street restoration, which could be as much as \$20,000.

ADDING TESTING KIT REQUESTS TO BUFFALO'S 311 HOTLINE

To identify more LSLs through water testing, Buffalo Water amplified its existing program in two ways. First, it enabled customers to request free testing kits through the city's 311 program, Buffalo's reporting hotline already familiar to residents. Second, the utility engaged the services of 120Water to take advantage of its expertise in LCRR compliance management and LSL inventories. With 120Water, Buffalo's testing program between customers, the utility, and the testing labs was simplified and streamlined.

CAPITAL PROGRAM: A PILOT STRATEGY FOR REPLACING SERVICE LINES WHEN REPLACING MAINS

Innovative Strategy: Replacing LSLs During Water Main Replacement

In a bold move, Buffalo Water decided to pilot a practice that whenever a water main is replaced, the utility would also replace LSLs connecting to that main. This allows the utility to replace LSLs when the cost of replacing the main is already covered under its capital budget (and the ground has already been excavated).

Customer Survey Challenge and Initial Response Issues

However, they needed to know in advance which service lines needed replacing, which required customers to inspect

their lines and complete a survey. This step initially proved to be much more complicated than expected. Of 375 requests sent to customers affected by the first main line replacement in the pilot, only three were returned, showing that customers needed more trust, motivation, or both.

Enhanced Outreach, Education, and Increased Customer Engagement

Buffalo Water responded by increasing outreach and education with multiple notifications to affected customers, working with city council members, and attending community meetings. After the revamped outreach plan, responses increased from three to 65 in the initial trial.

Key Takeaways



Build Trust
with customers



Just Start
somewhere



Collaborate
with stake holders



Think
like a customer



GET WATER WISE (GWW) INITIATIVE

Buffalo Water recently launched its Get Water Wise (GWW) initiative to build upon community engagement. This digital resource serves as an online hub for affordable water program assistance and LSLR information where customers can easily navigate and learn about their water and the available resources.

Social Media Management and Ad Campaign

Buffalo Water established a social media management team to manage GWW's Facebook and Instagram accounts to support this program and develop engaging content communicating information about affordable water programs and their LSLR project. The team has also launched a social media ad campaign to raise awareness and drive people to the getwaterwisebuffalo.org website.

Ongoing Program Refinement to Increase Community Engagement

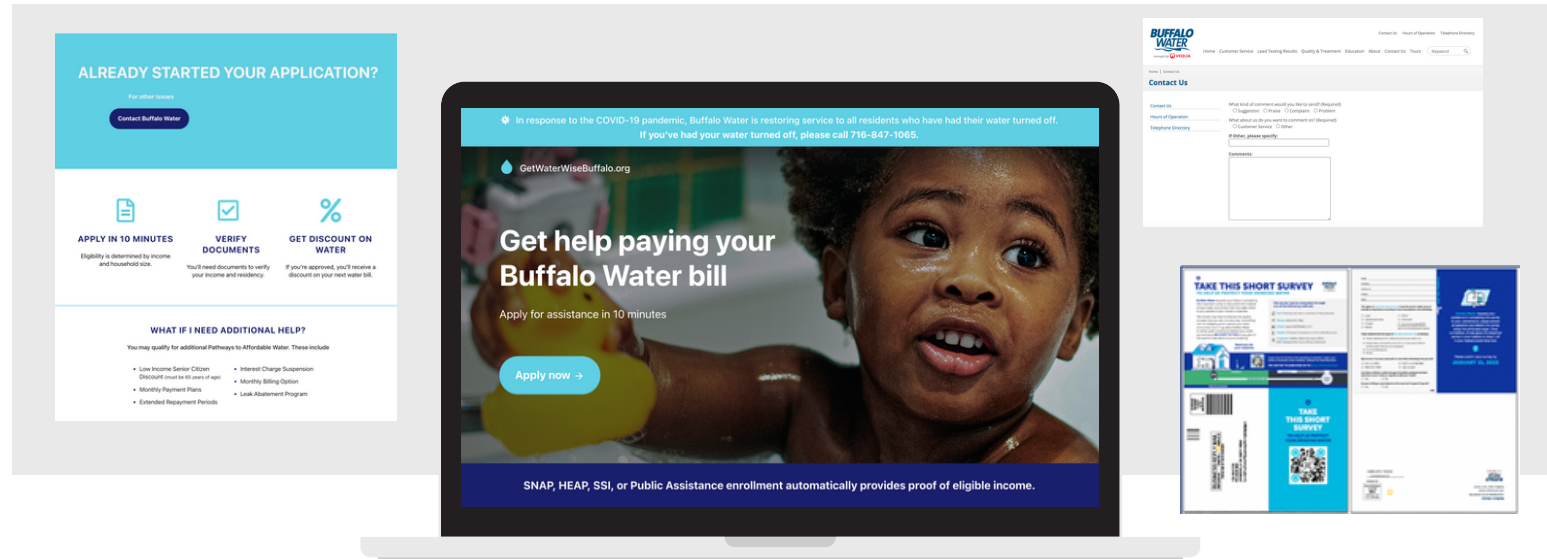
Much like their approach to building an inventory, the Buffalo Water team constantly builds upon this program to refine it. GWW recently added a calendar for on-site activations at local summer festivals as another channel to engage their community and share resources. The first on-site activation was at the city's Juneteenth Festival.

Their tent had over 130 visitors who left with literature about their program and water initiatives.

On-site activations proved to be a great channel for customer engagement, showcasing the community's interest in learning about affordable water programs, lead service line information, and Buffalo's Water Plant. At the on-site tent, 28 people provided contact information to attend a free public water plant tour during the summer. In addition, 44 people provided their information to enter a raffle to win a free Galaxy tablet. Those who provided their contact information will receive Buffalo Water-related news through an upcoming Get Water Wise monthly newsletter. This is another valuable channel to keep their community engaged and updated on their initiatives and water-related communications.

Payoff to Activating Best Practices

Surveys proved invaluable for gathering crucial information about customers' lead service lines (LSLs) and willingness to participate in lead service line replacement (LSLR) programs. Initially, Buffalo Water encountered difficulties obtaining responses, revealing underlying challenges such as customer distrust or apathy. However, despite the initial hurdles, surveys remain pivotal for several reasons:



1. They provide insights into the prevalence of lead service lines within the community, essential for prioritizing replacement efforts and allocating resources effectively.
 2. Surveys help gauge customer awareness and attitudes toward LSLR programs, informing outreach and education strategies to address misconceptions or concerns.
 3. By soliciting feedback through surveys, Buffalo Water can tailor its communication efforts to better resonate with customers, fostering trust and engagement in the process.
- Ultimately, surveys enable Buffalo Water to comprehensively understand customer needs and preferences regarding LSLR initiatives, facilitating targeted interventions and fostering community participation in efforts to ensure safe and reliable water infrastructure.

MOVING TOWARD A LEAD-FREE RURAL WATER SYSTEM



Michael Griffiths
CoBank

Lead service lines are poisoning communities, many of which are already disadvantaged, making it a national emergency that utilities must address with haste. These tips guide the way.



INTRO

“Getting the lead out” is a slow-moving process when replacing lead-based water service lines. However, one thing’s sure: Historical lead pipes aren’t doing residents of small American communities any favors. That’s why many utilities and cooperatives are beginning to take steps toward finally ridding their water systems of lead.

Just how large a problem is lead contamination in drinking water across the nation? According to research from the American Bar Association, an estimated 21 million people were exposed to drinking water that held unacceptable amounts of contaminants in 2015 alone — lead was one of those contaminants. Although it would be appealing to assume that the figure is much lower now, not much has changed since then.

There are multiple reasons why many households in small towns haven’t upgraded from aging lead pipes. Most are financial. For instance, homeowners don’t want to or can’t pay more monthly, either to pay for replacements or to cover “passed on” fees from their water utility providers.

Remember that the average cost of an individual household lead service line replacement can hover just under \$5,000. That’s not exactly pocket change for rural residents, who may struggle with financial insecurity.

Utilities don’t want to charge their customers more, either. The last thing a utility wants is to set itself up for the negative press of a significant rate hike. This leaves both parties in tacit agreement to ignore the lead lines.

Another barrier to replacing water lines is that the water itself might taste fine, even though it’s contaminated. Many residents are surprised when they find out that their drinking water exceeds the U.S. EPA’s lead limit of 15 parts per billion. Even then, they may just install water filters as a temporary measure instead of addressing the issue.

FIGHTING FOR WATER QUALITY...AND EQUALITY

Despite the obstacles inherent in replacing water lines en masse, communities and those who live and work in those communities deserve clean, potable water. Replacing lines isn’t just a “nice to have” project. It’s a necessary — but fortunately, a one-time — solution that will bring major health benefits to rural Americans.

Many studies have found fault with the EPA’s ruling on “acceptable” lead levels in drinking water, especially for young kids. Poor-quality drinking water that contains lead has been linked to cognitive issues in children.

Is it any wonder that between 2020 and 2021, state legislatures enacted no fewer than 500 bills related to lead in drinking water, mostly focused on children and lead poisoning? The point is that any lead exposure could be bad for the youngest, most vulnerable populations.

So, how can utilities and cooperatives begin moving the needle? Below are five good starting points:

1. Identify how broad-based the problem is.

It's hard to make any progress without knowing just how big the problem of lead service lines is in any given community. Utilities can create maps of their service line networks as other communities have done. These maps can help identify concentrations of lead pipelines.

Knowing the extent of the issue makes it much easier to tackle. Plus, digital maps can help let consumers and businesses know whether they might be at risk of drinking lead-contaminated water. In Cincinnati, the city's online and interactive database serves as a single source of lead service line truth for consumers.

2. Inform customers about potential lead pipeline contamination.

The average customer doesn't think about lead contamination when turning on the tap. Customers need to be educated about what their pipes are constructed of and how those materials can affect their water quality. The more they know, the more likely they'll want their utilities or cooperatives to help them solve the problem.

Customer education can take many forms, including regularly updated digital portals. For instance, a utility might want to create blog posts about water regulations and standards. A topic, such as a quick overview of the "Revised Lead and Copper Rule" from the EPA, can become the springboard for many pieces of informative content.

3. See how other communities have replaced their lead pipes effectively.

Some communities, utilities, and cooperatives have successfully upgraded their water systems. Consequently, other communities should take notice. Building a playbook based on a city or town that has already undertaken the effort can be simpler than starting from scratch.

Some considerations to look for in other communities include how long projects took and how the projects were paid for. Again, every area will have unique needs, but following in other communities' footsteps makes sense.

4. Look for funding sources.

As mentioned above, any kind of pipe replacement is costly. That's why staying on the leading edge of any funding streams available to cooperatives, utilities, towns, etc., is important. For instance, the EPA has excellent resources and links to various water project grants and loans, such as the Drinking Water State Revolving Loan Fund.

Not all will apply to every community or organization, of course. Nevertheless, some may be able to cover all or part of the replacement of lead water lines. At the same time, other funds might help cover the cost of educating customers with seminars, workshops, or marketing materials. Cobbling together various money streams can be more pragmatic than hoping to find one single source to pay for everything.

5. Build a framework for replacing all the lead service lines.

With the right information and well-educated customers, utilities and cooperatives can begin building timelines to replace all the lead service lines. This won't happen overnight. Even incremental improvements can make a huge difference — and they spread out the costs.

In time, the overarching goal can be a lead-free water system. Though some customers might not like absorbing minimal costs along the way, most will appreciate not having to worry about the quality of the water they and their families are drinking.

Lead pipes become ever more hazardous over time. Waiting is riskier than doing something now for the good of rural residents and visitors.

REFERENCES

1. https://www.americanbar.org/groups/crsj/publications/human_rights_magazine_home/vol--44--no-2--housing/rural-america-s-drinking-watercrisis/
2. https://www.epa.gov/sites/default/files/2019-10/documents/strategies_to_achieve_full_lead_service_line_replacement_10_09_19.pdf
3. <https://www.epa.gov/dwreginfo/lead-and-copper-rule>
4. <https://www.science.org/doi/10.1126/sciadv.abn5164>
5. <https://www.ncsl.org/environment-and-natural-resources/state-and-federalefforts-to-address-lead-in-drinking-water#anchor16079>
6. <https://geo.dcwater.com/Lead/>
7. <https://gcwww.maps.arcgis.com/apps/webappviewer/index.html?id=0a170c268c694e46a8a4e394630df0bd>
8. <https://www.epa.gov/ground-water-and-drinking-water/revised-lead-andcopper-rule>
9. <https://www.epa.gov/ground-water-and-drinking-water/funding-lead-serviceline-replacement>
10. <https://www.epa.gov/dwsrf/how-drinking-water-state-revolving-fund-works>

ABOUT THE AUTHOR

Michael Griffiths is the vice president of the Water and Community Facilities division at CoBank, a national cooperative bank serving vital industries across rural America by providing loans, leases, export financing, and other financial services in all 50 states.

INFRASTRUCTURE UPGRADE: EXPEDITING LEAD PIPE REMOVAL PROTECTS COMMUNITIES



Emily Newton
Editor In Chief at Revolutionized

Assuring everyone has access to clean drinking water is essential. However, despite significant improvements in technology and public health across history, lead water pipes still pose a substantial threat to that goal. The extent of this issue has become more evident, and the push for lead pipe removal is accelerating.

THE PUSH FOR LEAD PIPE REMOVAL

A 2022 poll revealed that seven in 10 Americans¹ say lead pipes in drinking water systems are either a crisis or a major problem. The overwhelming majority also support updating U.S. EPA laws to require replacing all lead pipes within the next 10 years.

Recent legislation follows this trend in public opinion. The 2021 Bipartisan Infrastructure Law — also known as the Infrastructure Investment and Jobs Act (IIJA) — allocates \$15 billion to lead pipe replacement² and another \$11.7 billion to general safe drinking water funds. This funding aims to support the goal of replacing all lead service lines in the U.S. within the coming decade.

Many states are also implementing their own lead pipe removal initiatives. These may provide additional funding on top of the federal investment from the IIJA or outline specific steps and regulations for water and utility companies.

HOW LEAD PIPE REMOVAL BENEFITS COMMUNITIES

Federal and state governments phased out lead service lines in the 1980s, but much of America's water infrastructure still uses older lead pipes. Replacing these with newer, unleaded alternatives has many benefits for the communities that rely on them.

PUBLIC HEALTH IMPROVEMENTS

The most important reason to replace lead pipes is to protect public health. Lead could seep into people's drinking water as these service lines corrode. Ingesting this metal can damage the nervous system³, impair growth, lead to learning and behavioral problems, and cause hearing and speech problems.

The effects of lead poisoning are also permanent, and it can take decades for levels in the body to decrease. Health officials say there is no safe level of lead exposure, especially in young children. Given these substantial medical threats, removing all traces from the country's drinking water is essential.

INFRASTRUCTURE MODERNIZATION

Lead pipe removal has benefits outside of these health concerns, too. Lead has been illegal in new water systems since the '80s, and any infrastructure that still contains the metal is over 30 years old. Even if it weren't for the risk of lead poisoning, updating that aging infrastructure is a good idea.

Old water lines may also face higher risks of corrosion, clogging, breaking, and other performance-related issues. Replacing them allows utility companies to minimize these hazards, creating a more reliable water system. Utilities could install Internet of Things (IoT) monitoring technologies, more resilient pipes, and other upgrades to improve future service.

PROJECT OPPORTUNITIES FOR WATER COMPANIES

Rising government investment in water infrastructure upgrades also provides a business opportunity for the companies that aid in these initiatives. Finding and replacing old pipes is a considerable undertaking, so this movement offers plenty of work for professionals in the field. Consequently, these efforts can sustain infrastructure businesses and fuel local economies.

On top of the \$15 billion the IJJA allotted to lead pipe removal, many states and federal agencies are investing heavily in these efforts. Rochester, New York, has budgeted \$21.5 million⁴ to remove lead water lines, Washington, D.C., provides \$30 million to assist with removal, and the USDA has awarded at least \$132 million in loans and grants to remove lead. These investments represent a considerable business opportunity.

PRACTICAL CONSIDERATIONS FOR LEAD PIPE REMOVAL

As these benefits highlight, expediting lead pipe replacement is critical for water companies and their communities. However, it can be a complex process. Businesses wanting to participate in this movement should keep the following considerations in mind.

FINDING LEAD PIPES

The first challenge in lead pipe removal is finding the service lines needing replacement. Because this infrastructure is old, documentation around it is limited. Water systems also don't have to submit service line inventories to the EPA until late 2024⁵, so many utility organizations don't know which parts of their systems contain lead.

Customer outreach is an essential part of this discovery. Homeowners may have records about their pipes that water authorities don't, so encouraging consumers to report what their pipes are made of will help. Organizations can spread awareness of the issue by mailing residents in areas with limited service line documentation.

Water companies should also test exposed or easily accessible lengths of pipes to see if they're made of lead. Carefully monitoring water samples for metal traces can also help identify their location.

CHOOSING THE RIGHT TOOLS FOR THE JOB

Once teams find where these old service lines are, they should consider the tools they'll use to replace them. Using the wrong equipment for the job can make replacement a longer or more disruptive process than it needs to be, so this is a crucial step.

Trenching may be a more cost-effective way to remove old pipes, but directional boring is quicker and less invasive⁶, so it's better for residential areas. Teams must also ensure they work as carefully as possible, as too much disruption can cause lead to flake off from old pipes and flow further down the system.

SELECTING OPTIMAL PIPE MATERIAL

Water companies should carefully assess what types of pipe should replace lead water lines. PVC and other plastics may be the new industry standard, but some research suggests plastic may leach pollutants into waterways⁷, posing more health risks to residents.

Copper doesn't leach chemicals and is more resistant to outside pollutants, but it's expensive and can react to some contaminants to corrode faster. Stainless steel requires more care to prevent corrosion but is less reactive.

The ideal pipe material may depend on the area. Utility companies should consider their water content, ground composition, temperatures, and other factors to determine the safest alternatives.

WORKING WITH HOMEOWNERS

Water companies should also work closely with homeowners. In many areas, residents also own the parts of the water system feeding into their property. Consequently, replacing these pipes means gaining permission from these consumers and working with them to manage the disruption and costs.

Many municipalities offer reimbursement programs for homeowners for lead pipe removal, helping remove the financial burden from their shoulders. If no such programs exist in an area, utilities may consider covering the costs of removal or offering other benefits to encourage homeowners to replace these dangerous pipes.

CONDUCTING POST-REMOVAL MONITORING

After completing the job, teams should closely monitor areas where they've removed lead pipes. Ensuring nothing lingers in the system is crucial since there's no safe lead level. Many organizations use IoT sensors to monitor conditions⁸ remotely, and water companies can do the same, as these technologies provide real-time updates to enable faster responses.

Teams should remind consumers to flush their water systems a couple of times after replacing pipes to remove all contaminants. Only after a few consistent periods of no lead turning up on monitoring systems is it safe to assume it's free from the system.

LEAD PIPE REMOVAL IS CHALLENGING BUT NECESSARY

The growing lead pipe removal movement is an essential step forward for public safety. It can also present an opportunity for water companies to gain business and improve their infrastructure for future use. There are some challenges, but the benefits far outweigh the difficulties.

Effective removal starts with understanding the obstacles ahead. Utilities that keep these considerations in mind can safely and efficiently upgrade America's service lines.

REFERENCES

1. <https://www.nrdc.org/press-releases/poll-access-safe-drinking-water-top-priority-across-america>
2. <https://www.epa.gov/newsreleases/epa-launches-new-initiative-accelerate-lead-pipe-replacement-protect-underserved>
3. <https://www.cdc.gov/nceh/lead/prevention/health-effects.htm>
4. <https://www.whitehouse.gov/briefing-room/statements-releases/2023/01/27/fact-sheet-biden-harris-administration-announces-new-actions-and-progress-to-protect-communities-from-lead-pipes-and-paint/>
5. <https://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/DrinkingWaterMgmt/Regulations/Pages/Lead-and-Copper-Rule.aspx>
6. https://www.catrentalstore.com/en_US/blog/benefits-directional-boring.html
7. <https://www.scientificamerican.com/article/replacing-lead-water-pipes-with-plastic-could-raise-new-safety-issues/>
8. <https://revolutionized.com/what-is-an-iot-sensor/>

ABOUT THE AUTHOR

Emily Newton is an industrial journalist. She regularly covers stories for the utilities and energy sectors. Emily is also editor in chief of Revolutionized (revolutionized.com).



ABOUT US



Water Online is the preeminent internet source of useful and timely information about the water and wastewater industry. If you are a professional in this field, you will have rapid access to a comprehensive web site dealing with the basic operational elements of this industry: the resource management, supply, treatment and distribution of drinking water, and the collection, treatment and disposal of wastewater, as well as the many ancillary functions that accompany them, for example, stormwater management and sludge conditioning and disposal.

The Water Online database serves the information needs of engineers, planners, operational and financial managers, business executives, consultants, elected officials, government personnel and others who are involved in the municipal water supply industry, and the municipal and industrial wastewater treatment field. Reflecting the dynamic and interactive character of the internet, Water Online is the most convenient source of technical, operational, product, management and regulatory information available for this industry.

WaterOnline.com

info@WaterOnline.com

814.897.7700

5340 Fryling Rd., Ste 100, Erie, PA 16510