

Economic Cost of Lead Remediation in Drinking Water in Wilmington, Delaware

Feb 18, 2026

WSP Brownbag Seminar Series

Penny Hall Room 005

University of Delaware

Newark, Delaware

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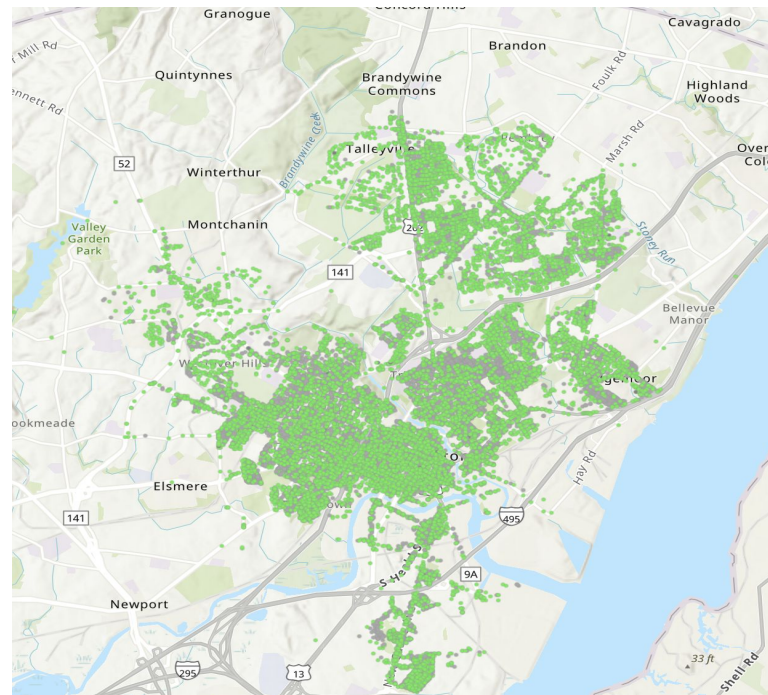
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Wilmington Lead & Copper Rule Inventory Project (Overview)



Background



- Federal mandate under the EPA Lead and Copper Rule Revisions (LCRR).
- Requires full inventory of water service line materials.
- Goal: Identify and remove lead exposure risks in drinking water systems.
- Municipal clerks play a communication and record coordination role.



Why is Lead Dangerous?



- Lead is a neurotoxin: even low exposure can harm brain development, especially in children and pregnant women.
- No safe level of lead in drinking water: According to the CDC and EPA.
- Symptoms of exposure: Can include developmental delays, behavioral issues, fatigue, and long-term cognitive impairment.

Flint, Michigan (2014–2016): Case Study:

- Water source switch caused lead to leach from old service lines.
- Thousands of children were exposed, blood lead levels doubled, and in some neighborhoods tripled.
- Crisis resulted in state of emergency, national media attention, lawsuits, and long-term public distrust in water utilities.
- Key lesson: Accurate service line records and preventive action are critical to avoid public health crises and loss of public confidence



Jacobs



Who Was Involved?

- City of Wilmington Department of Public Works (DPW)
- U.S. Geological Survey / EPA Support
- Jacobs Engineering & University of Delaware DWRC
- GIS Mapping and AI Processing Team (Jacobs/City of Wilmington)

Scope of Work

FORM 6 6-57

60855

WATER DEPARTMENT
COST SHEET

WORK ORDER No 52882

November 12, 1958

819 6-3

INSTRUCTIONS (820 S. Heald St.
Replace existing service with a 1"

WORK STARTED 11-12-58
WORK COMPLETED 1-12-59
Thelma C. Lance

2- 3/4" Brass nipples
2- 1" Brass " "
1- 1" " " Tee
1- 1" Brass ell
2- 1" x 3/4" Brass Bushings
1- 1" — curb stop

11-12-58
Jony

38672
29,911 1-18-50

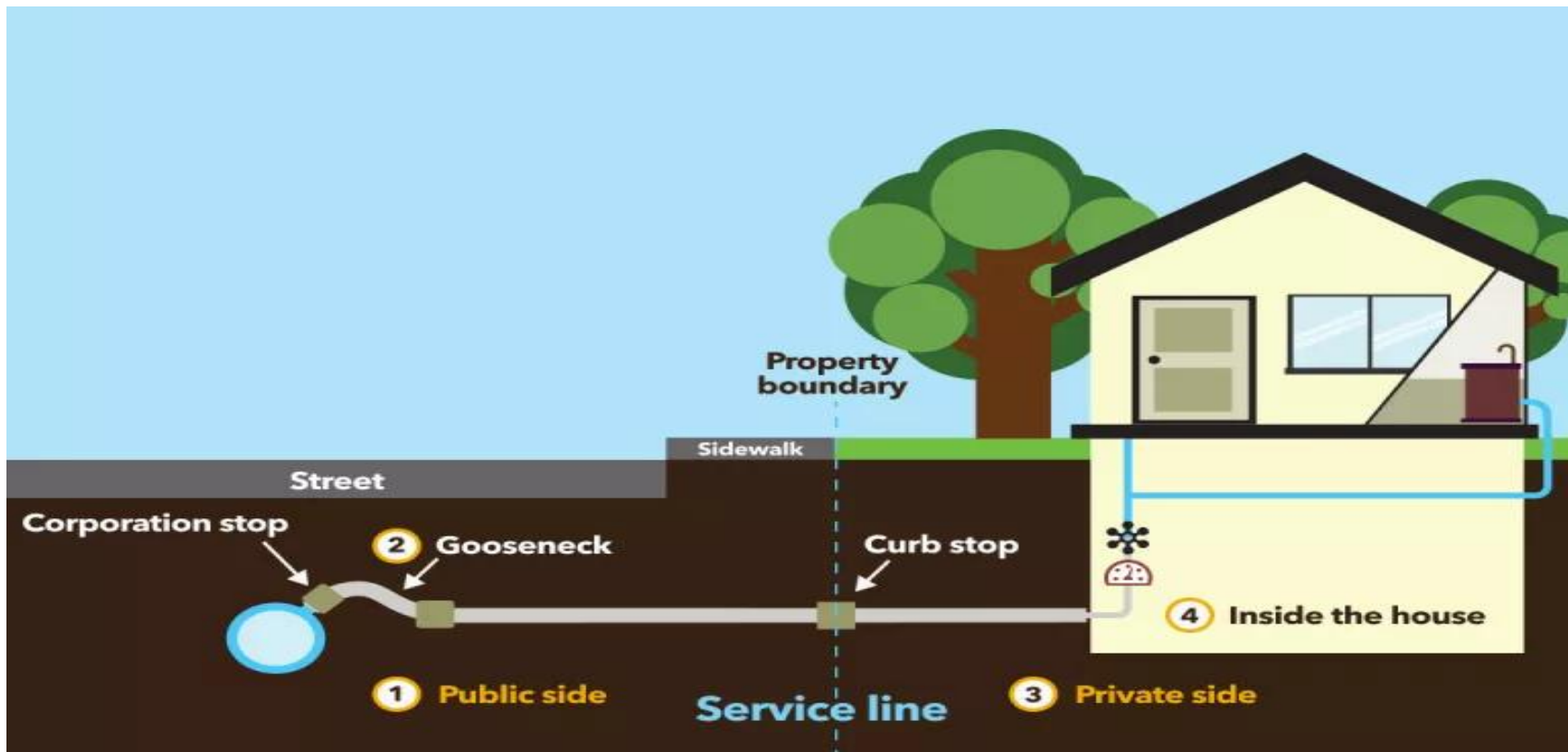
MAP 64
12-4-58
A.L.J.

M. W. MCKAY
APR - 7 1959
WATER DEPT.

4459

- Review 36,442 historic work orders.
- Identify service line materials across public properties.
- Link records to GIS mapping for transparency and planning.
- Prioritize areas with potential lead service lines.

Public Vs Private Lines

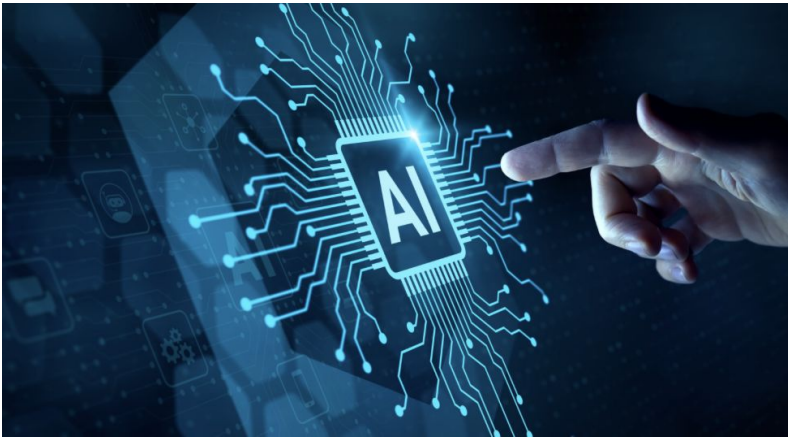


Homeowners Testing Barriers



- Service lines split: city/public vs. private homeowner side.
- Homeowner cost for verification or replacement creates reluctance.
- Many residents don't know their line material.
- Fear of cost, disruption, or paperwork lowers participation.

AI in Data Filtering



- AI pre-scanned work orders to detect keywords like “replacement,” “lead,” “copper.”
- Helped filter out non-service-related records.
- Reduced manual review workload by **approximately 42%**.
- Municipal records remained central: AI enhanced, not replaced, human review.

Material Breakdown

City Lateral 36,442	Private Lateral 36,313	Total Laterals 72,765
City Lateral - Lead 1,912	Private Lateral - Lead 11	Total - Lead 1,923
City Lateral - Galvanized 399	Private Lateral - Galvanized 469	Total Galvanized 868
City Lateral - Not Lead or Galvanized 22,069	Private Lateral - Not Lead or Galvanized 30,773	Not Lead or Galvanized 55,161
City Lateral - Unknown 1,618	Private Lateral - Unknown 1,384	Total Unknown 3,004
City Lateral - Unknown Unlikely Lead 5,991	Private Lateral - Unknown Unlikely Lead 1,771	Unknown Unlikely Lead 7,762
City Lateral - Unknown Likely Lead/Galv 4,453	Private Lateral - Unknown Likely Galv 2,270	Unknown - Likely Lead /Galv 6,837

Material Breakdown by Percentages

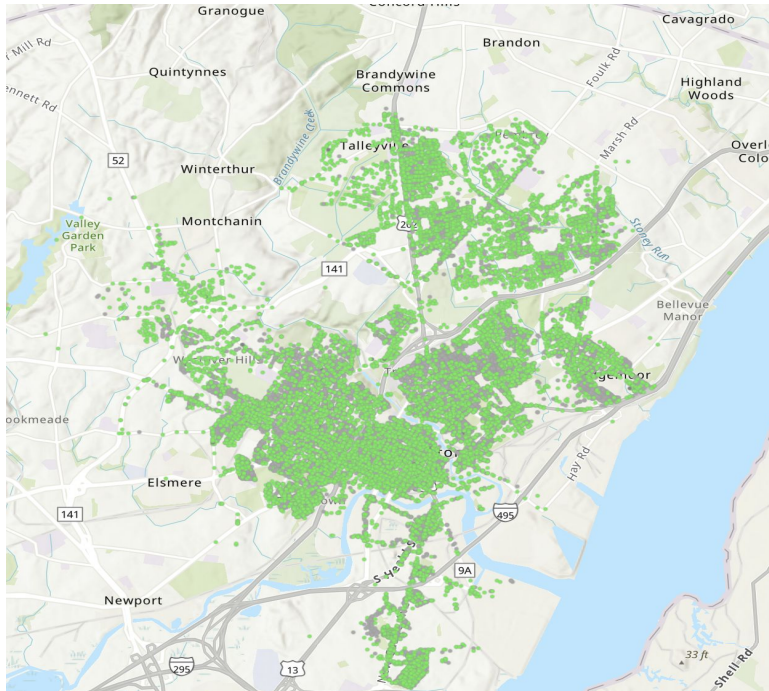
Metric	Count	Percent of Total
Water laterals (total)	36442	100.00%
Reviewed by UD	36442	100.00%
Confirmed lead	1912	5.25%
Likely lead	4453	12.22%
Unlikely lead	5991	16.44%
Laterals saved (no digging) — all not-unknown	24380	66.90%

Minimum cost to dig up/identify service line material is \$500. Therefore, this work theoretically saved over \$12M ($\$500 \times 24,380$) through electronic verification done by members of this project.

What is an “Unknown Line”

- Lines listed as unknown require field investigation.
- These account for nearly 30% of all records.
- Cost to physically verify: Approx. \$700 per line.
- These areas will be prioritized before replacements begin.

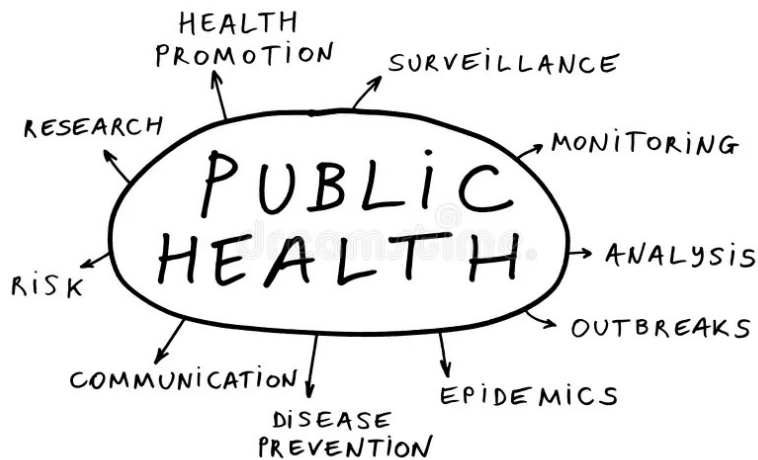




GIS Mapping Insights

- Lead and galvanized lines clustered in older neighborhoods.
- Many of these areas align with lower-income or historically underserved census tracts.
- GIS tools allow clear visuals for public transparency and grant justification.

Public Health Considerations



- Lead service lines are a significant source of household water contamination.
- Children and vulnerable populations at higher risk.
- Early identification enables targeted homeowner outreach and public communication planning.



Cost Implications

- Estimated replacement cost: \$8,000–\$12,000 per service line.
- Federal funding through Bipartisan Infrastructure Law available.
- Having an accurate inventory strengthens grant applications and funding eligibility.
- Estimate of roughly \$63M-\$76M in costs to remediate confirmed and likely lead lines in Wilmington, DE
- Total budget for water and sewer for FY26 is \$100,026,153 (City of Wilmington)

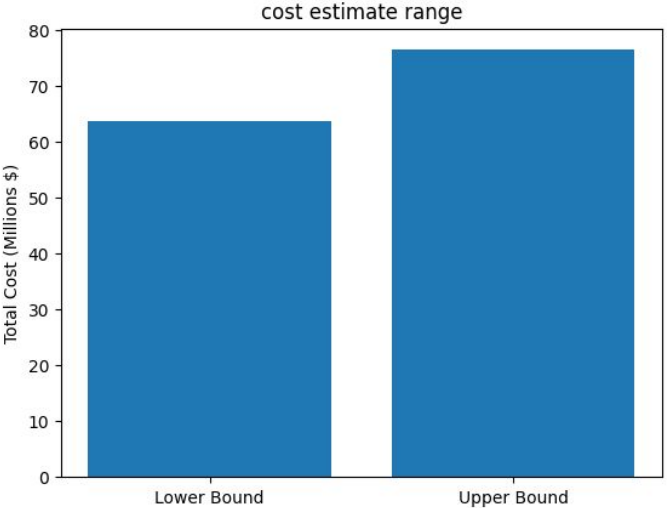


Benefit Implications

“Removing a single lead service line yields roughly \$4,000 in avoided health-related economic damages per year.” - Natural Resources Defense Council

Therefore, with 1912 confirmed lead service lines within the city, remediation of publicly owned lead service lines would yield \$7,648,000 in annual benefits related to health and avoided infrastructural costs. This number grows by \$44,000 annually when considering the 11 confirmed lead service lines owned by private citizens. This number grows even further by \$17,812,000 when considering the service lines that are currently unknown marked as likely lead.

Simple Cost/Benefit Model for Confirmed/Probable Public Lead Service Lines



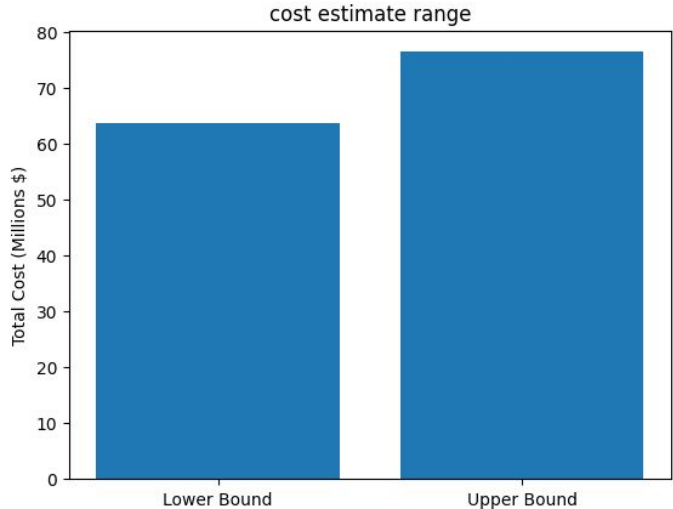
Jacobs replacement cost range: \$10k–\$12k per service line.

Multiplying by confirmed (1912) + likely lead (4453) categories yields a citywide burden of \$63M–\$76M without accounting for inflation, excavation contingencies, or market volatility in copper / labor inputs.

Assumption: remediation will take 10 years total, making 1/10 of pipes per year, and therefore 1/10 of total benefits per year count towards the total received benefits.

Year	Lines Replaced (Year)	Total Lines Replaced	Annual Cost (Low)	Annual Cost (High)	Annual Benefit	Unvented Net Benefit (Low)	Unvented Net Benefit (High)	Cumulative NPV (Low)	Cumulative NPV (High)
1	636.5	636.5	\$6,365,000	\$7,638,000	\$2,546,000	-\$3,707,767	-\$4,943,689	-\$3,707,767	-\$4,943,689
2	636.5	1273	\$6,365,000	\$7,638,000	\$5,092,000	-\$1,199,925	-\$2,399,849	-\$4,907,692	-\$7,343,539
3	636.5	1909.5	\$6,365,000	\$7,638,000	\$7,638,000	\$1,164,975	\$0	-\$3,742,716	-\$7,343,539
4	636.5	2546	\$6,365,000	\$7,638,000	\$10,184,000	\$3,393,132	\$2,262,088	-\$349,584	-\$5,081,450
5	636.5	3182.5	\$6,365,000	\$7,638,000	\$12,730,000	\$5,490,505	\$4,392,404	\$5,140,921	-\$689,047
6	636.5	3819	\$6,365,000	\$7,638,000	\$15,276,000	\$7,462,822	\$6,396,705	\$12,603,743	\$5,707,658
7	636.5	4455.5	\$6,365,000	\$7,638,000	\$17,822,000	\$9,315,589	\$8,280,524	\$21,919,332	\$13,988,182
8	636.5	5092	\$6,365,000	\$7,638,000	\$20,368,000	\$11,054,098	\$10,049,180	\$32,973,430	\$24,037,362
9	636.5	5728.5	\$6,365,000	\$7,638,000	\$22,914,000	\$12,683,431	\$11,707,782	\$45,656,860	\$35,745,144
10	636.5	6365	\$6,365,000	\$7,638,000	\$25,460,000	\$14,208,473	\$13,261,242	\$59,865,334	\$49,006,385

Cost/Benefit Summary



Lower Cost (\$10,000 per service line) indicates \$59.8M in Net Present Benefits by the time of the remediation completion with the high cost (\$12,000 per service line) yielding \$49M in Net Present Benefits.

This shows that, while the cost of remediation is very high, the benefits will have caught up to and surpasses the costs well before the completion of the remediation efforts (year 6).

Year	Lines Replaced (Year)	Total Lines Replaced	Annual Cost (Low)	Annual Cost (High)	Annual Benefit	Unaudited Net Benefit (Low)	Unaudited Net Benefit (High)	Cumulative NPV (Low)	Cumulative NPV (High)
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Potential for Public Outreach



- Maintain alignment between public records and GIS database.
- Help manage resident communication and responses.
- Track notices, public hearings, and transparency requirements.
- Ensure any replacement authorizations are properly documented.

<https://wilmingtonewater.gov/209/Lead-Service-Line-Replacement>

Public Outreach (continued)



- Focus messages on health protection and transparency.
- Residents will ask: “Is my house on the list?”
- GIS map will be useful for public-facing lookup tools.

What Now?

- Finish verifying remaining unknown service lines.
- Field inspection planning underway.
- Prioritization list to be created based on risk + equity factors.
- Replacement work will follow once funding and approvals are aligned

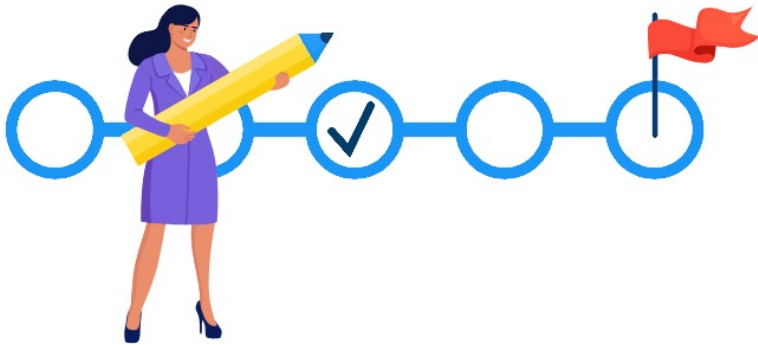


Funding Possibilities



- Bipartisan Infrastructure Law: Major federal support for lead removal.
- State Drinking Water Fund: Loans with possible forgiveness.
- EPA Replacement Grants: Favor cities with mapped inventories.
- Partnerships with universities/health agencies strengthen proposals.
- Wilmington's completed mapping improves funding eligibility.

Long Term Goals



- Lead-free Wilmington water infrastructure within ~10 years.
- Data will be updated continuously as replacements occur.
- Municipal clerks will be essential in ensuring clean records, public trust, and compliance audits.

Main Takeaways

- Inventory complete for majority of city (first major compliance milestone)
- AI/GIS tools greatly increased efficiency.
- Around 30% of service lines need field verification.
- Project sets foundation for future federal funding, transparency, and public outreach.
- Remediation justified through Cost-Benefit Analysis despite large costs.



The background features a large, light blue watermark of the University of Delaware seal. The seal is circular and contains a shield with two open books. The left book is labeled 'GRAMM PHILOL RHETOR ETHICA' and the right book is labeled 'METAPH LOGICA MATHEM PHYSICA'. Below the shield is a banner with the motto 'SOL MENTIS'. The outer ring of the seal contains the text 'UNIVERSITY OF DELAWARE' and the year '1743'.

Questions?

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