

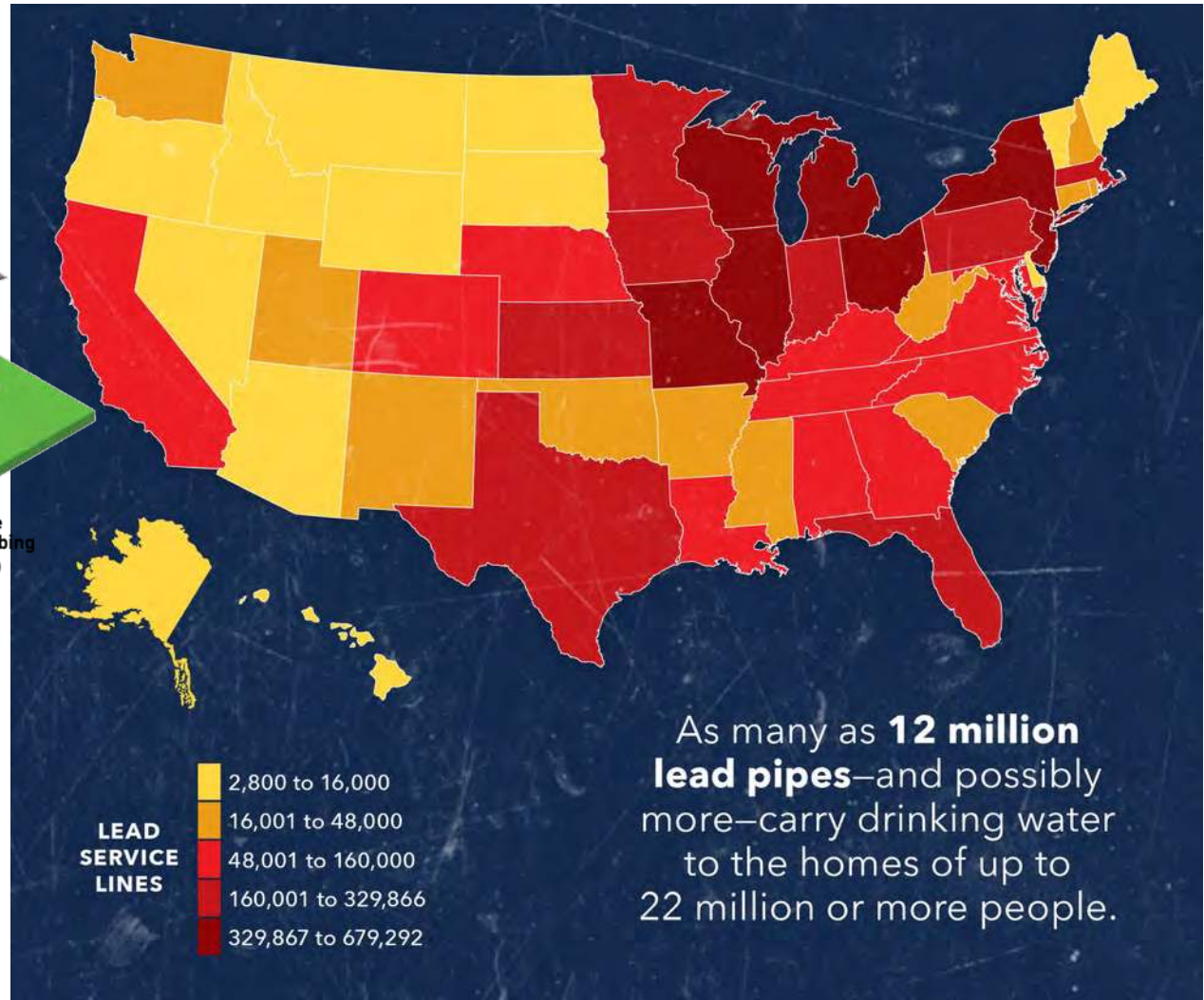


Introduction



Lead Service Lines By State

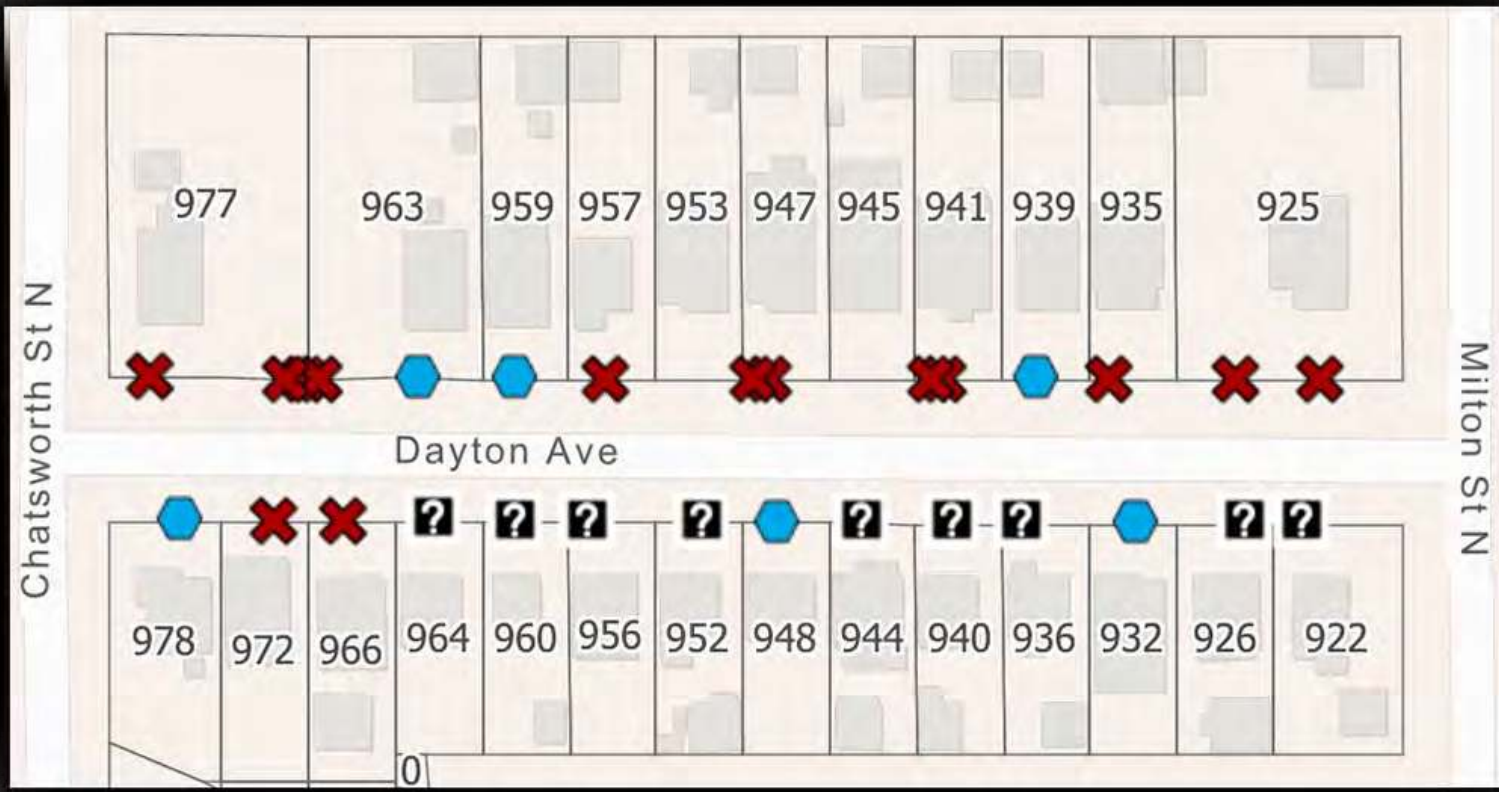
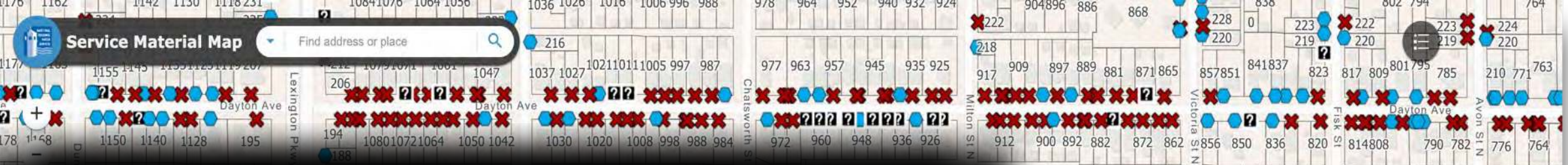
12 MILLION LEAD PIPES



As many as **12 million** lead pipes—and possibly more—carry drinking water to the homes of up to 22 million or more people.

How to Locate?





LEGEND

-  Lead Service 16
-  Possible Lead Service 9
-  Not a Lead Service 6

TOTAL SERVICES 31

DESKTOP ANALYTICS DON'T DELIVER CERTAINTY TO 'DIG'

June 8, 2020



PROJECT NO.
4693

Lead Service Line Identification Techniques

TECHNOLOGIES ASSESSED

1. Vacuum Excavation
2. CCTV Inspection
3. Metal Detectors
 - 3.1. Very Low Frequency (VLF) Technology
 - 3.2. Terahertz Technology
 - 3.3. Three-Dimensional Electromagnetic Induction
 - 3.4. Pulse Induction
 - 3.5. Multi-mode Electromagnetic Target Discriminators
 - 3.6. Polyharmonic Metal Detectors
4. Desktop Predictive Models
5. Magnetometers and Gradiometers
6. Ground-Penetrating Radar
7. Stress Wave Propagation
8. Acoustic
9. Electrical Conductivity Object Locators
10. Field Portable X-ray Fluorescence Spectrometry



THE
Water
Research
FOUNDATION®



\$2,000/hr Cost to Hydro-Excavate.

ABOVE GROUND EXPOSED PIPE



MAGNET TEST

Sticks →



steel pipe

Doesn't Stick

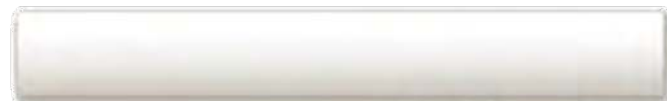
SCRATCH TEST

Color of a Penny →



copper pipe

No Shine →



plastic pipe

Silver Streaks →



lead pipe



Lead Pipe



Galvanized Steel Pipe



Copper Pipe

5.6 Emerging Methods

Service line material identification technology is the subject of ongoing research. A review of emerging methods is provided in Hensley et al. (2021) and Bukhari et al. (2020). A central theme of these techniques is identifying creative ways to isolate the service line material and location based on physical signatures of the pipe, largely by assessing how service line materials respond to stimuli such as **electrical** or wave energy and pairing that information with documented characteristics of potential service lines in the evaluation area. Many of these emerging methods are

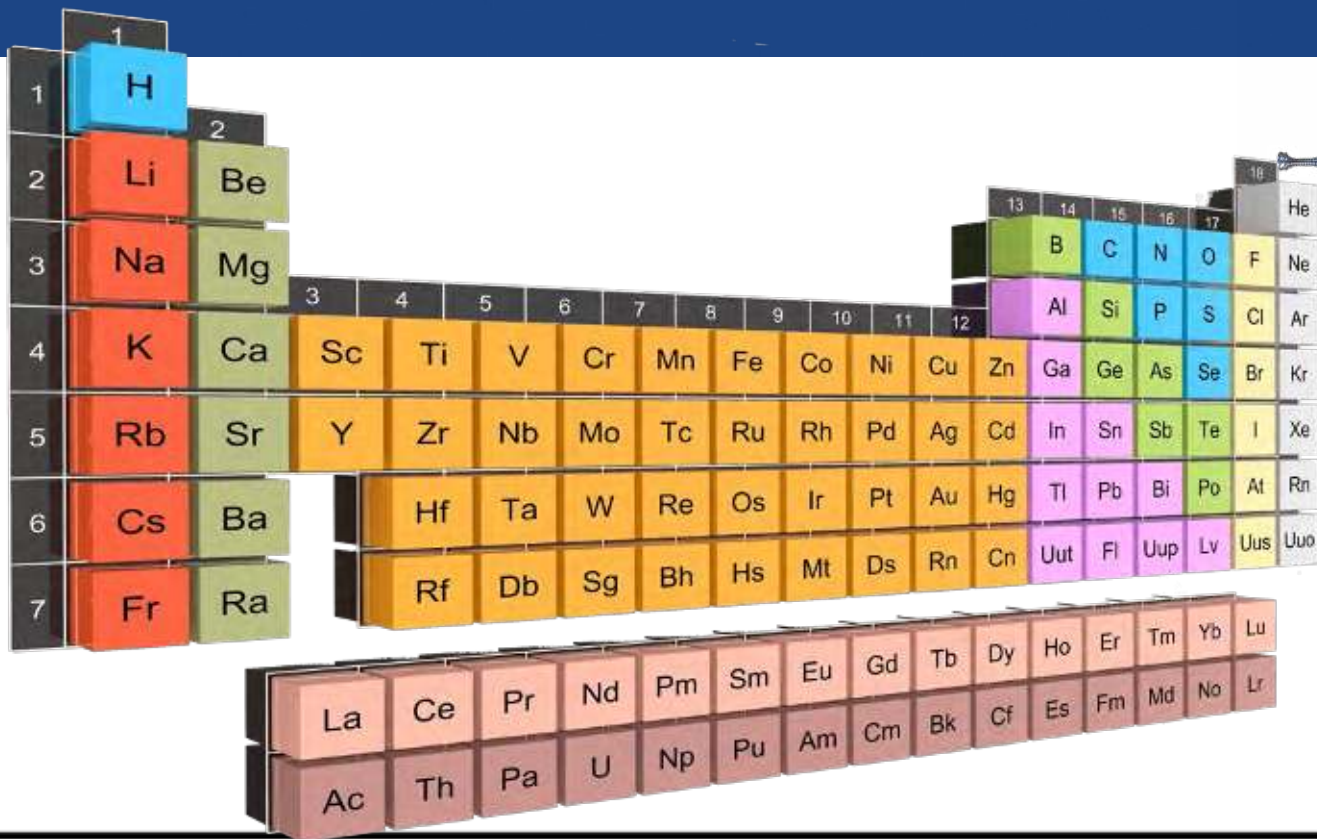
electrical resistance testing

potentially function as a service line inventory technique by linking the service line to the pipe with the corresponding service line material for that diameter (Deb et al., 1995; Bukhari et al., 2020). Other examples of emerging technologies include **electrical resistance testing** and stress wave propagation.

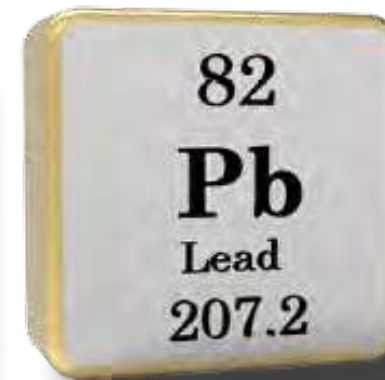
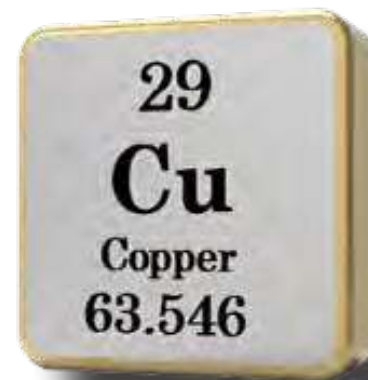
Application of these emerging technologies can be limited by signal interferences, caused by the presence of other pipe materials and subsurface environments, and the development of signal processing algorithms. Hensley et al. (2021) notes that emerging methods have “technical basis but limited research or field implementation to demonstrate their effectiveness.”



Lead Pipe Detection



SWORDFISH



International Annealed Copper Standard (IACS)	100%	7%
Electric Conductivity (10.E6 Siemens/m)	58,7	4,7
Electric Resistivity (10.E-8 Ohms.m)	1,7	21,3
Thermal Conductivity (W/m.K)	386	35

Challenges





Lead Pipe Removal



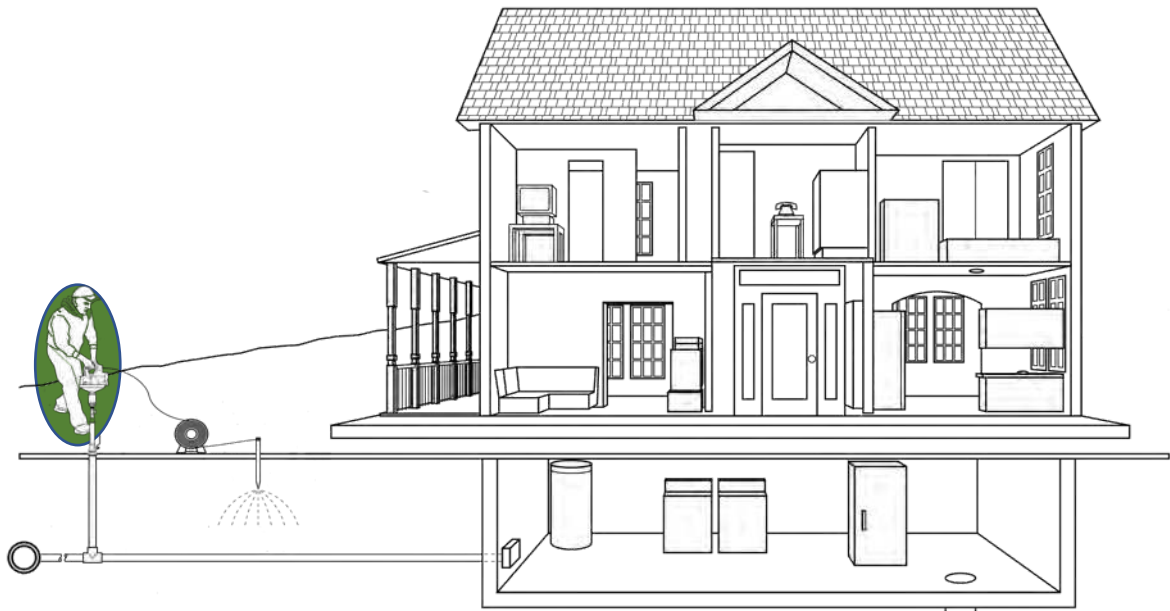
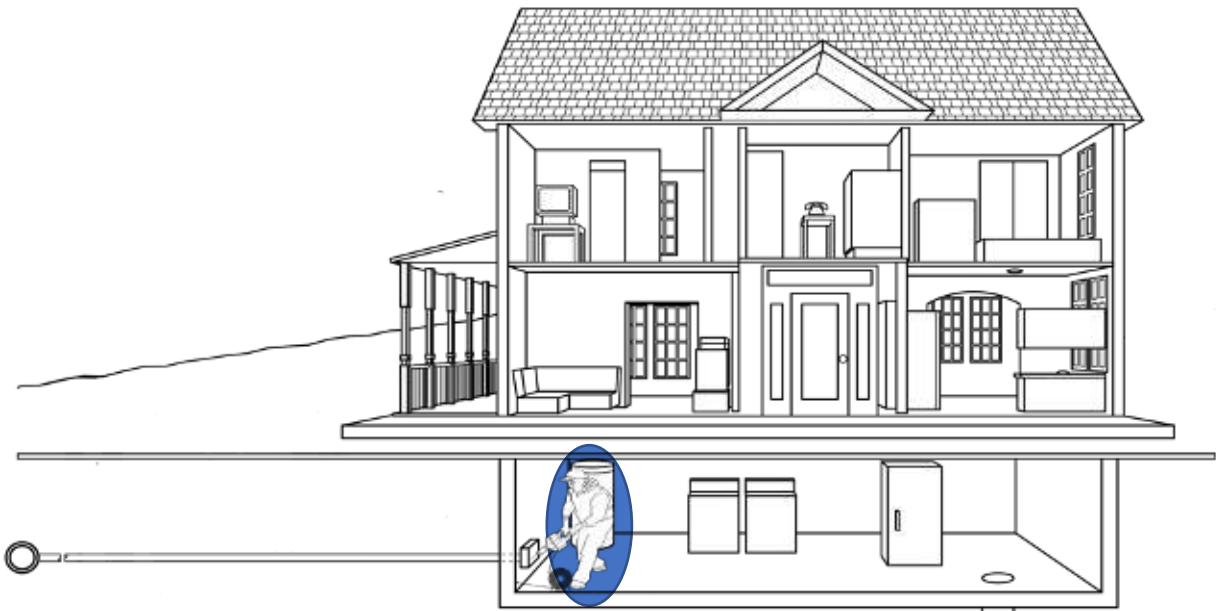
Copper Pipe Removal



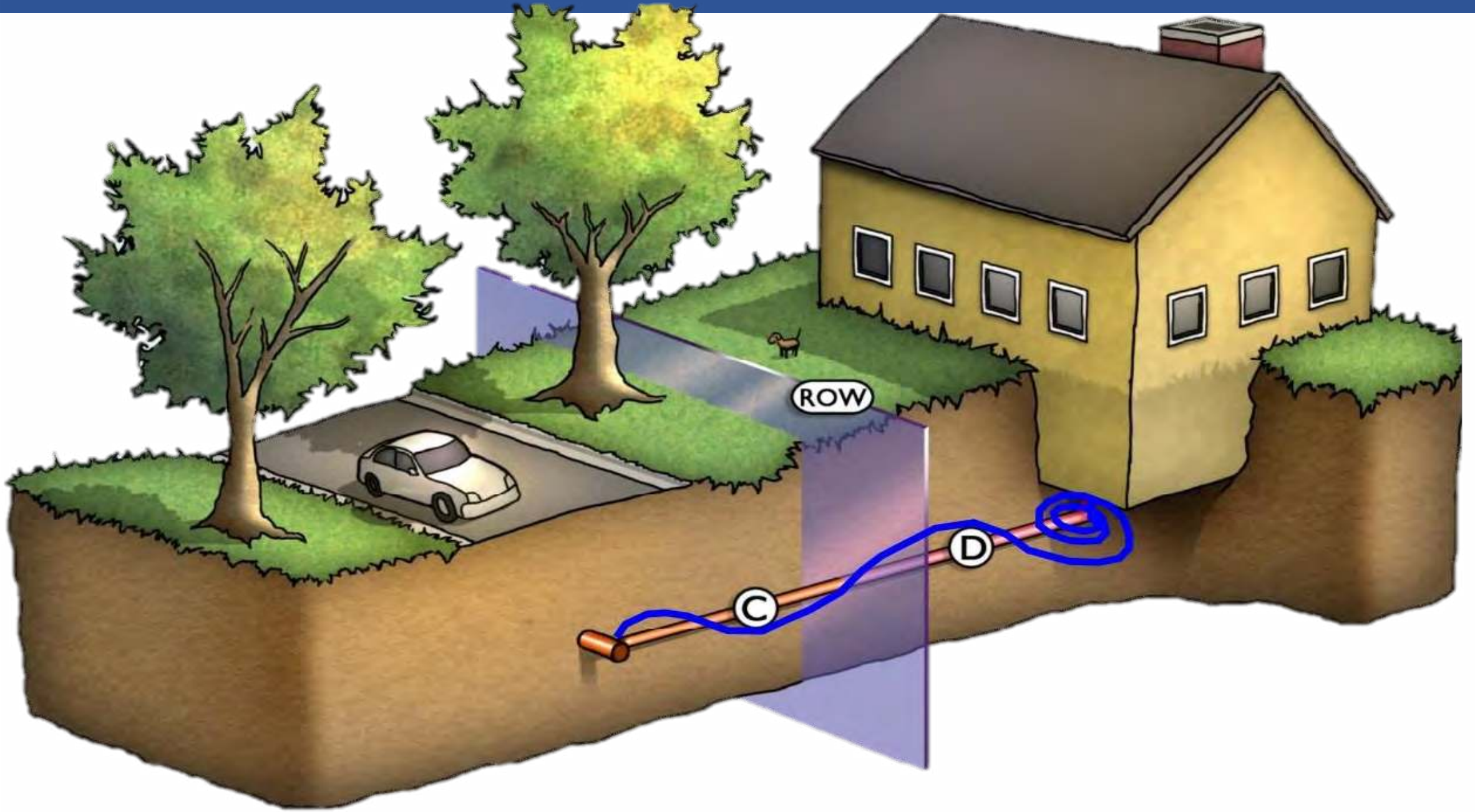
GOAL 100% Removal



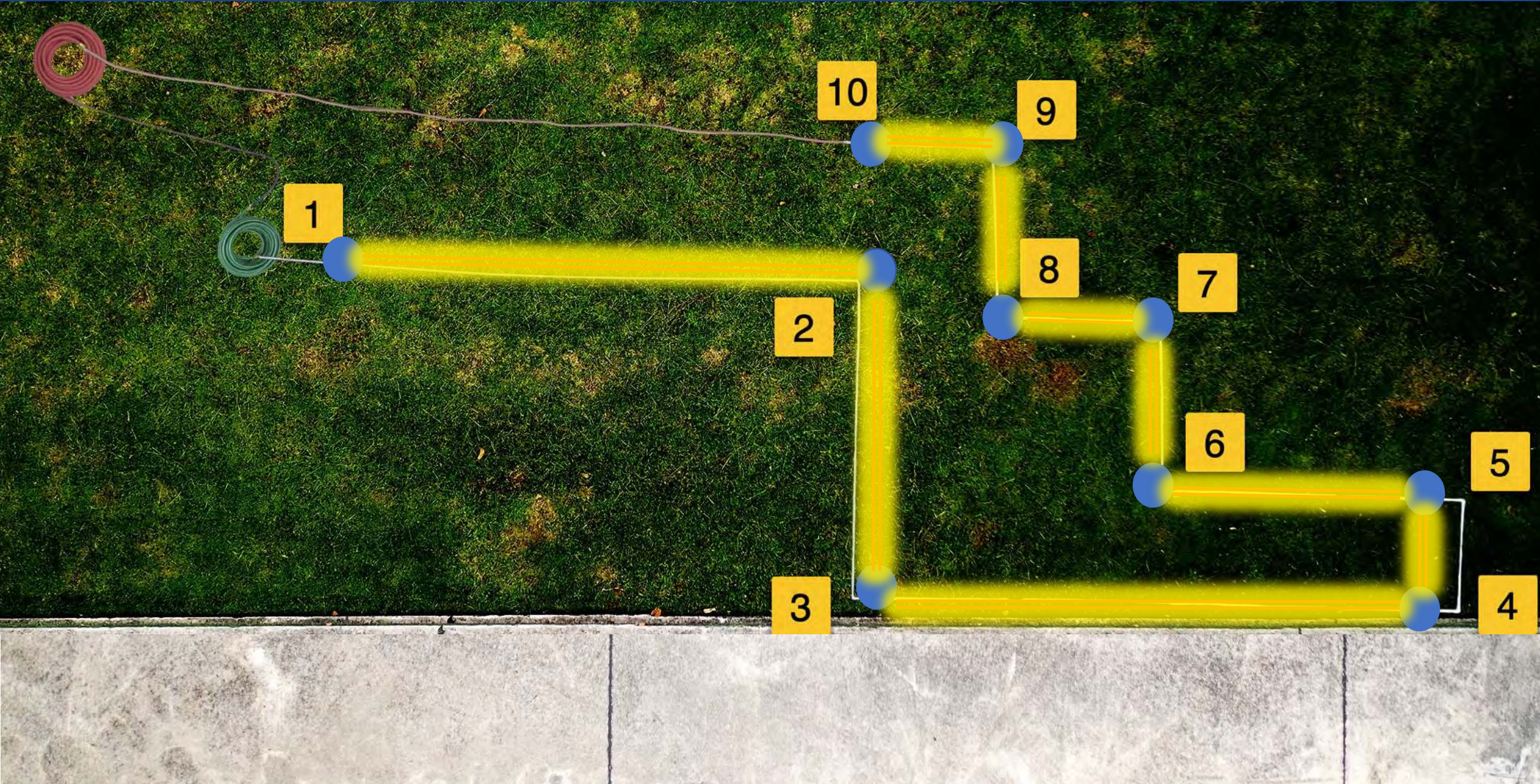
GOAL 0% Removal



Service Lines are Not Usually Straight

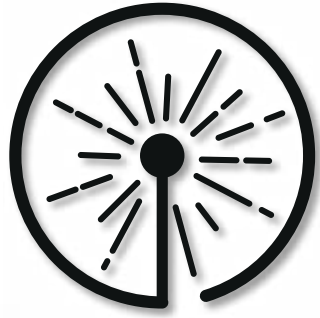


90-Degree Bends

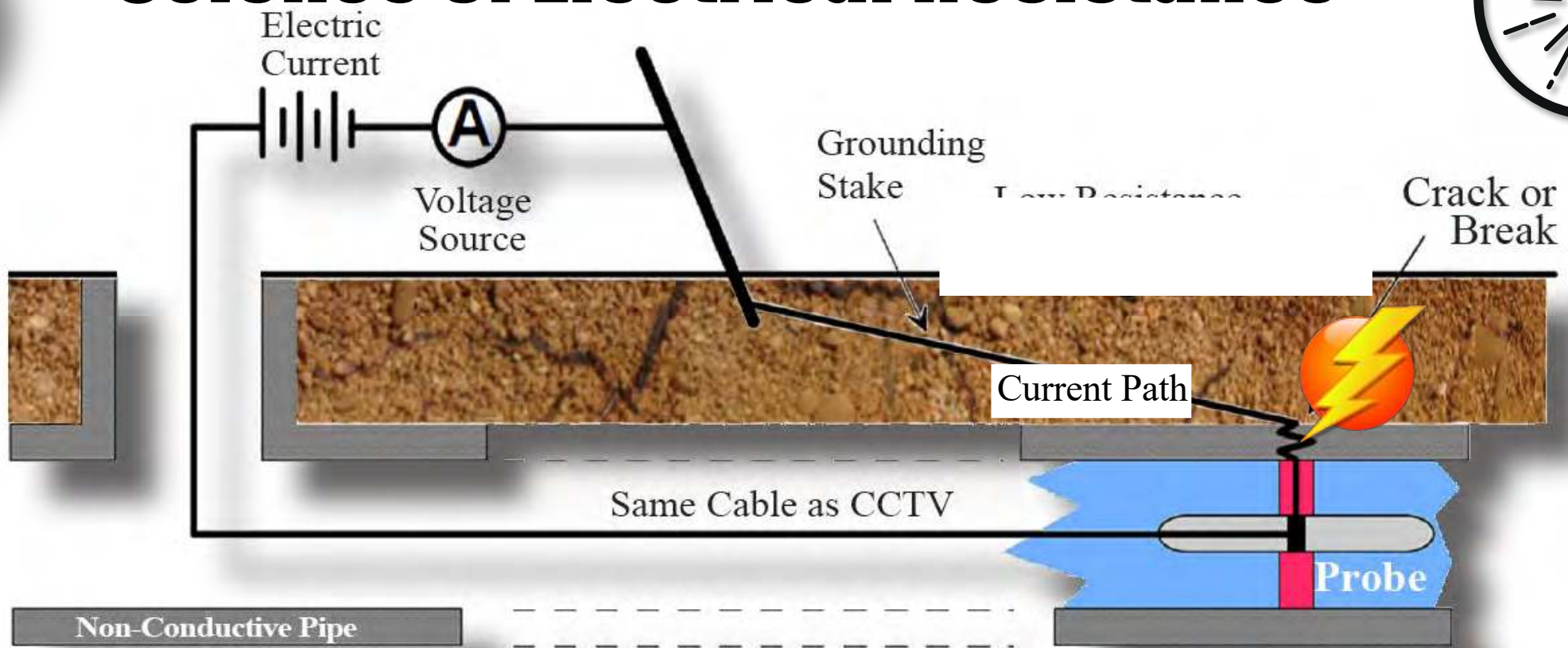


Solution





Science of Electrical Resistance



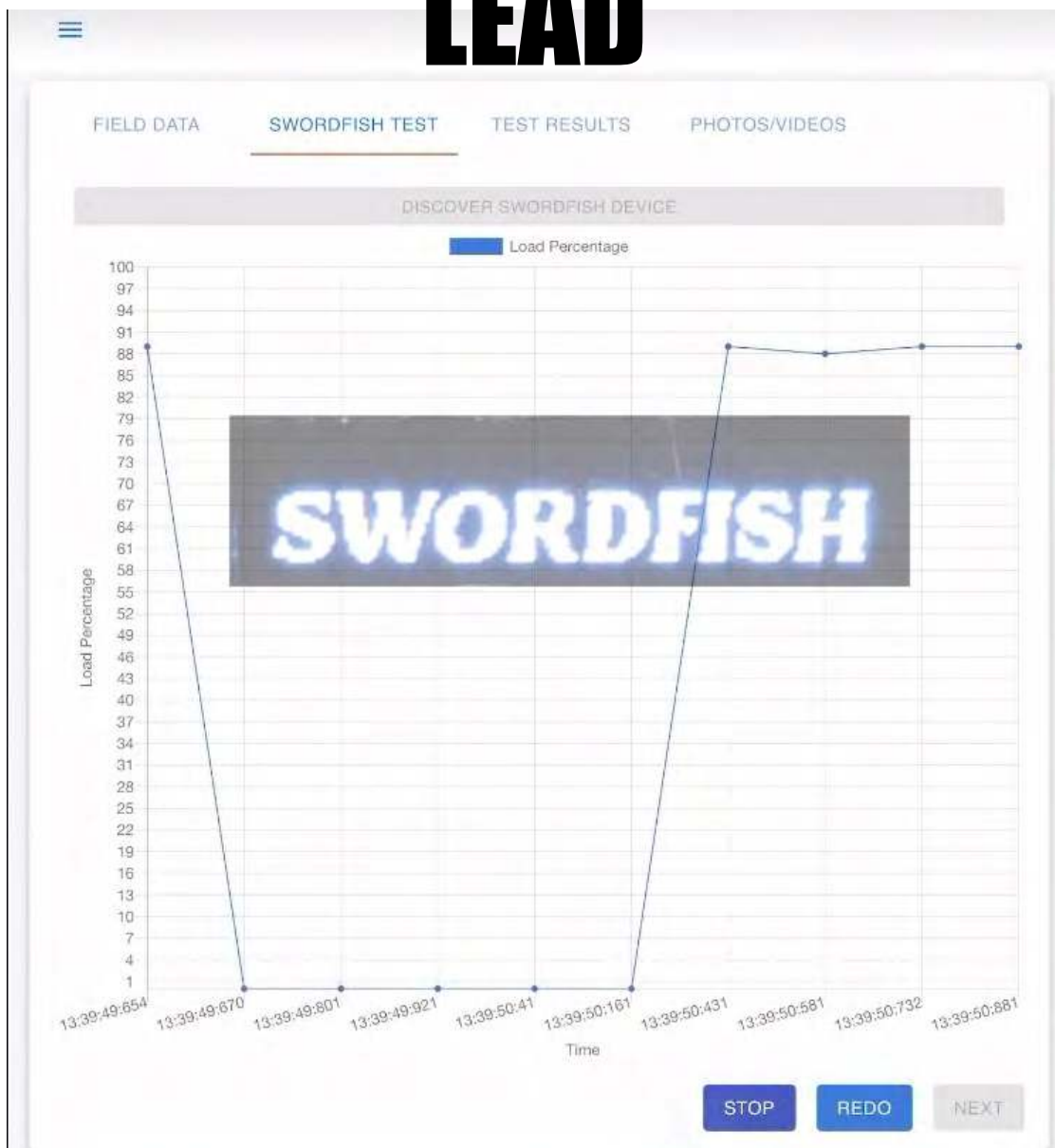


VIDEO

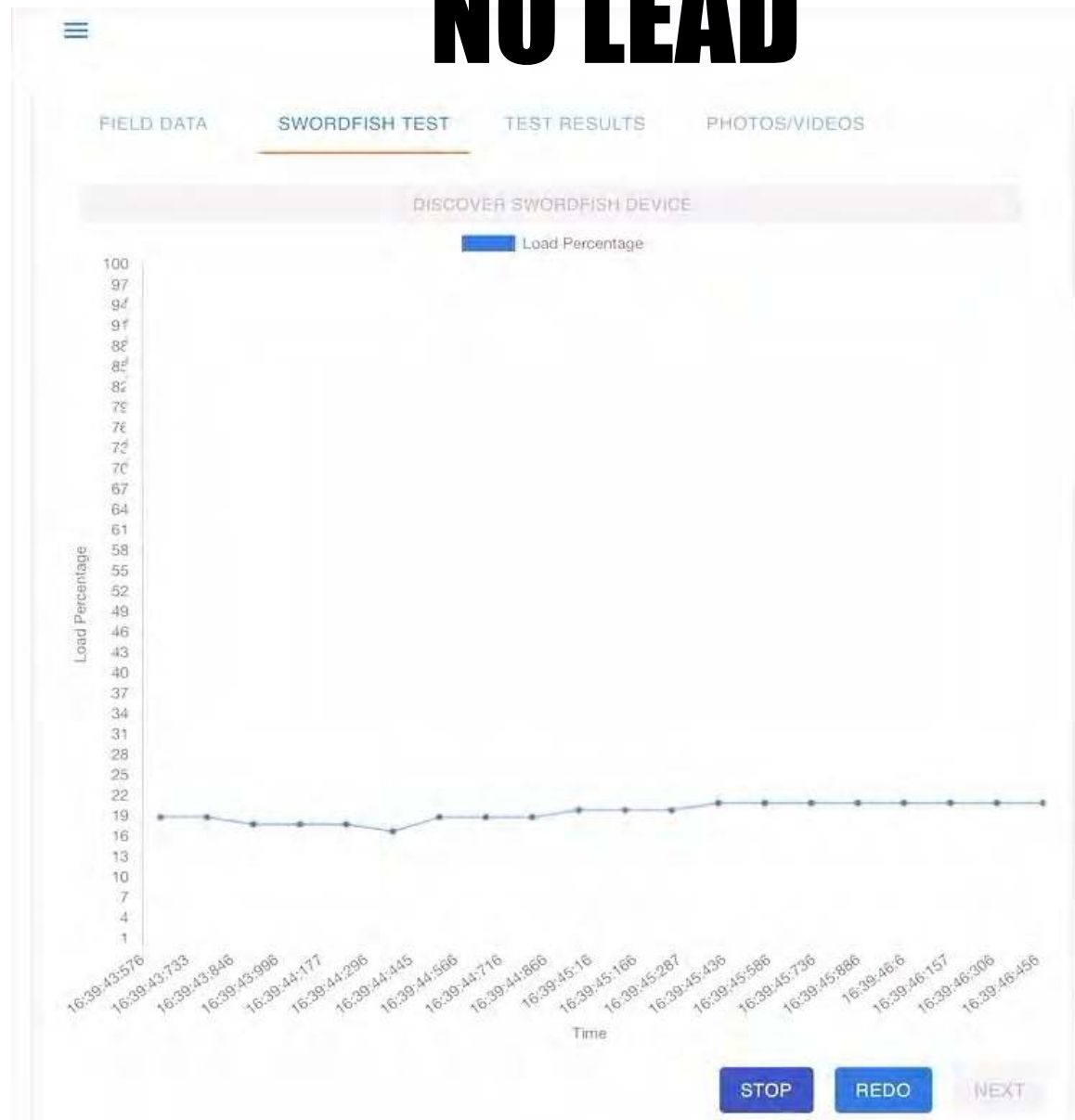
Chlorination Chamber & Footage Reading



LEAD



NO LEAD





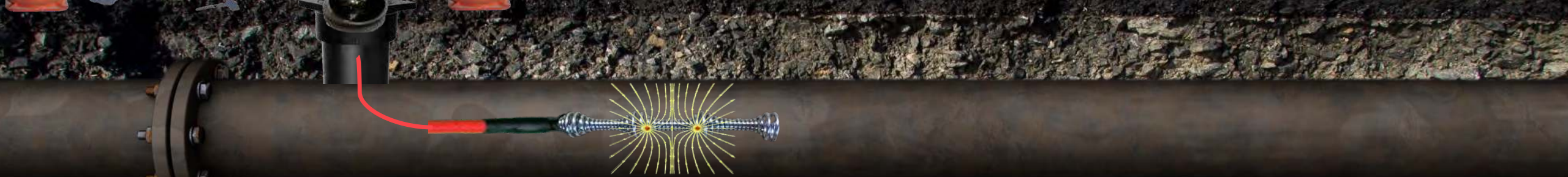
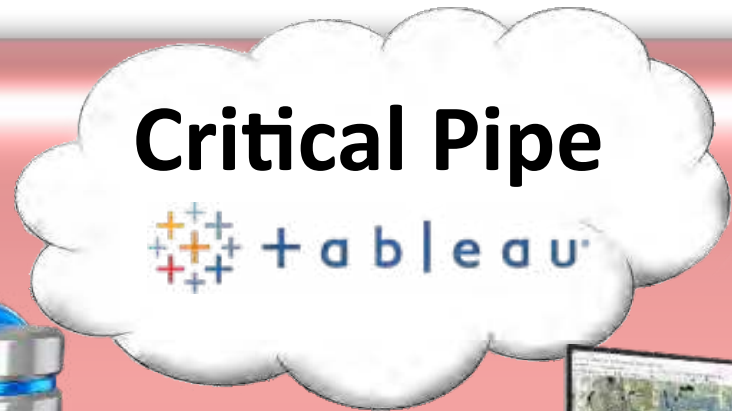
SWORD FISH

<p>BASE UNIT</p> 	<p>PROBES</p> 	<p>SURFACE LAPTOP</p>  <p>Microsoft</p>	<p>INSERTION TUBE Plus, Chlorination Chamber</p> 	<p>GROUNDING STAKE</p> 
<p>LITHIUM BATTERY</p> 	<p>WI-FI</p> 	<p>LEAD TEST</p> 	<p>CRITICAL H₂O CLOUD REPORTING</p> 	



Additional Lead Testing Confirmation





Swordfish deployed by thomas@electroscan.com at 94 South Cottage Road, Sterling on Thu Sep 08 2022 14:39:26 GMT-0500 (Central Daylight Time) with results indicating: No Lead

Agency

Loudon water
44865 Loudon water way
Ashburn Va 20147
Kathleen whitten
Kwhitten@loudonwater.org
5712917933

Worksite

94 South Cottage Road
Sterling Va 20184

Contractor

thomas@electroscan.com



Lead Test

Result: No Lead
Test Used: 3M Lead Check
Performed: Thu Sep 08 2022 14:39:26 GMT-0500 (Central Daylight Time)
Pipe Type: Copper (COP)
Pipe Diameter: 0.75
Max Load: 89
Pipe Entry Method: Curb Box
Operator Notes:

Swordfish

