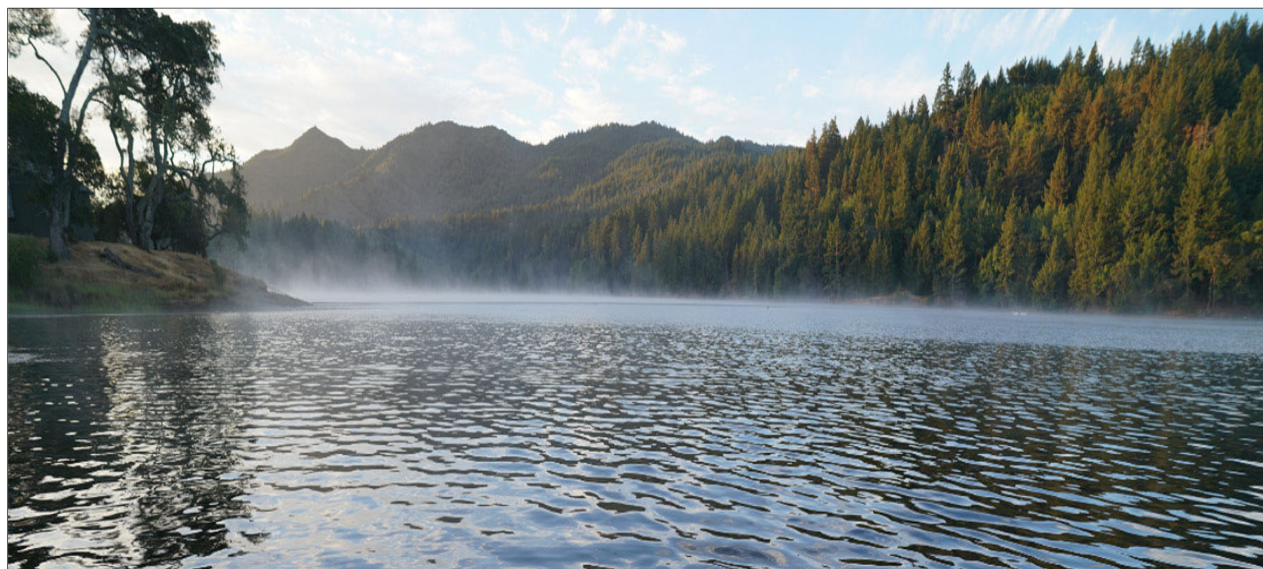




Lead and Copper Rule Revision Customer Service Line Inventory Compliance Plan and Results FINAL



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Table of Contents

Section 1: Introduction	3
Section 2: Overview of Marin Water	3
Section 3: Regulatory Requirements	3
Section 3.1: Lead and Copper Revision Inventory	3
Section 3.2: Regulatory Guidance	4
Section 4: Methods	4
Section 4.1: Data Methods	4
Section 4.2: Preliminary Desktop Methods	5
Section 4.3: Field Verification and Training	6
Section 5: Results and Discussion	7
Section 6: Conclusion	8
Section 7: References	8
Section 8: Appendices	8

Section 1: Introduction

The purpose of this report is to provide an overview of Marin Water, proposed methods for developing a compliant Lead and Copper Rule Revision inventory, and final results of field investigations.

Section 2: Overview of Marin Water

Marin Water is an independent special district located in Marin County, California serving drinking water to approximately 191,000 residents through 63,056 service connections. Marin Water was founded in 1912 and owns and maintains 886 miles of potable water pipelines, 94 pump stations, 121 treated water storage tanks, 3 water treatment plants, and 7 reservoirs with a total storage capacity of 79,566 acre-feet.

The District's average annual water demand is 25,319 acre-feet and has an average daily demand of 22.8 MGD. Approximately 75% of the District's water supply originates from its 7 local reservoirs and 25% is sourced from the Russian River in Sonoma County (MMWD Urban Water Management Plan 2020, Pg. 4, 2021).



Figure 1. Marin Water vicinity and service area

Section 3: Regulatory Requirements

Section 3.1: Lead and Copper Revision Inventory

The LCRR requires that all potable water retailers within the United States identify and make publicly available the location of known lead service lines (US EPA, 2022). To accomplish this water retailers are required to inventory the presence of lead services and develop a plan to replace any discovered lead pipes with non-lead pipe materials.

A customer service line (CSL) is defined as the portion of a service line that connects a commercial or residential property or building to the public water system. Typically, a CSL is privately owned and runs from the water meter to the customer's premises.

Section 3.2: Regulatory Guidance

The California State Water Resources Control Board, Division of Drinking Water (DDW) has provided guidance to local water agencies on how to determine CSL materials and complete a compliant lead service line inventory. Marin Water is categorized as a large public water system as it serves greater than 10,000 services and therefore can employ the stratified random sampling method described in the DDW guidance (DDW LCRR Inventory Methods, Pg. 13, 2023).

Stratified random sampling (SRS) is a statistical verification method which operates by breaking a large and diverse population, such as the District's 63,056 service lines, into smaller groups known as strata and selecting a random but representative sample from each group. Strata are formed based on a population's common attributes or characteristics (e.g. era of construction) to increase the homogeneity within each strata. The prevalence of lead as a pipe material has varied over time with each strata of CSL construction era sharing similar likelihoods of lead occurrence (DDW LCRR Inventory Methods, Pg. 13, 2023).

To effectively utilize SRS, a minimum level of confidence of the results must also be achieved. For strata groups with a population greater than 1,500, a result confidence of 95% +/- 5% margin of error is satisfactory as recommended by DDW. If a strata group has a total population of less than 1,500, a minimum of 20% of the population must be sampled.

Specific characteristics of each potable water retailer's distribution system, such as the history of approved pipe materials or known eras of increased rates of new system connections, should be considered to increase the accuracy of any SRS results. For example, if an era of heightened system connections coincided with known likely lead installation, more field verifications could be targeted for that identified strata. Per DDW guidance, certain eras prior to 1950 have the highest likelihood of lead CSL installation with lead becoming an uncommon pipe material in subsequent decades and banned statewide in 1986 (DDW, 2023).

A majority (75%) of Marin Water's service connections were constructed post-1950. For strata eras with increased likelihood of lead installation, such as during WWII (Table 1, Row 7), Marin Water will field verify 200% of the recommended SRS minimum to increase overall result confidence for that strata.

Section 4: Methods

Section 4.1: Data Methods

Marin water utilized the DDW guidance described above in Section 3.2 to develop data methods which meet the LCRR inventory requirements.

Nine distinct SRS eras shown in Table 1 below were defined for analysis by utilizing DDW guidance and based on Marin Water's specific water system attributes and construction history. The following are distinct eras of construction with similarity in the occurrence and use of lead pipe as a construction material as provided by DDW (DDW LCRR Inventory Methods, Pg. 18, 2023):

Table 1. Stratified random sampling by era of construction and total number of services

Construction Era	Total MMWD Services
Pre-1900	169
1900-1909	1,333
1910-1919	1,730
1920-1929	3,296
1930-1939	2,484
1940-1949	6,223
1950-1985	36,773
Post-1985	10,431
Unknown Age	626
All Eras	63,065

The age of each CSL used in this analysis was obtained primarily from the County records of property improvements derived from the date in which a building permit was issued and construction began for the new residential or commercial structure. If County records were not available for a given CSL the District record of original meter service installation was used as a secondary source of establishing meter service age. This method provides the most accurate determination of age for each CSL.

For example, when a new CSL is authorized for connection to the public water system, Marin Water first installs the meter and public service lateral (PSL) connection to the water system prior to installation of the CSL by the property owner at a later date. Following construction of the PSL, the CSL is installed as part of the issued building permit and connected to the existing PSL. All PSL material types were previously inspected and recorded by Marin Water in 2019 and no lead PSL were observed within the service area.

The date of County building improvement thus represents the age of the privately owned CSL while the date of meter installation represents the age of the public service lateral. On average, a CSL construction year is 2.8 years after the PSL construction year with a standard deviation of 9.9 years. These records provide an accurate determination of age for each CSL and PSL within the Marin Water service area. Strata populations based on the known era of construction of each CSL are shown in Table 1 above.

All active potable water services are included in this investigation. Abandoned or disconnected customer service lines were not selected for further analysis as they do not meet the definition of a CSL due to a lack of a direct connection to a residence or capability of providing water. If an abandoned or disconnected lateral were to be proposed for reconnection in the future a material type investigation would be completed and the results recorded prior to providing service.

Section 4.2: Desktop Methods

Early in 2023, letters were sent to 11 local jurisdictions within the Marin Water service area including all towns, cities, and the County to request records of building code ordinances which prohibited the installation of lead plumbing for water service lines.

Responses were received from 9 jurisdictions and all responses stated that they either did not have record of any lead prohibition or that the first recorded prohibition occurred during the statewide regulations prohibiting use of lead that was implemented in 1986. Therefore, customer service lines installed post-1986 were excluded from this investigation on the basis that lead was no longer a permitted construction material (DDW, 2023).

Section 4.3: Field Verification and Training

A field verification of the pre-1986 customer service lines was undertaken by District meter reading and repair staff. All staff received hands-on training prior to the field verifications beginning in May 2023. Hands on training included techniques in differentiating copper, galvanized iron, plastic, and lead pipes. The pipe materials used for identification trainings are shown in Figure 2 to the right.



Figure 2. Pipe materials used for ID training

During training, the meter reading and repair supervisor trained 13 staff on various pipe material type identification methods including visual (color) assessment, scratch testing, magnetic attraction, and chemical reaction. Training included scratching each pipe material and comparing relative hardnesses as well as an explanation of typical pipe colors and lead corrosion characteristics such as how to differentiate lead and other pipes with a similar appearance (e.g. galvanized iron).

Additionally, Marin Water staff purchased and trained with lead surface swab kits for use in circumstances in which a CSL was suspected of possessing or containing lead. Lead swab kits perform by activating via a chemical reaction and exhibit a visual color change when exposed to lead. Test kits were available to all inspection staff for use during the investigation period.

The District service area is divided into 365 individual meter reading routes, shown in Figure 3 to the right, and accessible customer service lines were randomly selected by staff for field verification while performing their typical meter reading duties.

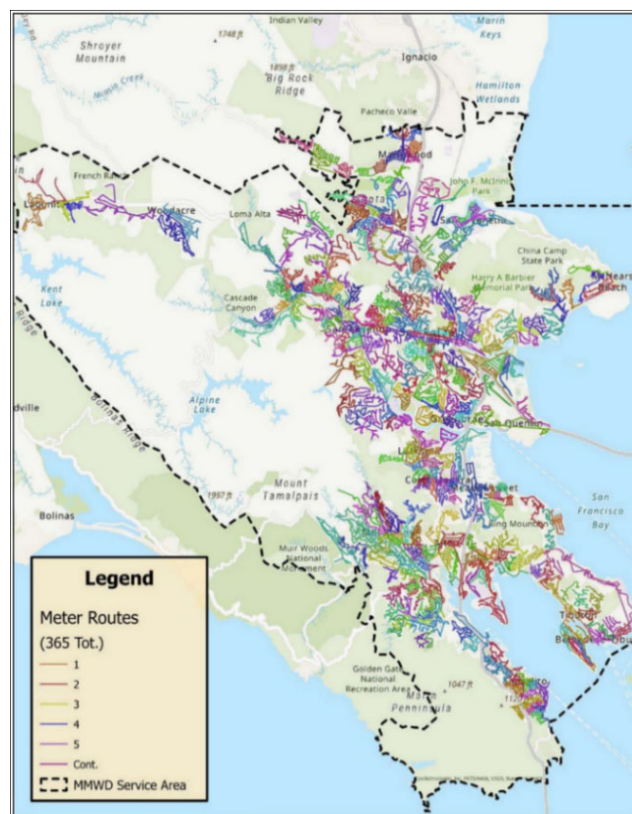


Figure 3. Marin Water meter reading routes

The material type of the service was visually examined within the meter box downstream (i.e. customer side) of the meter, as shown in Figure 4 below, and recorded with a handheld computer connected to the District's SAP database.

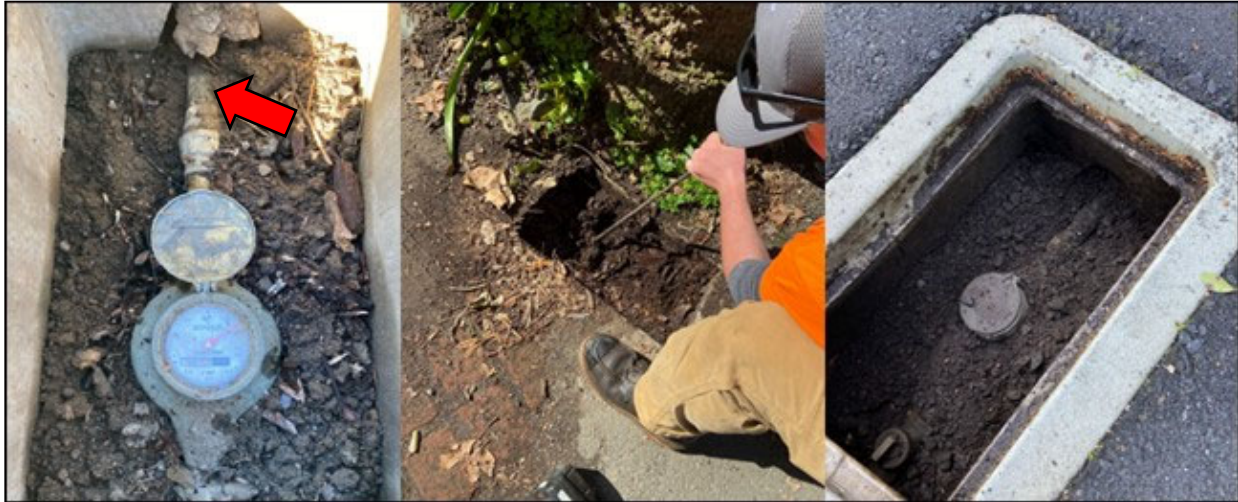


Figure 4. Field verification of customer service lines by Marin Water staff. Note: location of service pipe material verification indicated by red arrow.

Section 5: Results and Discussion

The District has 63,056 total service connections to its potable distribution system and has field verified 8,838 customer service lines with the most common materials observed being copper (68%), plastic (13%), galvanized iron (11%), and other non-lead (8%).

The other non-lead classification is primarily used to indicate CSL pipes which were observed to be a combination of two material types by field staff such as copper and plastic. For example, a CSL observed to consist of a combination of copper and plastic would be defined in this study as other non-lead. No lead services were observed during the entirety of the field investigation.

The sample size of this investigation provides a 95% confidence interval with an uncertainty of plus or minus 1%. This result exceeds the DDW minimum recommendation of 95% plus or minus 5% uncertainty.

If lead is observed during the investigation period or at any time after Marin Water staff are prepared to develop and implement a lead service line replacement plan compliant with the requirements of the Lead and Copper Rule Revision.

Table 2. Stratified random sampling field investigation results by era of construction

Era Constructed	Total Services	Min. Req. for 95% C.I.*	Field Inspected	Lead Found
Pre-1900	169	34**	35	0
1900-1909	1,333	267**	298	0
1910-1919	1,730	315	352	0
1920-1929	3,296	345	518	0
1930-1939	2,484	333	401	0
1940-1949	6,223	362	930****	0
1950-1985	36,773	381	6,319	0
Post-1985	10,431	N/A***	N/A	N/A
Unknown Age	626	125**	138	0
All Eras	63,056	N/A	8,991	0

* Confidence Interval (C.I.) sample size required to achieve 95% +/- 5% certainty per DDW guidance

** For sample groups with less than 1,500 total services a minimum sample size of 20% is required

*** Services constructed post-1985 do not require verification due to statewide lead ban effective in 1985

**** Marin Water field verified >200% of the SRS minimum to increase result confidence during WWII era

Section 6: Conclusion

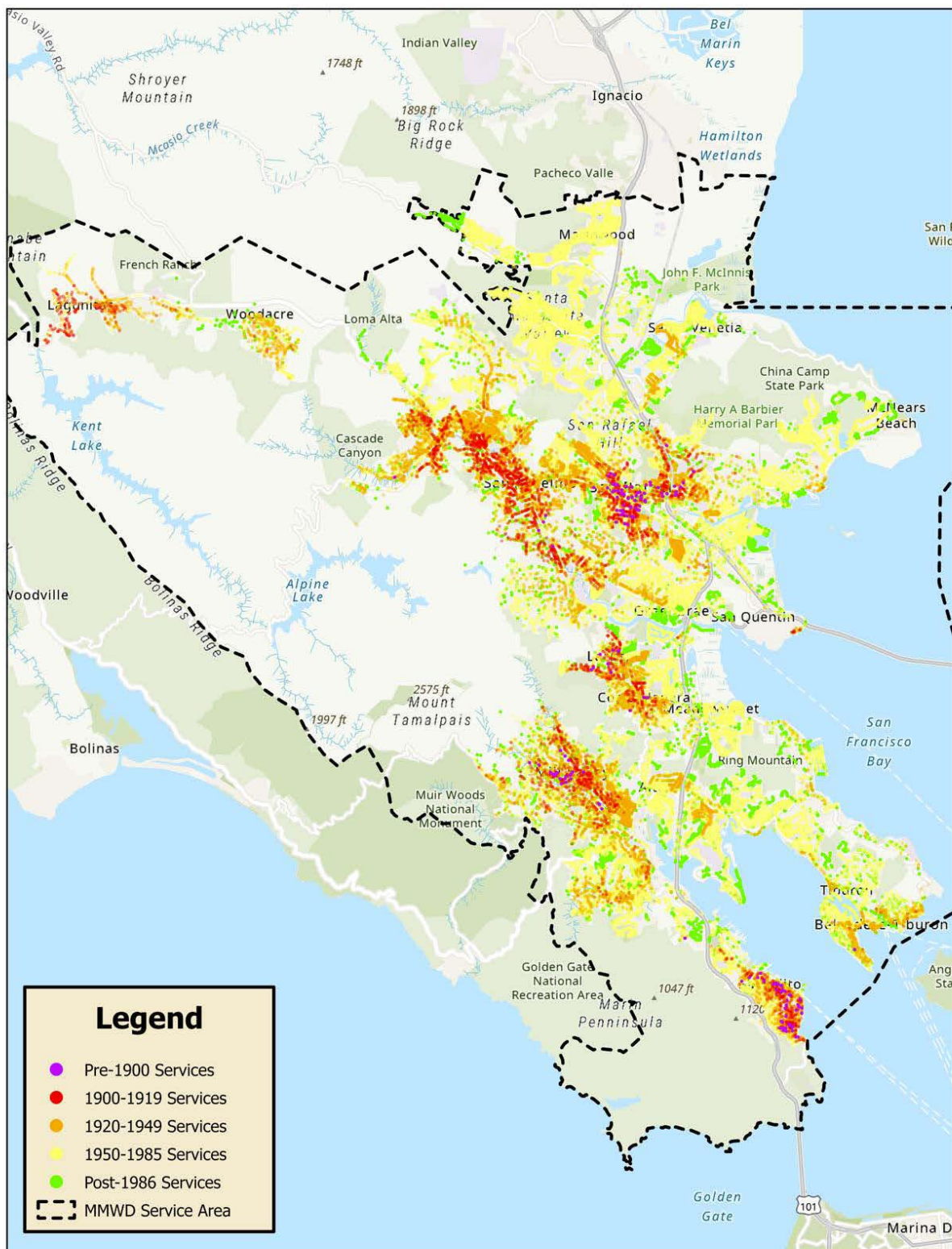
Marin Water's LCRR investigation followed the guidance provided by DDW (DDW, 2023). No lead services were observed within the Marin Water service area and the results of this investigation, which included substantial field investigation, provide statistical evidence that there are no lead customer service lines located within the area served by Marin Water.

Section 7: References

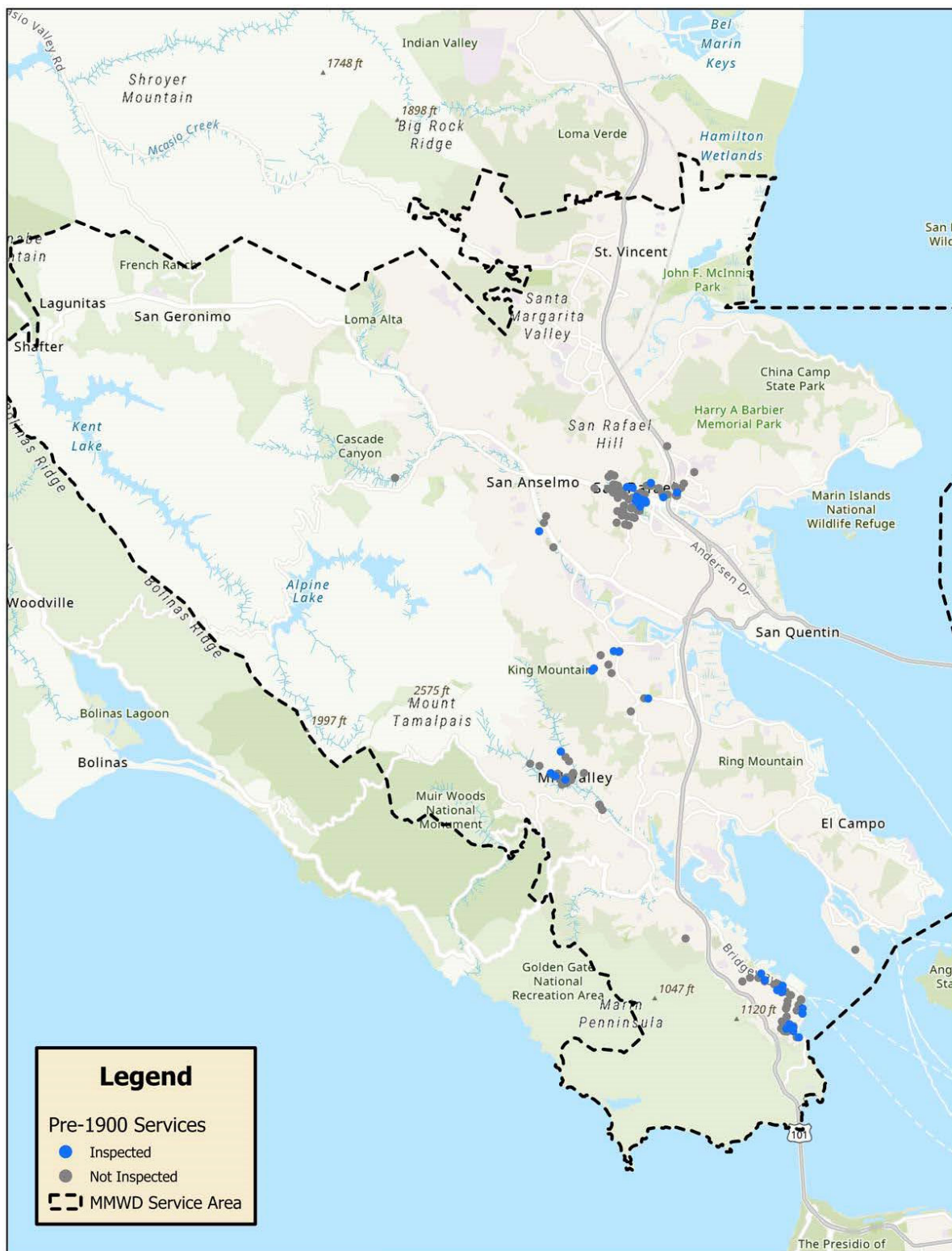
1. United States Environmental Protection Agency. (2022, August). Lead and Copper Rule Revisions Service Line Inventory Guidance. Revised Lead and Copper Rule.
2. SWRCB Division of Drinking Water. (2023, July). LCRR Lead Service Line Inventory Methods. Lead and Copper Rule for Drinking Water.
3. County of Marin Assessor-Recorder Office. (2023, December). Building Improvement Records and Year of Original Construction.
4. Marin Municipal Water District. (2021, June). Urban Water Management Plan 2020.

Section 8: Appendices

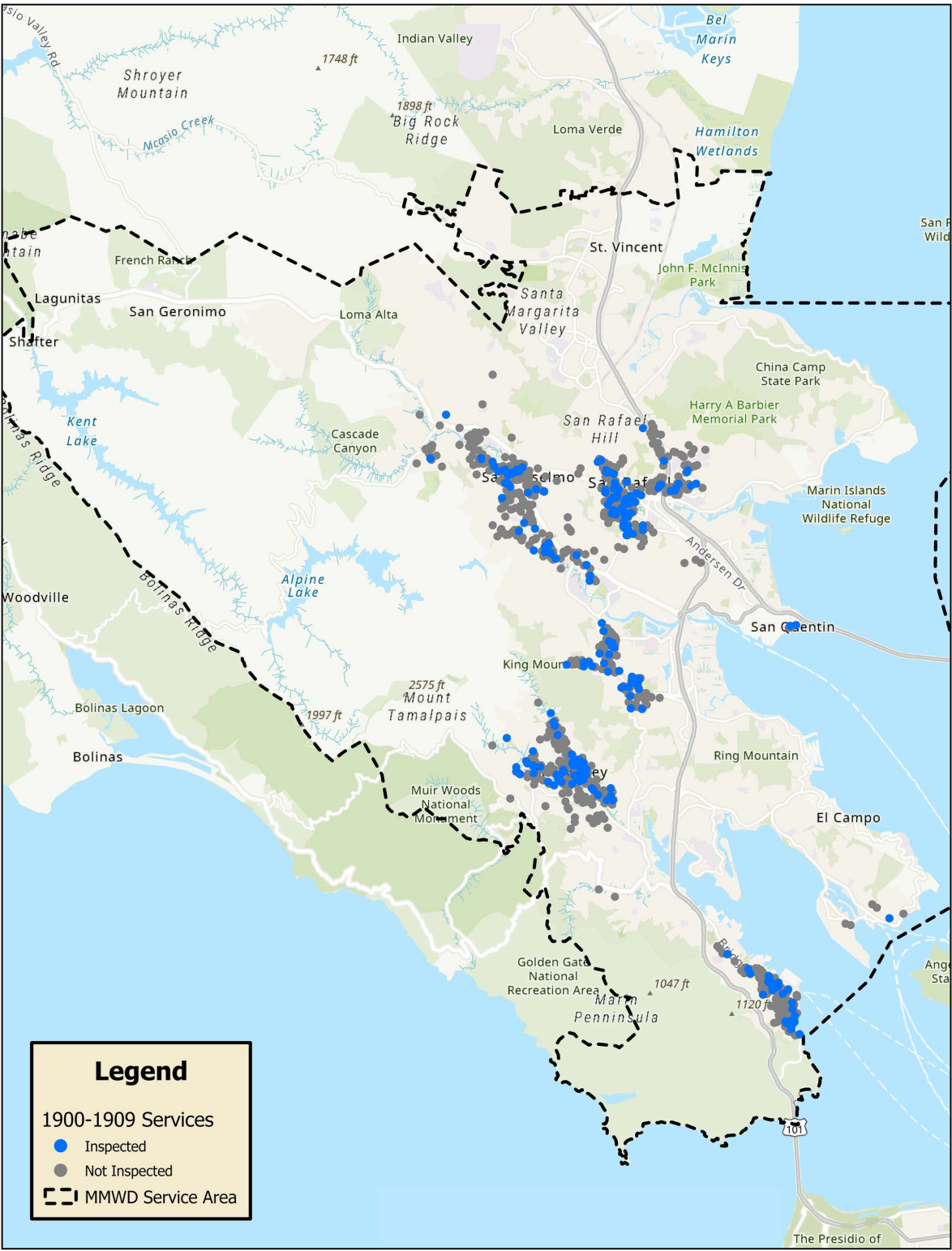
Appendix A: Maps of Marin Water CSL eras of construction and CSL field investigation results



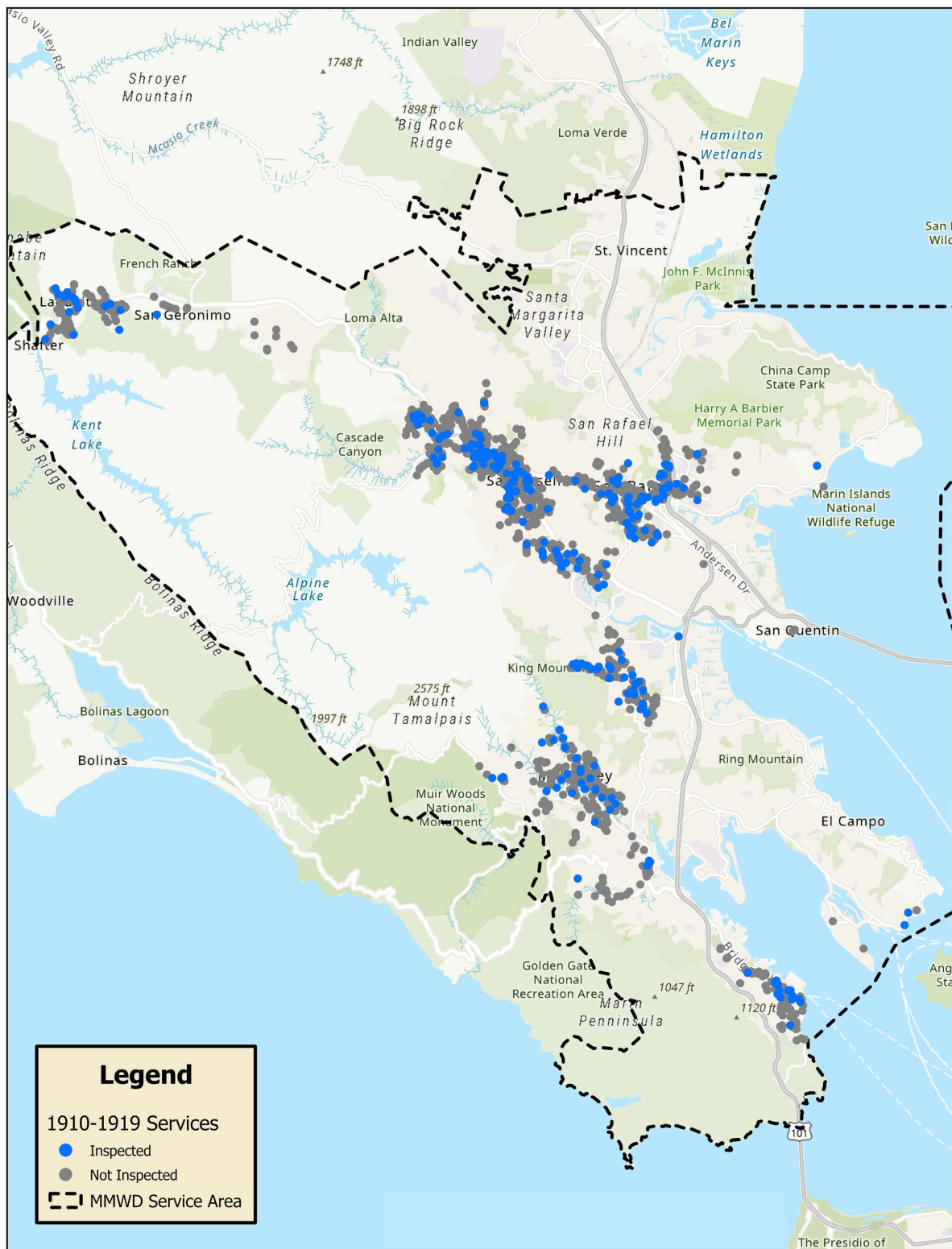
Appendix A. Figure A1. Marin Water customer service lines shown by era of construction



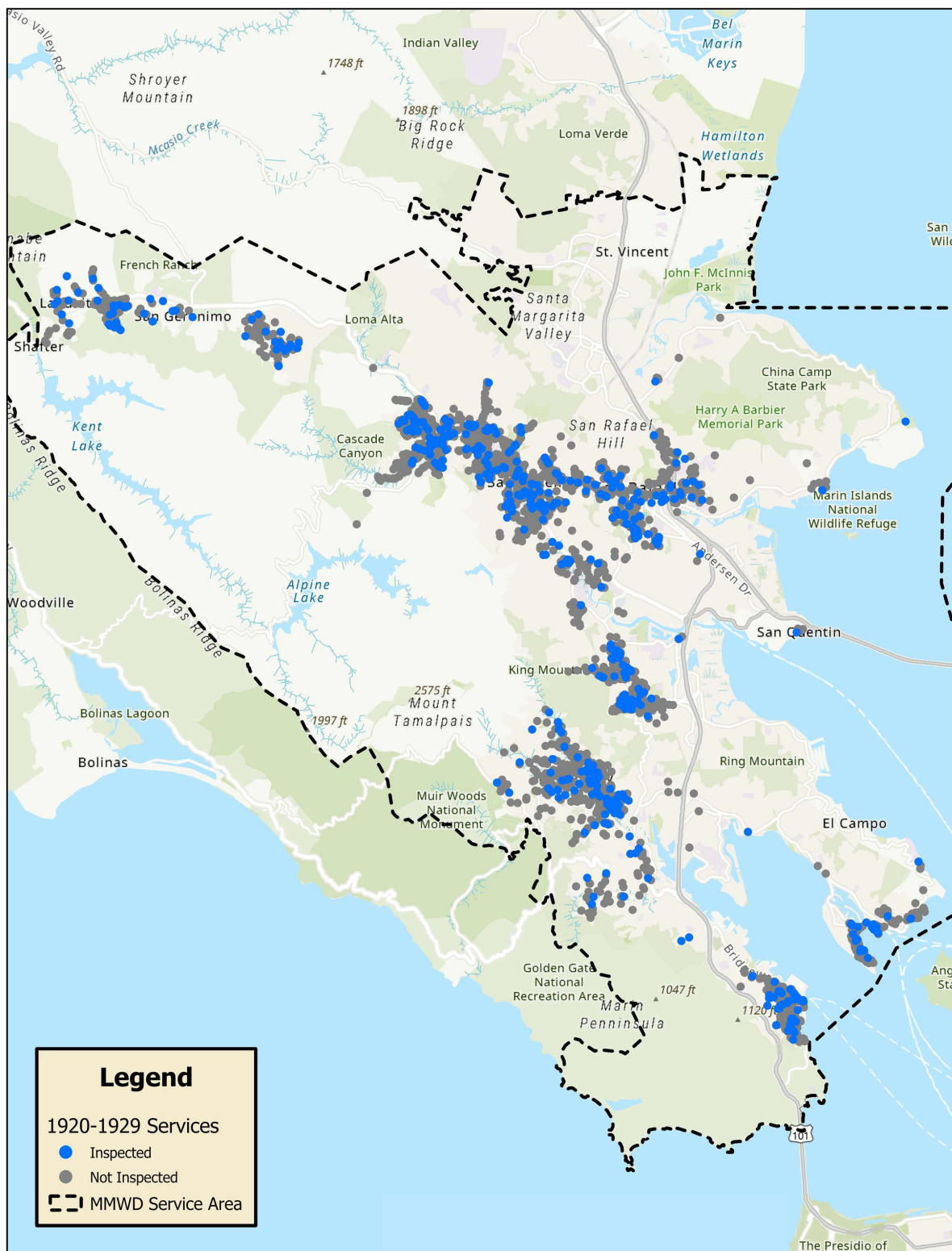
Appendix A. Figure A2. Field investigation results of customer service lines for pre-1900 era



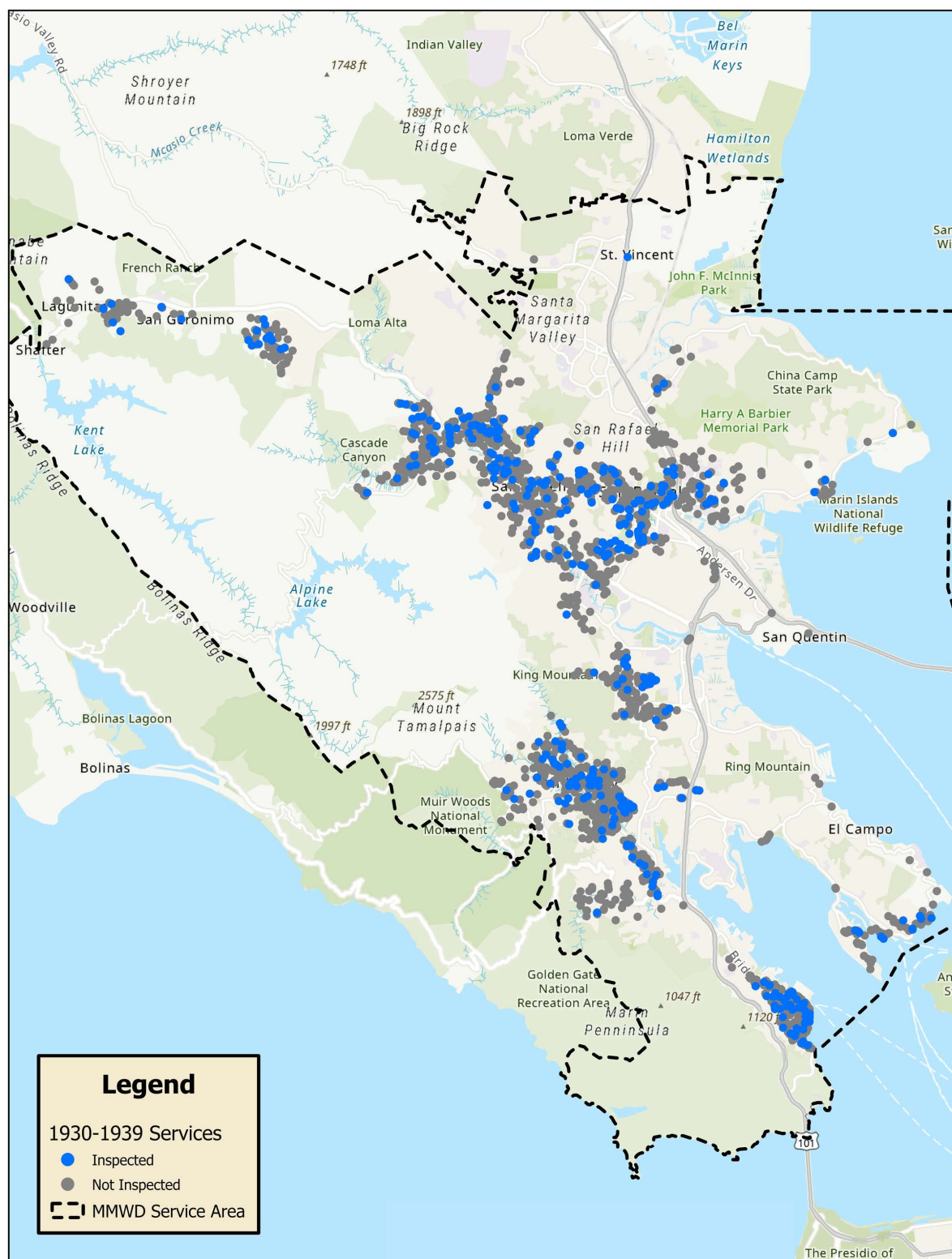
Appendix A. Figure A3. Field investigation results of customer service lines for 1900-1909 era



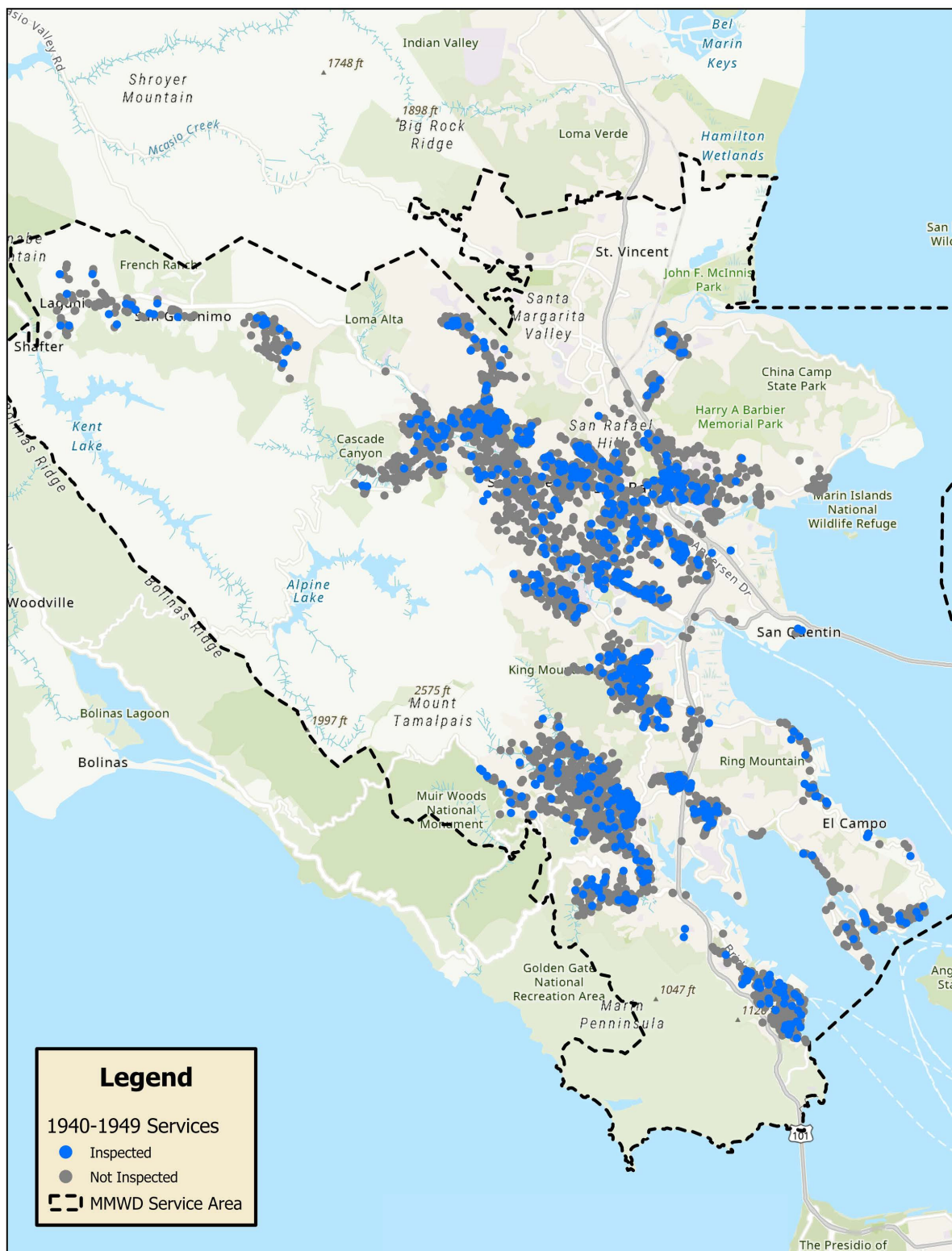
Appendix A. Figure A4. Field investigation results of customer service lines for 1910-1919 era



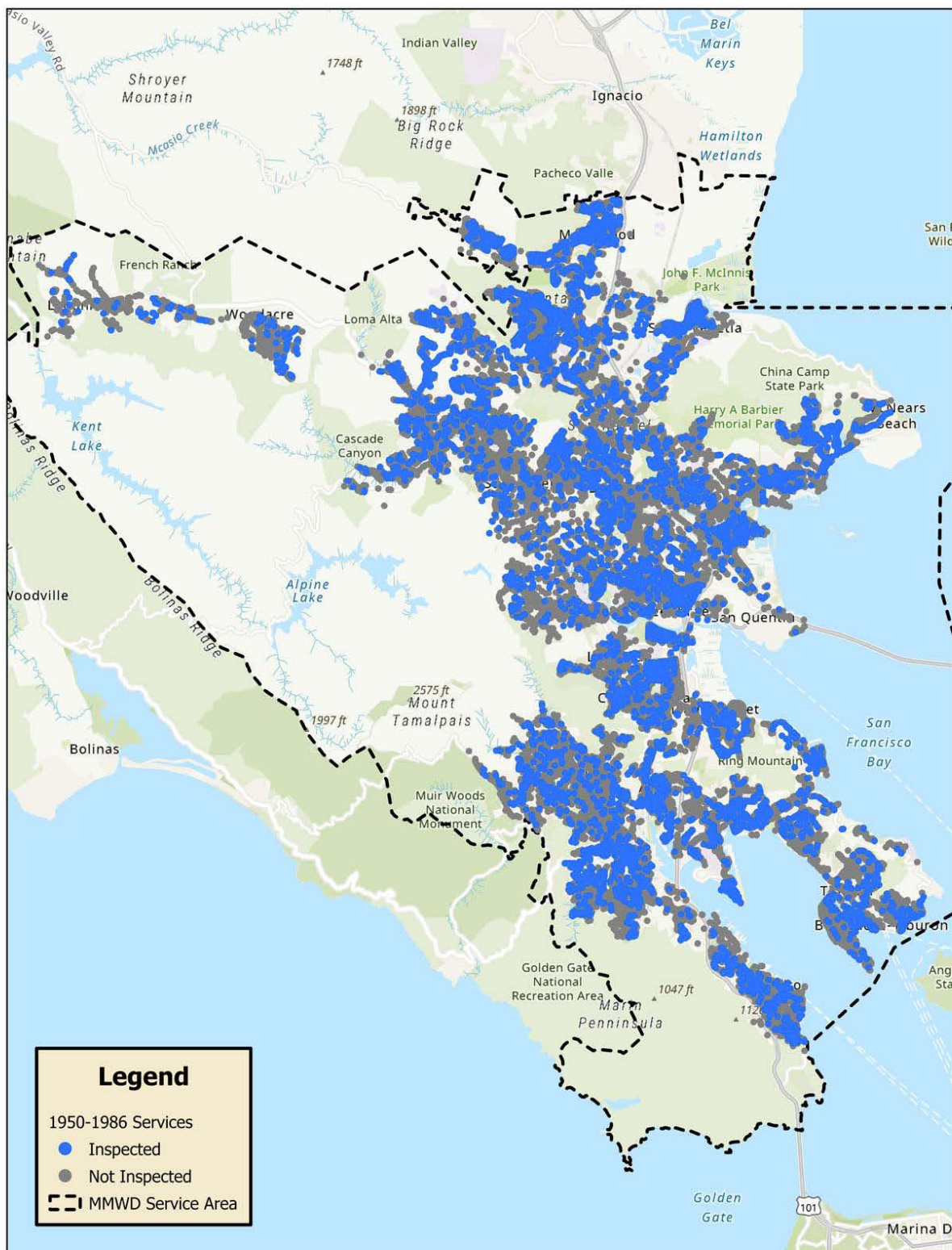
Appendix A. Figure A5. Field investigation results of customer service lines for 1920-1929 era



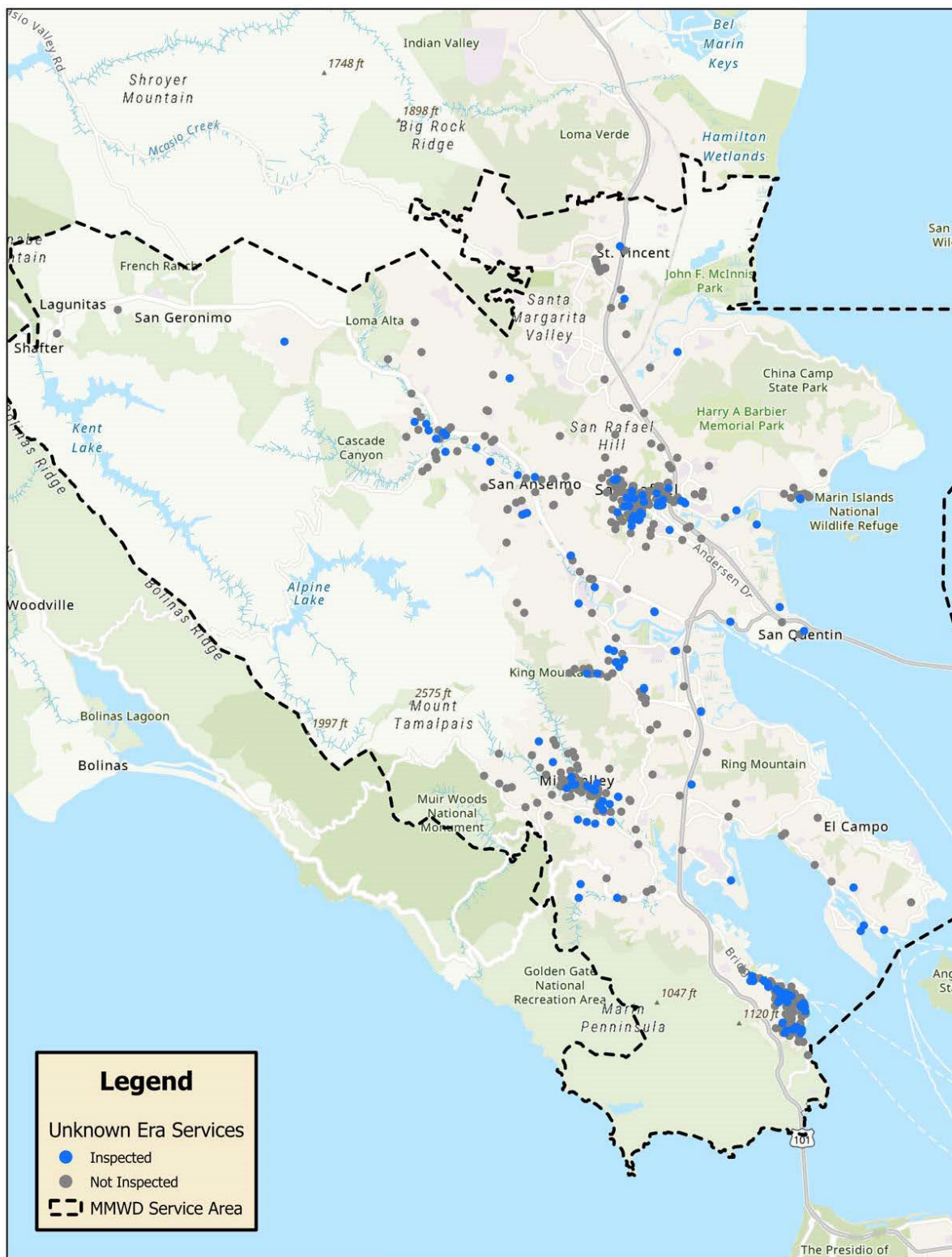
Appendix A. Figure A6. Field investigation results of customer service lines for 1930-1939 era



Appendix A. Figure A7. Field investigation results of customer service lines for 1940-1949 era



Appendix A. Figure A8. Field investigation results of customer service lines for 1950-1985 era



Appendix A. Figure A9. Field investigation results of customer service lines for unknown era