MEMO

To: Village of Stickney
6533 W Pershing Road
Stickney, IL 60402

Attn: Mayor & Board of Trustees

From: Tim Geary, P.E., Village Engineer

CC: Audrey McAdams, Clerk, Joe Lopez, Public Works Supervisor, #22566

Date: 9/15/2023

Re: IEPA Lead Service Line Material Inventory – Engineering Agreement

Dear, Mayor & Board of Trustees:

As required by the IEPA Lead Service Line Replacement and Notification Act (effective January 1, 2022), the Village is required to prepare a Lead Service Line Material Inventory for all water users by April 15, 2024. This inventory is required to include certain water service line information with this information also required to be obtained by IEPA approved methods. As the Village has approximately 1,900 water customers this will be a significant undertaking. The Water Department will incorporate water service material inspections as part of their residential inspections or meter reading visits to start the water service line material database compilation. As it will be difficult to inspect all water services lines, the IEPA allows the use of predictive modeling software to complete the inventory based on parcel data points that we will obtain from Cook County GIS property databases. The use of predictive modeling analytics will greatly reduce the time required to compile this water service material information.

Therefore, I have attached an engineering agreement for the preparation of the Water Service Line Inventory that will include the use of predictive modeling analytics as provided by BlueConduit as a subcontractor for your review and approval. Their services will include preparation of the water service line material inventory in compliance with IEPA requirements, and preparation of a GIS (Geographical Information System) mapping that can be posted on the Village's website. BlueConduit will host the GIS map on the Village's website for the first year with our firm taking over the mapping going forward. The water service line GIS mapping will also be a useful tool for management of the lead service line replacement program. The Village must complete 6% of their total lead service line replacements annually (17-year Max Completion Duration) – with a lead service line replacement start date of April 15, 2027.

If this Professional Services Agreement meets your approval, please execute two (2) copies of the agreement as shown. Please contact me if you should need any other information about this proposed project.

Note: The Village has also been awarded an IEPA Lead Service Line Inventory Grant ($40,000) for this work.

Thank you,

Tim Geary, P.E.
Village Engineer

OWNER:					ENGINEER:	
Village of Stickney	L O C A L A G E N C Y	AGREEMENT FOR ENGINEERING SERVICES FOR PREPARATION OF A COMPLETE LEAD SERVICE LINE MATERIAL INVENTORY	C O N S U L T A N T		**Frank Novotny & Associates, Inc. D/B/A Novonty Engineering**	
Address: 6533 W Pershing Road					Address: 545 Plainfield Road, Suite A	
City: Stickney					City: Willowbrook	
Project No.: 22566					State: IL	Zip: 60527

THIS AGREEMENT, made and entered into this _____ day of September, 2023, by and between **Frank Novotny & Associates , Inc. D/B/A Novotny Engineering** whose address is 545 Plainfield Road, Suite A, Willowbrook, IL 60527 hereinafter called **"NOVOTNY"**, and the **Village of Stickney** and hereinafter called **"STICKNEY"** covers certain professional engineering services, in connection with the preparation of the of a **Complete Lead Service Line Material Inventory (LSLI)** meeting the specified requirements of Illinois Environmental Protection Plan (IEPA) and the approved IEPA Lead Service Line Inventory Grant Agreement.

WITNESSETH THAT, in consideration of these premises and of the mutual covenants herein set forth,

NOVOTNY AGREES,

I.   **Project Predictive Modeling Tasks to be Completed Summary:** As the Village has approximately 1,900 water services lines, an IEPA approved predictive modeling approach will be utilized to complete the LSLI in partnership with BlueConduit implementing their Smart Service Line Material (SLM) Inventory Powered by ESRI Machine Learning Platform with the following tasks to be performed in connection with the proposed project:

a. Novotny will collect, organize, review, and prepare available data for the service line material inventory.

b. Novotny will host the Esri Lead Service Line Inventory (LSLI) solution in their ArcGIS Online (AGOL) account.

c. Novotny will install the free version of the Esri LSLI Solution Version 3.0 or higher.

d. Novotny will provide BlueConduit with access and creator permissions to ESRI LSLI Solution and Inventory Data Layer.

e. BlueConduit will coordinate with Novotny/Stickney to install a routine that adds our custom schema (tables, columns, views, triggers) to the Esri LSLI Solution.

f. Novotny will create the ESRI ArcGIS Online Inventory Project Map and load collected data into the Inventory App.

g. BlueConduit will pull the data into the BlueConduit machine learning platform to perform phase 1 of data analysis.

h. BlueConduit will produce the initial batch of targeted locations for Novotny/Stickney to complete physical verification (30-50 locations), which will be statistically representative of the entire system. Subsequent inspections may be recommended as needed, up to ~100 total and can be provided in batches of 20.

i. Novotny/Stickney performs physical verifications using their existing field-based ESRI apps. Saved inspection records are linked to the project's inventory table.

j. BlueConduit will pull the updated data into the BlueConduit machine learning platform to perform phase 2 of data analysis.

k. BlueConduit generates the 1st iteration of the model. The results are delivered directly into the ESRI LSLI. Linked fields will automatically have an up-to-date inventory with two views on the Lead Inventory project map: verified and predictions.

l. BlueConduit will configure an LSLI dashboard, reflecting verified and predicted service line materials.

m. Novotny/Stickney will perform ongoing field-based inspections and replacements.

n. As ongoing inspections and/or replacements have been performed, the newly updated material data will be ingested and analyzed by BlueConduit.

o. Service line material predictions will automatically be updated at a frequency determined between BlueConduit and Novotny (weekly, monthly etc.) for the duration of the contract agreement.

II.   **Additional Project LSLI Tasks to be Completed Summary:** Novotny will assist Stickney to complete the following additional tasks:

a. Prioritize inspections of high-risk areas identified by Stickney and inspection of high-risk facilities, such as preschools, day care centers, day care homes, group day care homes, parks, playgrounds, hospitals, and clinics and confirm service line materials in those areas at those facilities.

b. Review historical documentation, such as construction logs or cards, as-built drawings, purchase orders, and subdivision plans, to determine service line material construction.

c. Conduct visual service line inspections and document materials of construction during routine maintenance visits.

d. Identify any time period when the service lines connected to its distribution system were primarily lead service lines if known.

e. Discuss service line repairs and installations with Stickney employees, contractors, plumbers and other workers who worked on service lines connected to the distribution system.

III.   **Project LSLI Deliverables Summary**: Novotny will provide the following deliverables:

a. A complete Lead Service Line Inventory (LSLI) meeting the requirements of Section 17.12(g) of the IEPA Illinois Lead Service Line Replacement and Notification Act by no later than April 15, 2024.

b. A Configured ESRI Lead-Safe Community Site – Public Facing Service Line Map (SLM) Inventory Map.

IV.   To attend meetings to be held at the request of Stickney in addition to normal project visits.

V.   That basic notes and sketches, charts, computations, and other data prepared or obtained by Novotny pursuant to this Agreement, will be made available, upon request, to Stickney without cost and without restriction or limitation as to their use.

VI.   In the event information provided are found to be in error during the PROJECT due to the negligence or willful misconduct of Novotny, and revisions or corrections are necessary, Novotny agrees that he will perform such work without expense to Stickney even though final payment has been received by him.

VII.   Novotny will carry General Liability insurance in the amount of not less than $1,000,000; Workman's Compensation of not less than $500,000; and Professional Liability insurance of not less than $1,000,000. Novotny shall name Stickney as "Additional Insured" on Novotny's General Liability policy.

STICKNEY AGREES,

I.   To pay Novotny as compensation for all services performed as stipulated in Paragraphs I, II, III, IV, V, VI & VII of "NOVOTNY AGREES" section in accordance with the following:

a. A lump sum fee of $17,000.00 for completion of the LSLI predictable modeling report and preparation of the Lead Service Line Inventory as prepared by BlueConduit.

b. A sum of money based on the hourly rates stipulated below for Novonty personnel assigned to this project as payment in full to Novotny for the actual time spent in providing these services, the hourly rates include profit, overhead, readiness-to-serve, insurance, social security and retirement deductions. The classifications of the employees used in the work should be consistent with the employee classifications for the services performed:

Grade Classification of Employee	Hourly Rate Range
Principal	$160.00 - $180.00
Associate Principal	$155.00 - $170.00
Senior Project Engineer	$145.00 - $165.00
Project Manager	$125.00 - $145.00
Staff Engineer	$ 90.00 - $125.00

Senior Technician	$ 90.00 - $140.00
CAD Technician	$100.00 - $125.00
GIS Technician	$ 80.00 - $100.00
Engineering Intern II	$ 45.00 - $ 65.00
Engineering Intern I	$ 40.00 - $ 60.00

If Novotny is required to work overtime hours, the billable rate charged for all employee grade classifications performing overtime work, except Principals, shall be increased by twenty-five percent (25%).

The hourly rates itemized above shall be effective the date the parties, hereunto entering this Agreement, have affixed their hands and seals and shall remain in effect until December 31, 2023. In event the services of Novotny extend beyond that date, the hourly rates will be adjusted yearly by addendum to this Agreement to compensate for increases in the salary structure of Novotny that are in effect at that time.

IV.   That payments due Novotny for services rendered pursuant to this Agreement will be made as soon as practicable after the services have been performed.

V.   That, should the improvement be abandoned at any time after Novotny has performed any part of the services provided for in Paragraphs I-a and I-c, of "NOVOTNY AGREES" section, and prior to the completion of such services, Stickney shall reimburse Novotny an amount which bears the same ratio to the total fee otherwise payable under this Agreement as the services actually rendered hereunder by Novotny bear to the total services necessary for the full performance of this Agreement, such payment plus all reimbursable payments then due, shall be in full discharge of all rights of Novotny under this Agreement.

IT IS MUTUALLY AGREED,

I.   The laws governing this Agreement shall be the laws of the State of Illinois.

II.   This Agreement may be terminated by Stickney upon giving notice in writing to Novotny at his last known post office address. Upon such termination, Novotny shall cause to be delivered to Stickney all documents, partial and completed data with the understanding that all such material becomes the property of Stickney. Stickney acknowledges that if conflicts exist between electronically transmitted documents and hard copy documents, the hard copy documents prevail. If the Agreement is terminated Novotny shall be paid for services completed and services partially completed, an amount which bears the same ratio to the total fee otherwise paid under this Agreement as the services actually rendered hereunder by Novotny bear to the total services necessary for the full performance of this Agreement and such payment, plus all reimbursable payments then due, shall be in full discharge of all rights of Novotny under this Agreement

EXECUTED BY STICKNEY, this _____ day of _____, 2023.

Owner:	**Village of Stickney**
Address:	**6533 W Pershing Road**
	Stickney, IL 60402

By:_____

ATTEST:

Printed
Name/Title: Jeff Walik, Mayor

By: _____

Printed
Name/Title: Audrey McAdams, Clerk

* * * * * * * * * *

EXECUTED BY NOVOTNY, this _____ of _____, 2023.

**FRANK NOVOTNY & ASSOCIATES, INC
D/B/A NOVOTNY ENGINEERING
545 PLAINFIELD ROAD, SUITE A
WILLOWBROOK, IL 60527**

By:_____

Printed
Name/Title: Timothy P. Geary, President

ATTEST:

By: _____

Printed
Name/Title: Thomas R. Brandstedt, Vice President

Rev. 2023

BlueConduit

BlueConduit Proposal
Smart SLM Inventory Powered by Esri
Machine Learning Platform-as-a-Service

Novotny Engineering - Village of Stickney

Table of Contents:

Machine Learning Methodology and Approach

BlueConduit's machine learning methodology and approach is aligned with the guiding Principles of Data Science for Lead Service Line Inventories and Replacement Programs and in accordance with the EPA Guidance for Developing and Maintaining a Service Line Inventory. BlueConduit also adheres to specific state-level guidance and compliance requirements as applicable to the geographic location of the project.

An accurate service line materials inventory is the foundation of the Lead and Copper Rule Revisions (LCRR). BlueConduit will work with the Utility's existing data to develop its service line material inventory. BlueConduit's methodology produces a full SLM inventory for all line segments (public and private.) The SLM Inventory will display the presence of known materials and predict likely locations of lead service lines, galvanized steel/iron pipes with or without lead goosenecks, and the remaining materials used in the water system. BlueConduit understands the resource constraints of water utilities and that limited funding and time prohibits the ability to physically inspect service line materials at every address. Our Data Scientists will recommend a targeted inspection list for physical verification to determine the location of lead service lines or galvanized steel pipes with lead goosenecks. The verified service line material data collected from these verification inspections provides essential information to support the BlueConduit predictive model and improve overall model performance. The process is iterative and improves with continued data validation.

Field Verifications & Replacements

Data Collection & Preliminary Inventory

Data Gap Observations & Recommended Inspection List

Service Line Material Predictions

Compliance Reporting & Maps

Lead Service Line Replacement

Data Sources

To develop a full-service line material inventory, the Utility needs to collect and organize its existing system data and identify its gaps. This requires the Utility to find, organize, analyze, and document existing data sources (structure age, historical records, permit records, etc.) and understand how existing data patterns inform lead service line locations across a large, varied service area. BlueConduit's approach streamlines this process and takes the guesswork out of data analysis.

In developing a comprehensive inventory, BlueConduit analyzes data that can be classified as service lines of "known" materials. This involves reviewing verified service line material records, building codes, city ordinances about banned service line materials, and investigating other sources that provide certainty about pipe materials in the system. This initial step provides a baseline for the inventory and helps set the strategy for reducing "unknowns" for locations where pipe material is not known with high degrees of certainty.

BlueConduit will request information from the Utility to begin the statistical analysis and predictive modeling process.

High-value data sources that are commonly used in an SLM Inventory project include:

- Recently Verified Service Line Material Records (both public and private-side)
- Historical Water Service Line Material Records (both public and private-side)
- Information on service line cards, which are primarily incomplete but could have any of the following information on them:
    - Main size
    - Service line size
    - Service line materials
    - Customer account
- Records of previous materials for service line replacements performed over the last two years. (Earlier replacements do not indicate the date of replacement or material.)
- Water main age (this information is the best beginning in the 1950s)
- Historical water service line maps
- Taxable Parcel Records (year built, land size, value, zoning, etc.)
- Construction records (if available)
- Water Account Billing information (if available)
- Water Sampling Test Results (if available)
- Water Main Size and Material (if available)
- Census Data (if available)

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- Fire Hydrant Locations and Attributes (if available)
- List of daycare and school facilities and their previous testing records

Required Data Fields

Verified Service Line Material records and Historical Service Line Material records are absolutely essential to our work. Using ESRI's Lead Service Line Inventory Solution Version 3.0 or higher, BlueConduit recommends organizing and loading available data as it relates to the required fields in the designated State Agency or EPA Service Line Inventory Template . BlueConduit will ingest these data points via direct connection with Esri's Lead Service Line Inventory Solution.

The predictive model requires, at a minimum, the following fields:

- Public Water System ID (PWS ID) Number associated with the service line
- Unique service line ID
- Street address
- Utility side service line material information and replacement data (unknown permitted)
- Customer side service line material information and replacement data (unknown permitted)

Field	Status	Empty Values
Public Water System Number (PWSID)	Required	Not Permitted
Unique Service Line ID	Required	Not Permitted
Street Address	Required	Not Permitted
Geometry (Parcel, Service Point Asset)	Required (if available)	Permitted
Public Side - Service Line Material	Required (if available)	Permitted
Public Side - Replaced (Y/N)	Required (if available)	Permitted
Public Side - Install/Replacement Date	Nice to have	Permitted
Public Side - Basis of classification	Nice to have	Permitted
Private Side - Service Line Material	Required (if available)	Permitted
Private Side - Replaced (Y/N)	Required (if available)	Permitted
Private Side - Basis of classification	Nice to have	Permitted
Private Side - Service Line Material	Nice to have	Permitted
Lead connector?	Nice to have	Permitted
Lead solder?	Nice to have	Permitted

BlueConduit uses available data inputs to move "unknown" data points to high-probability data points, reducing uncertainty.

Recognizing that all requested information might not be available or accessible in all locations, BlueConduit's data scientists can work with the available data to develop the service line inventory. The data science team works closely with the Utility to train their team on using the platform and the model and reduce communication errors.

BlueConduit's data scientists search for other parcel-level datasets that could provide insights into service line materials. In other communities, BlueConduit has found that the age of the nearest fire hydrant helped predict service line material; the machine learning model can process datasets and identify patterns to determine which data is most useful in each geography. Only data about parcels and infrastructure will be collected. No personally identifiable or health information will be collected or stored.

Recommended Inspections

Generating an estimate of the total number of lead service lines in a system or the material at any given address will use information from previously verified service line materials to estimate the materials at service lines of unknown material. The accepted best practice in statistics to be able to make these kinds of estimates is gathering verified service line material data at a random set of homes where the service line material is unknown. Statistically, only such a representative set of verified service points will truly reflect the whole system. This representative randomized sample is critical for understanding the entire system's likely materials.

After preliminary evaluation of the quantity and quality of existing verified data, BlueConduit will generate a targeted list of service lines for the Utility to visually inspect and confirm the existing service line material. This verified data will be used to inform and train BlueConduit's predictive model. The number of homes included in the Recommended Inspection List will depend on factors determined by BlueConduit and the Utility.

BlueConduit estimates that up to 1% of the system's service lines may require visual inspections to reconcile uncertainty. The specific number will be based on BlueConduit's initial analysis and developed in collaboration with the Utility. These inspections will allow an efficient way to verify the reliability of those records.

The specific points/service line segments that will need to be inspected will not be known until BlueConduit conducts its initial analysis of existing data.

Note: BlueConduit does not perform any field verification work. The Utility will cover the cost of field inspections and verifications.

Typical verification methods utilize potholing or Hydrovac at the curb box to verify material on the public and private sides of the service line.

First Iteration of the Model

BlueConduit provides a complete picture of the distribution of service line materials across the system. It offers separate material predictions for different segments of the service line and can also provide the likelihood of a galvanized pipe or any material. BlueConduit also supplies supporting documentation for reports submitted to regulators about the methodology.

Upon completing the targeted inspection effort, BlueConduit will integrate the newly verified service line material data into its machine learning model to generate a complete service line material inventory (public and private) with home-level probabilities. These models will use characteristics of homes with verified service line materials including lead and copper to predict service line material at homes with unverified service lines.

BlueConduit will create an ArcGIS map layer for the project map that shows the likelihood of a point of service having a lead, galvanized, copper, or any other material. BlueConduit will use these methods to generate the probability of having a lead service line on the public side of the service line, the private side, and the joint probability. The predictions can be provided at different levels of detail as needed by the Utility:

- *System-Wide Level* A service-wide estimate can be used to estimate the total number of lead service lines, develop annual capital and operating budgets, and communicate this to customers.

- *Neighborhood Level* If there are indicated lead service lines, neighborhood-by-neighborhood information is ideal for prioritizing resources across the service area. Additionally, this information can be used to develop a public health communication strategy and, potentially, a "Filter Distribution Program."

- *Water main or block-level* Shows the highest likelihood of lead service lines by water main. The Utility can coordinate service line replacement work with other planned infrastructure/asset management work to optimize spending and reduce overall community disruption.

Measures of Accuracy and Reliability

When using a statistical model, it is important to continually evaluate model performance at every stage of model development and implementation. BlueConduit evaluates the performance of its statistical models with various metrics to ensure accuracy and reliability. One of the most critical metrics of model reliability is the AUROC (Area Under ROC Curve), which says how good a predictive model is at determining a lead pipe from a non-lead pipe. In multiple geographies, our models have accurately made this distinction 95% of the time. We anticipate that by following BlueConduit's methodology and approach, the Utility would achieve a similar level of confidence in communicating its inventory to regulators and consumers.

Another accuracy method leverages the use of a hold-out sample. A holdout sample refers to withholding a random portion of a data set from an initial model and then using the withheld data to assess the statistical model's performance. Aside from making sure that model probabilities are well-calibrated, it is important to define the accuracy measures used to evaluate and monitor model performance. The key metric to be used for in-the-field true hold-out evaluation is "Hit Rate," the number of LSLs that were identified divided by the number of attempted replacements regardless of what was discovered. Hit rate can be computed for an entire region or broken down into a specific geography or time.

BlueConduit also validates the model's performance using state-of-the-art metrics (e.g., precision and recall). Read about the tradeoff between Precision vs. Recall in this Article by BlueConduit Chief Data Scientist Jared Webb.

How BlueConduit Manages Unknowns

Having a large number of service lines of unknown material can make LCRR compliance and managing public communication regarding lead in water more complicated. The public notification requirement states that water systems are required to annually notify residents if the service line material at their address is "unknown." Additionally, "unknowns" count toward the required annual replacement rate in the case of a trigger level or action level exceedance.

BlueConduit's standardized approach to addressing unknown materials allows the Utility's LCRR Team to develop a method to identify service line materials and develop a plan for identifying the lack of lead

materials in previously unknown service lines. It is the basis for our highly developed machine learning algorithm. This is done through a combination of BlueConduit's expertise in managing service line replacement projects and leveraging BlueConduit's best-in-class predictive modeling software to generate trusted service line material predictions.

Updated Predictions and Continuous Validation

The predictive modeling process is most effective when taking an iterative approach, as recommended by the EPA. Each time the Utility verifies service line material through its regular operations, that data can be integrated to update the predictive model and refine the predictions. Leveraging the statistical model's machine learning nature, the model can improve over time with additional data. BlueConduit's team will continue to generate further iterations of the predictive model at a frequency determined in coordination with the Utility for the duration of the project engagement.
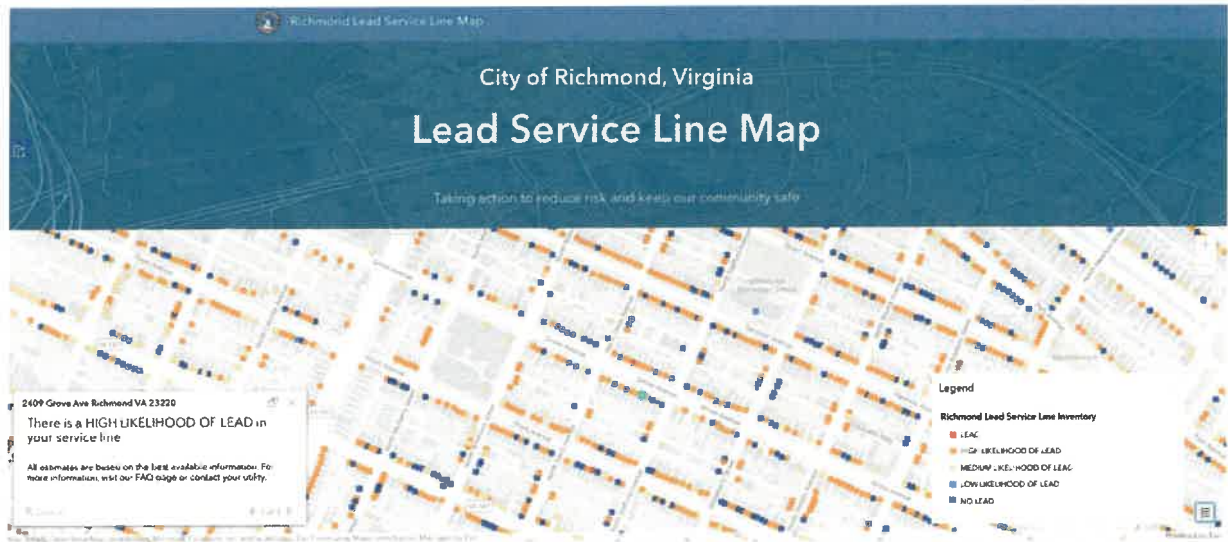
LCRR Compliance

The completed SLM Inventory will be viewable in the Esri ArcGIS Online Project Map with easy reporting tools available to generate reports in the formats mandated under LCRR. This will allow the PWS to quickly access the inventory report and submit it for compliance ahead of the April 2024 (IEPA) and/or October 2024 (US EPA) deadline.

BlueConduit will also provide a Statistical Analysis Report summarizing the methodology, inputs, model performance, and predicted material results as needed for compliance.

Public-Facing Map

Communicating lead service line information helps residents locate their properties and allows them to learn if their property may be affected by lead. The Esri Lead-Safe Community site can be used to communicate lead service line information to residents in the community. It can also include a link to the Water Service Line Material Survey tool which allows residents to report the material of their water service lines, allowing water utilities to better understand their water systems and make improvements to eliminate lead pipes within their water systems.

By leveraging Esri's Community Safe Website App, the final Esri ArcGIS Online Inventory Project Map can be published for public-facing consumption on the Utility's website, revealing only the layers/data fields required for compliance.

BlueConduit

City of Richmond, Virginia

Lead Service Line Map

Taking action to reduce risk and keep our community safe

2409 Grove Ave Richmond VA 23220

There is a HIGH LIKELIHOOD OF LEAD in your service line

All estimates are based on the best available information. For more information, visit our FAQ page or contact your utility.

Legend

Richmond Lead Service Line Inventory
- LEAD
- HIGH LIKELIHOOD OF LEAD
- MEDIUM LIKELIHOOD OF LEAD
- LOW LIKELIHOOD OF LEAD
- NO LEAD

What Are We Doing to Help?

As your water provider, we are doing the following to reduce lead exposure in our water system

Verify Material
Conducting verification of service line materials including field inspections

Inform Customers
Sharing results and any actions taken

Reduce Lead
Executing projects to reduce lead in the water system

Educate Public
Programs, maps, and informative tips used to educate residents

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Esri ArcGIS Collaboration - BlueConduit Smart SLM Inventory

BlueConduit is partnered with Esri to deliver a best-in-class, GIS-based Lead Service Line Inventory software solution. By combining the Esri ArcGIS Online technical architecture with BlueConduit's robust data analytics, service line inventory management and compliance is simplified and efficient.
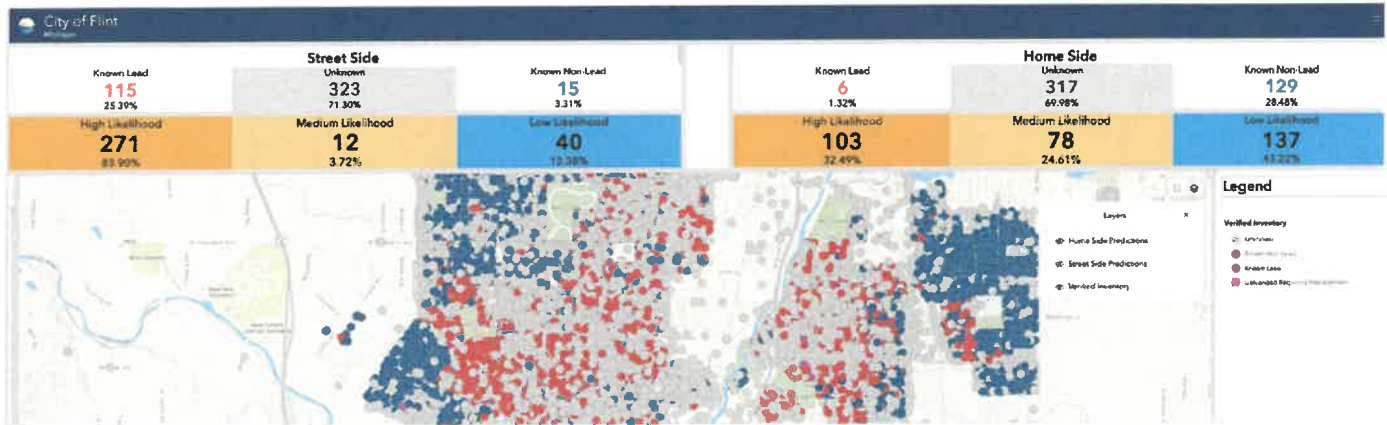
esri **Partner Network**
Silver

Our predictive model and machine learning capabilities are seamlessly integrated with the Esri Lead Service Line Inventory Solution, which features eleven applications that provide each key user with targeted functionality and can be deployed *free of charge* for existing Esri customers. This solution requires the Utility to retain an active ArcGIS Online environment and utilizes existing Esri licensing.
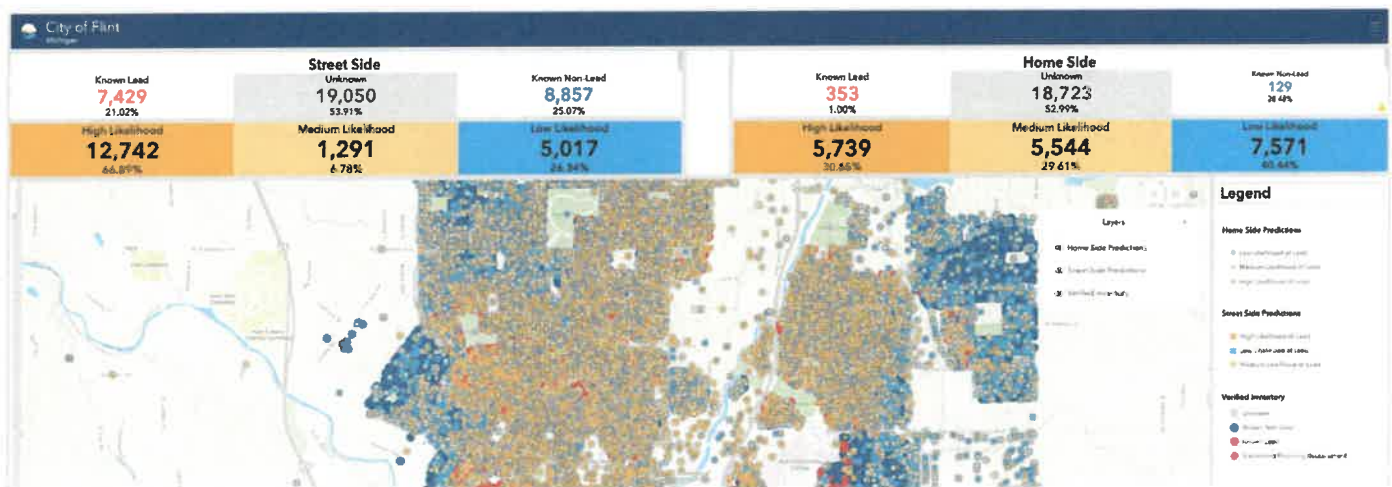
Features:
- BlueConduit Data Analytics for Smart SLM Inventory
- SLM Inventory Data Management
- ArcGIS Inventory Online Project Map (Hosted by Novotny/Stickney)
- Public-Facing Inventory Map
- Configurable Dashboards
- Parcel-level Material Predictions (public and private Sides)
- Up-to-date inventory with two views displayed on the map: verified and predicted materials.
- Ability to collect and record physical verifications using Esri field-based apps, where saved inspection records are automatically linked to the inventory table
- Water Service Line Material Survey for customer self-reporting

Mapping Technicians

◯ Lead Service Line Inventory

◯ Lead Service Line Editor

Mobile Workers

Lead Service Line Field Map

Office Staff

◯ Lead Service Line Viewer

Engineers

Lead Service Line
Replacement Manager

BlueConduit

Smart SLM Inventory
Service Line
Material Predictions

↕

esri
ArcGIS Online

Managers

◯ Lead Service Line Dashboard

Service Line
Self-Assessment Manager

Service Line
Self-Assessment Dashboard

Public

◯ Lead-Safe Community Site

◯ Lead Service Line Public Viewer

Water Service Line Material Survey

Verified Inventory View

Prediction Inventory View

Esri Lead Service Line Inventory Application Functionality

The chart below outlines the functionality of each application found within the suite of Esri LSLI tools. The applications denoted with a BlueConduit logo reflect where BlueConduit's integration and configuration plays a role within the suite of Esri LSLI tools. The remaining applications are pre-configured out-of-the-box from Esri, available for the City to deploy free of charge, and all link back to the same SLM inventory dataset.

BlueConduit Smart SLM Inventory Powered by Esri - LSLI Application Functionality		
Key Users	**Application**	**Description**
Mapping Technicians	Lead Service Line Inventory	The Lead Service Line Inventory (LSLI) is an ArcGIS Online application designed to help water utilities and other organizations collect, manage, and share information about lead service lines within their area. It includes tools for data collection, mapping, and analysis such as web forms, reports, dashboards, maps, and tables. Custom configuration by BlueConduit adds columns, views and triggers to represent both verified materials and predicted materials.
	Lead Service Line Editor	The Lead Service Line Editor is an application within to the LSLI system that allows water utilities to upload, access, and manage information about their lead service lines and connect it to relevant data from external sources. The Editor features custom configuration options to support compliance with state and federal lead and copper rule requirements. Using this application, water utilities can make informed decisions about maintenance, repair, and replacement.
Mobile Workers	Lead Service Line Field Map	The Lead Service Line Field Map (for ArcGIS Field Maps), a mobile app for staff and contractors doing material verification in the field. Allows for photo upload. Results are automatically linked to LSLI.
Office Staff	Lead Service Line Viewer Web App	The Lead Service Line Viewer Web App is a browser-based viewer that lets staff with the appropriate credentials view the LSLI.
Engineers	Lead Service Line Replacement Manager	The Service Line Replacement Manager is a web app intended for engineers, construction managers, etc to manage and track info about replacement activities.
Managers	Lead Service Line Dashboard	The Lead Service Line Dashboard is a configurable tool with customizable filters that provides actionable insights on the lead service line inventory, including material verification, predictions, and replacement progress. Custom configuration by BlueConduit provides visualization of both verified and predicted materials.
	Service Line Self-Assessment Manager	The Service Line Self-Assessment Manager is a web app for Utility staff use to triage information submitted through the Water Service Line Material Survey so they can take the appropriate next action.
	Service Line Self-Assessment Dashboard	The Service Line Self-Assessment Dashboard is a web app dashboard for Utilities that choose to use the Water Service Line Material Survey. It's functionality allows staff to ensure they are quickly triaging submitted information.
Public	Water Service Line Material Survey	The Water Service Line Material Survey is a web based service line self-assessment tool that allows customers to self-report their private-side service line material. The survey is a data collection form where the submissions will link directly to the LSLI. Citizens can self-report material types and upload photos. The Water Service Line Material Survey link can also be embedded in the Lead Safe-Community Site.
	Lead-Safe Community Site	The Lead-Safe Community Site is a preconfigured web site that can be embedded into a utilities webpage or be a stand alone website that gives key metrics about the utility's service line inventory and the actions they are taking to identify and remove lead services. Helps utilities comply with LCRR requirements for making the LSLI publicly accessible. Custom configuration by BlueConduit provides visualization of both verified and predicted materials.
	Lead Service Line Public Viewer	The Lead Service Line Viewer Web App is an intuitive and map-based tool that enables customers to easily access information on lead service lines in their area. This map is also embedded in the Lead-Safe Community Site and helps the utility comply with the LCRR requirements for LSL public availability.

Esri LSLI Project Workflow Summary

This high-level overview summarizes the workflow expectations defined by the BlueConduit project scope. We recognize that the client may have already completed some of these initial steps to launch the use of Esri's Lead Service Line Inventory solution.

1. Novotny/Stickney will collect, organize, review, and prepare available data for the service line material inventory.
2. Novotny/Stickney will host the Esri Lead Service Line Inventory (LSLI) solution in their ArcGIS Online (AGOL) account. Novotny/Stickney will install the free version of the Esri LSLI Solution Version 3.0 or higher.
3. Novotny/Stickney will provide BlueConduit with access and creator permissions to ESRI LSLI Solution and Inventory Data Layer.
4. BlueConduit will coordinate with Novotny/Stickney to install a routine that adds our custom schema (tables, columns, views, triggers) to the Esri LSLI Solution.
5. Novotny/Stickney will create the ESRI ArcGIS Online Inventory Project Map and load collected data into the Inventory App.
6. BlueConduit will pull the data into the BlueConduit machine learning platform to perform phase 1 of data analysis.
7. BlueConduit will produce the initial batch of targeted locations for Novotny/Stickney to complete physical verification (100-150 locations), which will be statistically representative of the entire system. Subsequent inspections may be recommended as needed, up to ~350 total and can be provided in batches of 50-100.
8. Novotny/Stickney performs physical verifications using their existing field-based Esri apps. Saved inspection records are linked to the project's inventory table.
9. BlueConduit will pull the updated data into the BlueConduit machine learning platform to perform phase 2 of data analysis.
10. BlueConduit generates the 1st iteration of the model. The results are delivered directly into the Esri LSLI. Linked fields will automatically have an up-to-date inventory with two views on the Lead Inventory project map: verified and predictions.
11. BlueConduit will configure an LSLI dashboard, reflecting verified and predicted service line materials.
12. Novotny/Stickney will perform ongoing field-based inspections and replacements.
13. As ongoing inspections and/or replacements have been performed, the newly updated material data will be ingested and analyzed by BlueConduit.
14. Service line material predictions will automatically be updated at a frequency determined between BlueConduit and Novotny/Stickney (weekly, monthly etc.) for the duration of the contract agreement.

Pricing Summary

Implementation Services (Fixed Fee)	$14,000.00
Project Management/Meetings	
Deployment: BlueConduit powered by Esri LSLI	
Data Ingestion into BlueConduit Machine Learning Platform	
Data Science Validation and Analysis	
Data Gap Observations and Recommendations	
Configuration of BlueConduit LSLI Dashboard (Verified and Predictions)	
LSL Replacement Strategy Assistance	
LCRR Compliance Support	
BlueConduit Machine Learning Platform-as-a-Service (Fixed Fee)	**$3,000.00**
BlueConduit Machine Learning	
BlueConduit - Esri Integration	
Recommended Inspection List(s)	
SLM Predictions per Service Line (Public and Private) - Unlimited Updates	
Project Total	**$17,000.00**

Platform-as-a-Service Renewal - Annual Inventory Update	$3,000.00

← TBD

Pricing – Key Assumptions

1. ~1900 SL's
2. Base Project TimeFrame: Contract Signing through June 2024.
3. Novotny/Stickney will prepare the SLM data set to be ingested into the Esri LSLI Inventory table.
4. Project Total will be invoiced within 10 days of contract signing and subject to NET30 payment terms.
5. Novotny/Stickney will utilize existing Esri ArcGIS Online licensing to execute the deployment of this solution.

Deliverables Summary

1. **BlueConduit - Esri LSLI App Configuration:** BlueConduit schema (tables, columns, views, triggers) deployed to the Esri LSL Inventory.
2. **Recommended Inspection Lists(s):** After evaluation of existing SLM Inventory data, BlueConduit will generate an initial batch list of targeted locations to conduct initial inspections to verify the public and private side service line materials. **(100-150 locations).**
    ⇒ BlueConduit's recommended inspection list is based on the quality of verified data provided. If there aren't enough verified lines in a representative sample, BlueConduit will generate a targeted list of lines for the Utility to inform the initial inspections. Those results will shore up the baseline data for the development of the statistical model.
    ⇒ If the initial batch of inspections does not provide a sufficient increase in the baseline data, BlueConduit will issue a second batch of targeted inspections. We estimate that up to ~350 total inspections may be needed and can be provided in subsequent batches of 50-100 locations each.
    ⇒ **Novotny/Stickney** will assume any property inspection and physical validation costs.
3. **BlueConduit Machine Learning Platform-as-Service**
    ⇒ First Iteration: Parcel-level material predictions (public and private side) that indicate the likelihood of lead and other hazardous materials for each service line.
    ⇒ Access to ongoing updated parcel-level material predictions (public and private side) that indicate the likelihood of lead and other hazardous materials for each service line in the distribution system for the duration of the contract agreement.
4. **BlueConduit Powered by Esri LSLI Dashboard (Verified and Predicted Materials)**
5. **Configured Esri Lead-Safe Community Site - Public-Facing SLM Inventory Map**
6. **Statistical Analysis Report for IEPA Compliance**