

Stratified Random Sampling for the Identification of Unknown Service Lines in South Tahoe, CA

A Workplan Prepared for the California Division of Drinking Water

Prepared by TruePani Inc. on behalf of the South Tahoe Public Utilities District

July 2025

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Overview

The Lead and Copper Rule Revisions (LCRR) requires water systems to identify the materials of all service line connections within the drinking water distribution network. The initial Service Line Material Inventory (SLM Inventory) was due to the California Division of Drinking Water (DDW) by October 16, 2024, and required a review of all historical documentation relating to service line materials (if such records exist) and the identification of service line materials when encountered during normal operations.

The EPA and, subsequently, state primacy agencies have released guidance on the SLM Inventory and developed an inventory template that must be used to submit the final inventory. Within the inventory template, a material classification must be made for both the portion of the service line that is owned by the water system (the “public” side) and the portion owned by the customer (the “private” side). The four main material type categories are: lead, non-lead, galvanized requiring replacement (GRR) and unknown. An overall material classification is also assigned to each service line that represents the most restrictive classification of the public and private side materials. For example, if a service line is unknown on the private side and non-lead on the public side, the entire line will have an overall material type of unknown.

South Tahoe Public Utilities District (“STPUD” or “the District”) submitted an initial service line material inventory by the October 16, 2024 deadline with all unknown material designations. Additional efforts have been completed since then to review historical records and make material determinations.

In March 2025, STPUD retained the services of TruePani Inc., an engineering, consulting, and data management firm specialized in lead in drinking water, to assist in developing a SLM Inventory for the District’s 15,183 service connections.

TruePani organized the meter pit and GIS information into a database format, which acts as the basis for STPUD’s update SLM Inventory. While historical records are still currently being linked to service lines to make material designations, all records have been reviewed, and none have indicated the historical use of lead or the presence of lead currently in the distribution system. TruePani will continue to use the historical records that have been reviewed to make material designations.

South Tahoe has several master meters that serve a currently unspecified number of private side service lines. TruePani is actively working to add these additional private side lines to the inventory, which may slightly increase the total number of unknowns. To account for this, STPUD will plan to perform additional inspections under the SRS methodology.

Table 1: Current Service Line Material Classifications in STPUD’s Inventory

Material	Public SLs	Private SLs
Non-Lead	4,451	5,349
Galvanized	2,678	1,533
Unknown	8,054	8,301
Lead	0	0
Total Number of Service Lines:		15,183

In California, a water system can elect to further reduce the number of unknowns through the following methods that are approved by DDW on a case-by-case basis: water quality sampling, statistical verification, interpolation, interviews, and other emerging methods.

STPUD has chosen to utilize the Stratified Random Sampling (SRS) methodology outlined by DDW to classify unknowns in the system as non-lead. DDW guidance suggests that SRS is the best statistical approach for medium to large systems with more than 1,500 unknown service lines.

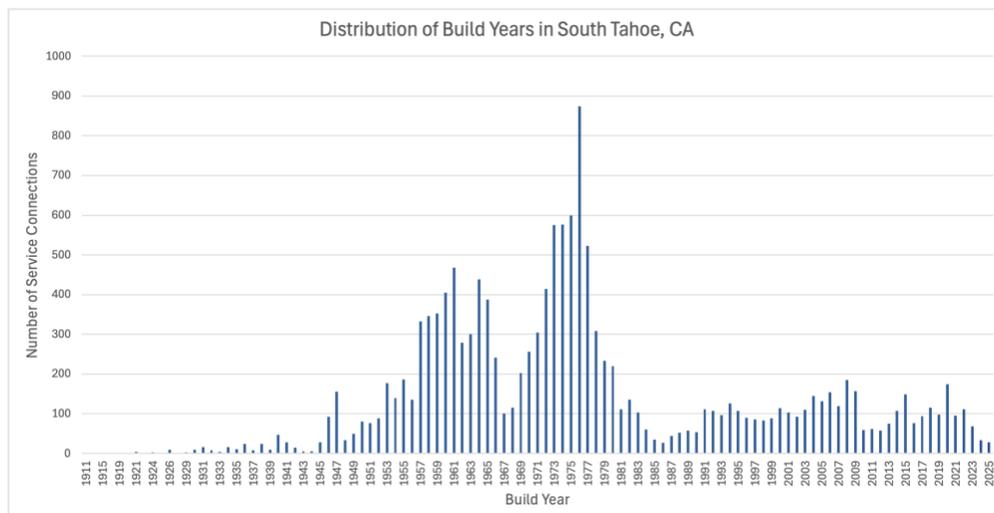
In SRS, a sample size calculation based a 95% confidence interval with a margin of error of +/- 5% is performed on the total number of unknowns to determine the minimum number of physical verifications that will need to be conducted. The unknown service connections are then stratified into tiers based on the date of installation and the number of verifications performed per tier is dictated by the percent distribution of service lines within the tiers. This ensures that the number of random physical verifications are representative across the different time periods.

In September 2023, TruePani connected with Allison Sim, Water Resources Control Engineer at State Water Resources Control Board, via email about the requirements for developing a workplan to use the Stratified Random Sampling (SRS) methodology to identify unknowns. Alison indicated that the workplan may include information on:

- **Stratified Random Sampling Groups:** Includes the number of interpolation groups, the characteristics for creating the groups, and the percent or number of verifications per group.
- **Physical Investigation Methods:** Includes the types of methods that will be used.
- **Other Methods for Identifying Unknowns:** Includes information on what methods will be utilized if SRS cannot be applied.
- **Lead Service Line Procedures:** Includes information on next steps if lead is found.

Stratified Random Sampling Groups

There are presently 8,924 unknown service lines present in STPUD’s initial inventory, 8,544 of which have an associated build year. The following histogram displays the breakdown of all service connections by build year.



Using a sample size calculation with a 95% confidence interval with a margin of error of +/- 5%, STPUD will need to perform a minimum of 369 random physical verifications. The District will likely perform more than the minimum number of verifications, to account for circumstances where the service line materials are unable to be determined during the inspection or the meter box is inaccessible.

After incorporating parcel data, historical aerals, and online resources, 380 unknowns in the inventory do not have an associated build year. These unknowns are included as a separate “decade group” in the SRS methodolgy. If all visual inspections conducted return non-lead material determinations, all unknowns in the inventory will be documented as non-lead.

Under the SRS methodology, the unknowns present in the District’s system will be stratified into five groups: 1911-1939, 1940-1949, 1950-1971, 1971-1985, and Unknown Build Year. These groups were selected based on the time periods of concern for pipes to contain lead in the state of California and the existing records reviewed during the historical records review.

Historical records that have helped to inform the tier stratification include the following. All records reviewed are available upon request.

- 1971 Improvement Plan for Pioneer Village requiring all water service from the main to the meter to be 1’ galvanized pipe
- 1971 Site Plan for Ski Run Village Townhouses requiring all services to be galvanized iron
- 1984 Improvement Plan requiring the use of galvanized iron for all service connections
- 1985 Improvement Plan indicating the use of polyethylene for service connections

Table 2: Minimum Number of Physical Verifications by Decade Group

Group	Number (and %) of Unknown Connections	Number to Physically Verify
1911-1939	125 (1.4%)	5
1940-1949	307 (3.4%)	13
1950-1959	1,343 (15.0%)	56
1960-1971	2,528 (28.3)	104
1971-1985	4,241(47.5%)	175
Unknown Build Year	380 (4.3%)	16
Total:		369

If all physical verifications show materials other than lead, a “non-lead” determination will be applied to all service line connections within the decade group.

Physical Investigation Methods

Physical verifications will be performed by STPUD staff at randomly selected connections within each group. Each unknown connection in the system will be assigned a number using the RAND() formula in Excel. Connections will be randomly selected from each group using the INDEX() and RANK() formulas.

Steps to generate a list of randomly selected connections for physical verifications:

1. Assign a random number to each service line connection using the RAND() formula

2. Apply the formula INDEX(\$A\$1:\$A\$200, RANK(B1, \$B\$1, \$B\$200),1) for the number of physical verifications needed within each group

In South Tahoe, the meter box is not a viable option for inspecting the service line materials. In 2010, the District began a project to replace meters and install new meters at service connections that were previously unmetered. The existing services were connected to the new meters with PVC connectors, which are the only part of the service lines that are visible in the meter boxes. As such, STPUD will need to conduct the physical inspections at a location further from the meter.

Lead Service Line Procedures

Should a lead service line be identified during the physical verifications, further stratification of the decade group will be performed. This will serve to isolate time periods of greatest concern for potential to find lead service lines, while still allowing for unknowns to be identified in time periods where lead is less likely to occur. If lead is identified in the system, the unknowns that do not have an associated build year will not be able to be classified as “non-lead” and will remain as unknowns in the inventory. Alternative methods for identifying service line material will have to be employed for the connections with unknown build years.

Accounting for GRR

A connection is defined as Galvanized Requiring Replacement (GRR) when the private portion of the service line is made of galvanized iron or steel and the material on the public side of the line is either lead, unknown, or there is no evidence that the line never was lead. If a system is unable to demonstrate that the galvanized line was never downstream of a lead line, it is also considered GRR.

So far, there have been 1,533 galvanized private side lines that have been identified in the system. Of these, 210 lines are currently downstream of a public side line with an unknown material designation. These lines will be considered GRR until the SRS methodology is completed and no lead lines are found.

In the instances where a galvanized line is identified during normal operations, the installation date for the public side is the primary piece of information that will be used to differentiate between galvanized and GRR. If the date of installation on the public side is 1986 or after, the line will be classified as nonlead. If the date of installation is before 1986, the line will be classified as GRR until the SRS methodology is completed.

Currently, there are no existing historical records that indicate the use of lead in South Tahoe. All historical records and current investigation activities performed by the district further support that no lead is present on the public side. Should the outcome of Stratified Random Sampling substantiate that lead was not used on the public side, any discovery of private side galvanized lines will be classified as nonlead.