

DENVER WATER LEAD REDUCTION PROGRAM

ANNUAL REPORT – 2022

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Presented by: Denver Water



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LIST OF ACRONYMS

µg/L	micrograms per liter
mg/L	milligrams per liter
ALSLR	Accelerated Lead Service Line Replacement
CASS	Coding Accuracy Support System
CCT	Corrosion control treatment
CDPHE	Colorado Department of Public Health and Environment
COE	Communications, Outreach and Education
DPS	Denver Public Schools
EPA	Environmental Protection Agency
FFLSLP	Federally Funded Lead Service Line Program
GRR	Galvanized requiring replacement
HE&EJ	Health equity and environmental justice
LCR	Lead and Copper Rule
LCRR	Lead and Copper Rule Revisions
LIMS	Laboratory Information Management System
LRP	Lead Reduction Program
LRPP	Lead Reduction Program Plan
LSL	Lead service line
LSLR	Lead service line replacement
NSF	National Sanitation Foundation
OCCT	Optimal corrosion control treatment
Order	Variance Order
QA/QC	Quality Assurance / Quality Control
T&D	Transmission and Distribution
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

The Annual Program Year Report presents the comprehensive evaluation of the Lead Reduction Program (LRP) performance to date using the equivalency model described in the Lead Reduction Program Plan (LRPP). As required by the Order, the comprehensive evaluation uses model inputs based on actual implementation from Jan. 1, 2020, through Dec. 31, 2022. This Annual Program Year Report also includes an assessment of the metrics that were achieved during calendar year 2022.

All performance metrics required in the Order have been achieved or exceeded:

- Results from lead sampling indicate that lead levels continue to decline at both lead service line homes and copper plumbing with lead solder homes with pH 8.8 ± 0.3 in the distribution system. The 90th percentile lead levels continued to be measured less than 5 µg/L in 2022.

TABLE ES-1. CCT PERFORMANCE BASED ON OVERALL 90TH PERCENTILE LEAD CONCENTRATION

LCR Six-Month Sampling Period	2019	2020	2021	2022
Spring Overall 90 th Percentile Lead Concentration (µg/L)	10.0	6.7	4.1	3.9 ¹
Fall Overall 90 th Percentile Lead Concentration (µg/L)	11.0	4.4	4.4	3.8 ²

¹ See letter from CDPHE dated July 22, 2022.

² See letter from CDPHE dated Jan. 27, 2023.

- By the end of 2022, a total of 5,119 LSL replacements were completed for program year 2022, making the annual replacement rate 8.0%, the overall cumulative annual replacement rate 8.1% and the cumulative annual replacement rate within health equity and environmental justice areas of concern 9.4%.
- Responses from the 2022 filter adoption survey suggest that 83% of customers are using their filters for drinking, cooking, and preparing formula if formula-fed infants reside at the household.
- Approximately 92% of samples collected from filters in the customers' homes had no measurable lead.

The equivalency model demonstrates that the holistic approach of the LRP is as effective and efficient as an alternative treatment technique as compared with orthophosphate treatment, and exceeds performance predicted with orthophosphate. Overall, the performance of the third program year (2022) is equal to or better than the performance of the first and second program years (2020 and 2021).

The Dec. 16, 2019, Variance remained in effect in 2022 and did not change the base inventory of 63,955 estimated LSLs. Therefore, 4,477 LSLs remain as the 7% annual replacement goal.

PART 1: INTRODUCTION

As we noted in our Nov. 17, 2022, Notice¹ to the Environmental Protection Agency and Colorado Department of Public Health and Environment describing the 2022 year-end reporting intent, Denver Water is combining the second semi-annual report for 2022 with the 2022 annual report, per the reporting requirements under the new Variance (Dec. 1, 2022).

Denver Water is committed to significantly reducing the lead exposure levels to customers from lead service lines and plumbing. The Lead Reduction Program (LRP) provides a holistic and permanent lead reduction approach that will significantly reduce lead exposure to our customers and be less harmful to the environment. In December 2019, Denver Water began the process of implementing the Lead Reduction Program Plan (LRPP) in accordance with the Environmental Protection Agency's (EPA) Dec. 16, 2019, Variance approval of Denver Water's request for modification of optimal corrosion control treatment under the Lead and Copper Rule (LCR) and in 2023 will implement the LRPP under the updated Dec. 1, 2022, Variance under the Lead and Copper Rule Revisions (LCRR).

This annual report was prepared in compliance with paragraph 7.B of the Variance and commitments made by Denver Water in the 2019 LRPP. An updated LRPP will be submitted to EPA and CDPHE by July 1, 2023, as instructed by the Dec. 1, 2022, Variance.

The following plans are referenced throughout this report:

- LRPP (submitted Sept. 16, 2019, and approved Dec. 16, 2019)
- 2022 Accelerated Lead Service Line Replacement (ALSLR) Plan (not a formal submission, references all properties planned for replacement in 2022)
- 2022 Communications, Outreach and Education (COE) Plan (submitted Jan. 7, 2022, alongside the Second Semi-Annual Report of 2022)
- Elevated Lead Response Plan (re-submitted July 6, 2021)
- Corrosion Control Treatment (CCT) Implementation Plan (re-submitted June 4, 2020)
- Nitrification Control Plan (re-submitted July 15, 2021)

The report addresses the last seven months of 2022 for the period of June 4, 2022, through Dec. 31, 2022, as well as the 2022 program year as a whole. During this time period, Denver Water has provided 12 monthly reports for January through December 2022 to CDPHE.

¹ See Appendix REG-2 Copies of Letters for Compliance-Related Submissions (Second Six-Month Period of 2022).

This report includes data and information from these monthly reports, as well as additional reporting as required by the Variance for the semi-annual and annual reports.

C. Annual Program Year Reports. No later than February 10, Denver Water must submit a Program Year report to CDPHE and EPA, containing a summary of the information and data required under this paragraph for the previous Program Year, including an assessment of which metrics were achieved. The data listed above for the 2nd semi-annual report can be combined into the annual report. The Annual Program Year Report must include a comprehensive evaluation of LRPP performance to date using the equivalency model described in the LRPP with updated inputs based on actual LRPP implementation for: 90th percentile lead levels at LSL and copper with lead solder sites after operation of increased pH and alkalinity adjustment as CCT, number of LSLRs conducted, filter adoption rate, and filter performance in the field. This requirement remains in effect for the term of the variance. The Program Year report must also document any deviations from the LRPP during the most recent Program Year. If CDPHE or EPA provides any comments or requests related to the annual report, Denver Water must provide a written response within 30 Days that addresses any identified comments/requests.

Text is taken verbatim from the Order, dated Dec. 1, 2022.

What to Expect: Reporting on Program Activities

The purpose of the semi-annual and annual reports is to document the implementation of the LRP, describe the actions taken by Denver Water to reduce lead levels and support the subsequent evaluation of the LRP in anticipation of the Lead and Copper Rule Improvements.

The performance data included for the different elements of the LRP described in this report vary depending on the launch date of the different program elements (see Table 1). The reporting dates for the different program elements are shown in Table 2. In general, data is shown for 2022, with details for the second six-month period of June 4, 2022, through Dec. 31, 2022, with a few exceptions to either provide additional information not included in previous reports or to align with other reporting timelines (for example, with LCR six-month reporting periods).

TABLE 1. WHAT TO EXPECT IN THIS REPORT

Paragraph (and LRP Task)	What to Expect in this Annual Report and Status
7.B.i CCT	This section includes a summary of results previously submitted in the six monthly reports ² for July, August, September, October, November, and December 2022, as well as a summary of 2022 as a whole.
7.B.ii LSL Inventory	Denver Water first published the LSL Inventory on its website on March 5, 2020. The map was updated on the Denver Water website on Jan. 3, 2023, using data current up to Dec. 28, 2022.
7.B.iii LSL Replacements (aka ALSLR Program)	This section summarizes the number and type of replacements completed. Denver Water crews have been replacing lead service lines since Jan. 1, 2020. Contractors started lead service line replacement on March 5, 2020.
7.B.iv Filters (aka Filter Program)	This section summarizes filter distribution. Initial filter distribution was completed by Sept. 21, 2020. Replacement filter distribution was initiated on July 1, 2020, and continued through 2022.
7.B.v Compliance Metrics	The Equivalency Model is updated using data collected for the program year.
7.B.vi Communications, Outreach and Education	This section describes implementation of the 2022 COE Plan, ³ virtual community meetings, engagement with the Stakeholder Advisory Committee, and development of new customer resources and materials.
7.B.vii Health Equity and Environmental Justice	This section summarizes implementation of the 2022 COE Plan, updates on community partnerships, and outreach.
Paragraph 7.C of the Variance Order	This Annual Report contains a summary of the information and data for the previous Program Year, including an assessment of which metrics were achieved. The Annual Report also provides a comprehensive evaluation of LRPP performance to date using the equivalency model described in the LRPP with updated inputs based on actual LRPP implementation for: <ul style="list-style-type: none"> • 90th percentile lead levels at LSL and copper plumbing with lead solder sites after operation of increased pH and alkalinity adjustment as CCT. • Number of LSL replacements conducted. • Filter adoption rate. • Filter performance in the field.
Deviations (7.C)	This section documents deviations from the LRPP during the 2022 Program Year.
Appendices	Appendices include CCT, LSL inventory, water quality results, LSL replacements, customer refusal lists, COE and HE&EJ.

² See Appendix REG-2 Copies of Letters for Compliance-Related Submissions (Second Six-Month Period of 2022).

³ See Appendix COE-15 2022 COE Plan in the Second Semi-Annual Report of 2021 (submitted Jan. 7, 2022).

TABLE 2. DATES FOR DATA INCLUDED IN THE SEMI-ANNUAL REPORTS FOR 2022

Description	First Semi-Annual Report (2022)	Annual Program Year Report (2022)
CCT pH/alkalinity Adjustment Start-up	All three WTPs have the capability to adjust pH	All three WTPs have the capability to adjust pH
LCR 90th Percentile Lead Concentration based on Compliance and Customer Requested Samples	All LCR compliance samples collected from Jan. 1 to June 30 All customer requested samples reported in LIMS ¹ between Jan. 1 and June 30	All LCR compliance samples collected from July 1 to Dec. 31 All customer requested samples reported in LIMS between July 1 and Dec. 31
Elevated Lead Response Reporting	Jan. 1 to June 3	June 4 to Dec. 31 ²
Water Quality Sampling from Select Households (1983 to 1987 Homes)	Jan. 1 to June 3	June 4 to Dec. 31
Inventory – Posting of Map to Denver Water’s Website	Data through June 27, 2022 Posted June 30, 2022	Data through Dec. 28, 2022 Posted Jan. 3, 2023
Inventory – Update	Jan. 1 to June 3	June 4 to Dec. 31
Investigations – Verification Potholing as Part of ALSLR Program	Jan. 1 to June 3	June 4 to Dec. 31
Investigations – Investigative Potholing Independent of ALSLR Program	Jan. 1 to June 3	June 4 to Dec. 31
Investigations – Water Quality Sampling as part of ALSLR Program (not included in 90th Percentile Calculation)	All results reported in LIMS by June 3	All results reported in LIMS by Dec. 31
Investigations – Water Quality Sampling Independent of ALSLR Program (not included in 90th Percentile Calculation)	All results reported in LIMS by June 3	All results reported in LIMS by Dec. 31
Water Quality Sampling Post-LSL Replacement	All results reported in LIMS by June 3	All results reported in LIMS by Dec. 31
ALSLR Program Replacements	Jan. 1 to June 3	June 4 to Dec. 31
ALSLR Program Consent Forms	Jan. 1 to June 3	June 4 to Dec. 31
Initial Filter Distribution	Jan. 1 to June 3	June 4 to Dec. 31
Replacement Filter Distribution	Jan. 1 to June 3	June 4 to Dec. 31
Filter Program Occupancy Changes³	Jan. 1 to June 3	June 4 to Dec. 31
Informal Filter Adoption Survey as Part of ALSLR Program	Jan. 1 to June 3	June 4 to Dec. 31
Filter Testing in the Field	Jan. 1 to June 30	July 1 to Dec. 31
COE Activities	Jan. 1 to June 3	June 4 to Dec. 31

¹ LIMS is the Laboratory Information Management System used by Denver Water.

² For samples collected and reported in LIMS by Dec. 31 and follow-up response by Jan. 4, 2023.

³ Includes occupancy changes at ALSLR properties by definition.

Key Changes in Report due to new Variance (Dec. 1, 2022)

Activities in 2022 were performed under the original 2019 Variance, but for the purposes of this report, are being summarized per the original 2019 Variance and the new 2022 Variance. Table 3 below details the key changes within this report due to the Dec. 1, 2022, Variance.

TABLE 3. REPORTING CHANGES UNDER DEC. 1, 2022, VARIANCE

Reference Paragraph	Dec. 16, 2019, Variance	Dec. 1, 2022, Variance
3.D	Required a 1.4% investigation rate each year based on the number of possible and suspected lead service lines.	Requires a 1.4% <u>cumulative</u> investigation rate based on the number of unknown service lines (likely LSL or unlikely LSL).
4.A	Required a 7% replacement rate each year.	Requires a 7% <u>cumulative</u> replacement rate.
6.C	No HE&EJ metric.	Requires that the replacement rate in HE&EJ areas of concern must be greater than or equal to overall replacement rate.
5.G, 7.B.iv	Required detailed address lists of: <ol style="list-style-type: none"> 1. Filter distribution addresses. 2. Cartridge distribution addresses. 3. Proof of 95% outreach to customers. 	Does not require detailed address lists. Address lists can be provided to CDPHE and EPA, if requested.
7.B	Required two semi-annual reports and one annual report.	Merges the second semi-annual report with the annual report, requiring only two reports each year.
1.C, 1.I, 1.P, 1.X	Terminology used: <ul style="list-style-type: none"> - Known lead - Suspected lead - Possible lead - Unlikely lead - Non-lead 	Introduces new terminology: <ul style="list-style-type: none"> - Confirmed LSL - Likely LSL - Unlikely LSL - Non-lead - Galvanized requiring replacement

ASSESSMENT OF METRICS ACHIEVED

Compliance Metrics per Paragraphs 2.C, 3.D, 4.I, 5.G, 6.B, and 6.C

As required by the Order, the performance metrics for the six elements of the LRP, including the application of CCT, the development – and regular updates – of the LSL inventory, the replacement of LSLs overall and within HE&EJ areas, and the distribution of filter outreach and education materials, have been achieved. The overall performance of the LRP is evaluated by modeling performance under the conditions of the Order and comparing it to modeling performance with orthophosphate. For comparison, summaries of the required performance metrics from the Dec. 16, 2019 and Dec. 1, 2022 Variance Orders are provided in Table 4 and Table 5.

TABLE 4. SUMMARY OF COMPLIANCE METRICS FOR 2022 (DEC. 16, 2019 VARIANCE ORDER)

Paragraph	Description	2022 Results
2.C	<p>C. Corrosion Control Treatment Metric. Consistently <u>maintain in all parts of the System a minimum target pH of 8.5 during the first year of operation</u> under this Order.</p> <p>In the future, maintain pH and alkalinity within the ranges designated by CDPHE in its modification decision under Section 11.26(3)(d)(ii) of 5 CCR 1002-11.</p>	<p>Achieved.</p>
3.D	<p>D. LSL Inventory Compliance Metric. <u>Investigate a minimum of 1.4% of the total estimated number of suspected and possible LSLs in the LSL Inventory each Program Year (based on a subset of Y as described in paragraph 3.A above), as adjusted.</u></p> <p>These investigations are performed independently of the LSL replacements.</p>	<p>Achieved.</p> <p>Completed 4,918 investigations independently of the 2022 ALSLR Program.</p>
4.I	<p>I. Accelerated LSL Replacement Compliance Metric. <u>Annually achieve at least a 7.0% cumulative average Program Year LSL replacement rate</u> as determined based on reporting required in paragraph 7.B.</p>	<p>Achieved.</p> <p>Completed 5,119 LSL replacements in 2022.</p>
5.G	<p>G. Filter Communication Compliance Metric. <u>Make direct contact with lead outreach and education materials to 95% of all customers enrolled in the Filter Program in every Program Year. . . Compliance shall be documented by mailing lists and mail receipts, lists of customer email addresses for customers who elect to receive email communication, or other forms of documentation approved by CDPHE.</u></p>	<p>Achieved.</p> <p>Provided outreach and education materials to over 95% of all customers enrolled in the Filter Program.</p>
6.B	<p>B. Comprehensive LRPP Performance Metric. Demonstrate to EPA's satisfaction, using the updated equivalency model results as reported under paragraph 7.C, that the <u>combined actual performance of the LRPP as implemented continues to be "at least as efficient as" orthophosphate treatment in reducing lead exposure on an annual basis.</u> Account for the CCT optimization period in this demonstration.</p>	<p>Achieved.</p> <p>See this report for the model output demonstrating that the LRP is more efficient than orthophosphate treatment.</p>

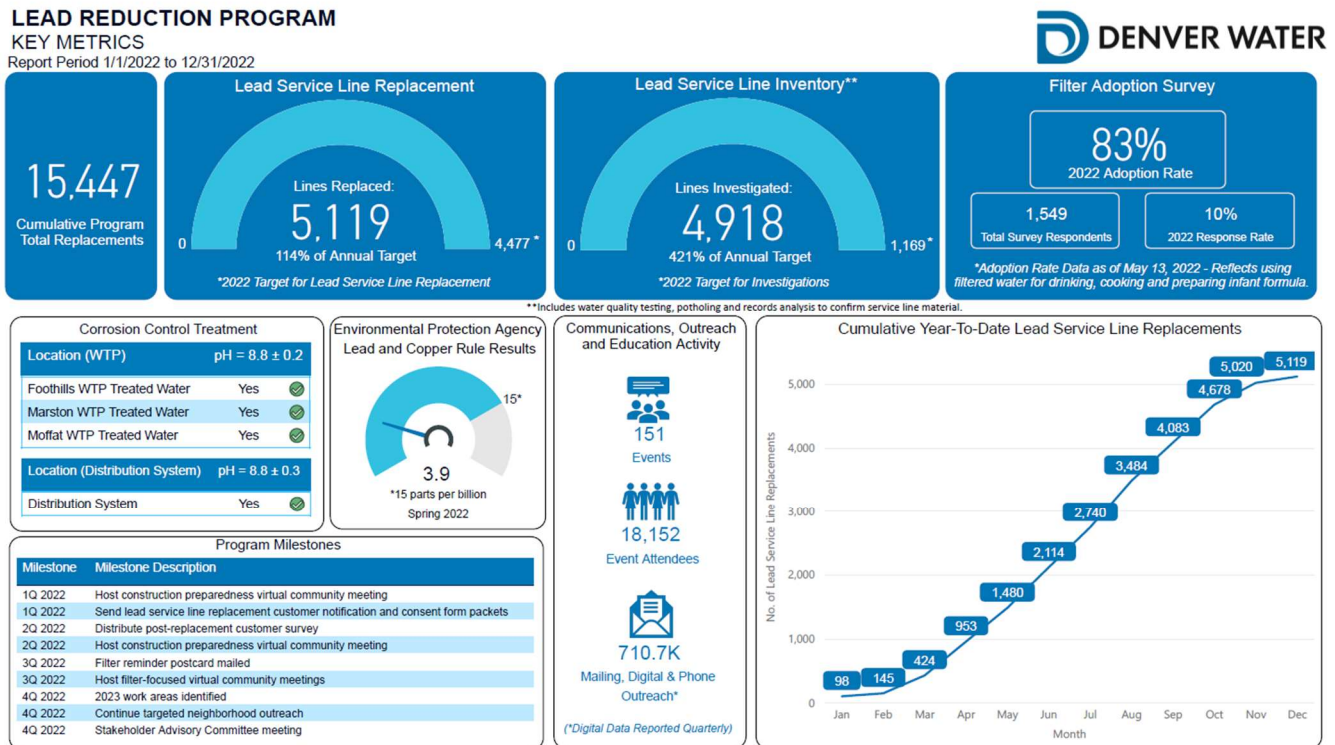
TABLE 5. SUMMARY OF COMPLIANCE METRICS FOR 2022 (DEC. 1, 2022 VARIANCE ORDER)

Paragraph	Description	2022 Results
2.C	<p>C. Corrosion Control Treatment Metric. <u>Maintain pH and alkalinity within the ranges designated by CDPHE. For the entry points to the distribution system, pH must fall within a range of 8.6 to 9.0 and a minimum alkalinity of 20 mg/L as CaCO₃; for distribution location, pH must fall within a range of 8.5 to 9.1 and a minimum of 20 mg/L as CaCO₃.</u></p> <p>CDPHE may modify these required water quality parameters through a modification decision under 5 CCR 1001-11.26(3)(d)(ii).</p>	<p>Achieved.</p>
3.D	<p>D. LSL Inventory Compliance Metric. <u>Investigate a cumulative average of 1.4% of the total estimated number of unknown service lines</u> in the inventory each Program Year from Jan. 1, 2020, to the Variance End Date.</p> <p>These investigations are performed independently of the LSL replacements.</p>	<p>Achieved.</p> <p>Completed 4,918 investigations independently of the 2022 ALSLR Program.</p>
4.I	<p>I. Accelerated LSL Replacement Compliance Metric. <u>Annually achieve at least a 7.0% cumulative average Program Year LSL replacement rate</u> as determined based on reporting required in paragraph 7.B.</p>	<p>Achieved.</p> <p>Completed 5,119 LSL replacements in 2022.</p>
5.G	<p>G. Filter Communication Compliance Metric. <u>Make direct contact with lead outreach and education materials to 95% of all customers enrolled in the Filter Program</u> in every Program Year. . . Compliance shall be tracked by mailing lists and mail receipts, lists of customer email addresses for customers who elect to receive email communication, or other forms of documentation approved by CDPHE.</p>	<p>Achieved.</p> <p>Provided outreach and education materials to over 95% of all customers enrolled in the Filter Program.</p>
6.B	<p>B. Comprehensive LRPP Performance Metric. Demonstrate to EPA's satisfaction, using the updated equivalency model results as reported under paragraph 7.C, that the <u>combined actual performance of the LRPP as implemented continues to be "at least as efficient as" OCCT as that term is used in 40 C.F.R 141.82(E) and as it relates to CDPHE's March 2018 designation of OCCT as orthophosphate treatment for Denver Water, in reducing lead exposure on an annual basis.</u></p>	<p>Achieved.</p> <p>See this report for the model output demonstrating that the LRP is more efficient than orthophosphate treatment.</p>
6.C	<p>C. Health Equity and Environmental Justice (HE and EJ) Compliance Metric. <u>Annually achieve a cumulative Program Year LSL replacement rate in areas with HE and EJ concern that is equal to or greater than the total replacement rate.</u> Denver Water must also <u>make direct contact with lead outreach and education materials to more than 95% of customers</u> as identified in areas with HE and EJ concerns enrolled in the filter program in every Program Year.</p>	<p>Achieved.</p> <p>Completed 3,284 LSL replacements in HE&EJ areas in 2022, equating to a 9.4% cumulative replacement rate.</p> <p>Provided outreach and education materials to over 95% of customers as identified in HE&EJ areas enrolled in the Filter Program.</p>

Performance Dashboard

Denver Water uses a dashboard to communicate key metrics to share the progress of the LRP with the public. The dashboard was posted on Denver Water’s website on Feb. 9, 2023, in both English and Spanish, and currently shows data through Dec. 31, 2022.⁴ The dashboard can be accessed from the Denver Water website at: <https://www.denverwater.org/your-water/water-quality/lead/dashboard>

FIGURE 1. DASHBOARD AS POSTED TO THE DENVER WATER WEBSITE (DATA TO DEC. 31, 2022)



⁴ See the 2020 Second Quarterly Report for an explanation of the metrics used in the dashboard.

PART 2: REQUIRED REPORTING

The gray box at the beginning of each reporting section will include language from the 2019 Variance, unless otherwise noted. Reporting requirements under the new 2022 Variance, effective Jan. 1, 2023, are also included in this report as supplemental information, and are noted as such.

7.B.i CCT

Section 7.B.i of the Variance addresses Denver Water's Corrosion Control Treatment recordkeeping and reporting requirements for 2022 for the following parameters:

i. CCT.

- a. within 90 days of the Effective Date, an elevated lead response plan for approval by CDPHE and EPA in accordance with requirements of paragraph 2.B.iv.*
- b. notification to CDPHE and EPA of elevated lead levels and the actions that Denver Water is taking to reduce drinking water exposure to lead at those locations.*
- c. all lead and copper compliance tap sampling results, as required in Subpart I of 40 C.F.R. Part 141 and 5 CCR 1002-11.26, as well as the results of any customer requested samples;*
- d. CCT water quality parameters for pH and alkalinity, reported monthly no later than the tenth day of the following month; and*
- e. all lead and water quality results collected as part of Denver Water's investigation of LSLs and post LSL replacement and service line material of those sites, reported monthly no later than the tenth day of the following month.*

Text is taken verbatim from the Order, dated Dec. 16, 2019.

Denver Water uses a combination of water quality parameters and lead sampling results to report the performance of CCT. Information that was previously reported as part of the monthly reports for January through December 2022 is not included in this report with the exception of a summary of some of the data.

During this reporting period, Denver Water continued to operate at or near a pH of 8.8 at all three plants. Denver Water also submitted several miscellaneous reports to CDPHE and EPA as required in the LRPP as described in Table 6.

TABLE 6. OVERVIEW OF 7.B.I REQUIREMENTS

Paragraph Reference	Description	Refer to
7.B.i.a	Notify CDPHE of elevated lead levels and actions taken by Denver Water to reduce lead exposure.	See Table 7 and Appendix. ⁵
7.B.i.b	Lead sampling results per the Lead and Copper Rule and from customer requested sampling.	See Table 8 (90 th percentile to date). See monthly reports for June through December 2022 submitted previously. ⁶
LRPP III.E (p 70)	Monthly trending of LCR compliance samples and customer requested samples.	See monthly reports for June through December 2022. ⁷
7.B.i.c	90 th percentile lead levels for LSLs and for copper with lead solder sites.	See Table 8.
7.B.i.d	CCT parameters for pH and alkalinity, reported monthly.	See Table 9. See monthly reports for June through December 2022. ⁷
LRPP III.E (p 70)	Install automated pH control loops at all three treatment plants by March 2020.	All three plants have feedback loops in place and are functioning.
7.B.i.e	All lead and water quality sampling results from investigations for LSLs. All lead and water quality sampling results from post-LSL replacement sampling. Note that lead results from investigations and post-LSL replacement sampling are not included in the calculation of the 90 th percentile lead concentration.	See Table 10 and monthly reports for June through December 2022. ⁷ See Table 11.
LRPP Executive Summary LRPP III.E (p 65)	Targeted communications for select households built between 1983 to 1987 that self-identify as expecting or existing families with formula-fed infants and children up to 2 years of age. Offer water quality sampling; provide filter if lead measured > 3 µg/L (as described in paragraph 5.D).	Described with section 7.B.vi. Outreach materials launched Aug. 21, 2020. See Table 12.
LRPP III.E (p 71)	Complete distribution system modeling, evaluating pH, disinfection by-products and water age by Jan. 31, 2020. Submit nitrification control plan by June 30, 2020, to address sampling, monitoring, and flushing.	Submitted July 6, 2020. Re-submitted July 15, 2021.
Voluntary	Results from continued operation of the pipe racks.	Submitted Feb. 16, 2022.

Denver Water manages lead and water quality samples via its Laboratory Information Management System (LIMS), with analysis performed by either the Denver Water Quality Lab or a contract lab. The sub-program under which the sample was collected is reported in LIMS, including LCR compliance samples, customer requested samples, customer requested samples

⁵ See Appendix CCT-5 Summary of Response to Elevated Lead Levels (Second Six-Month Period of 2022).

⁶ See Appendix REG-2 Copies of Letters for Compliance-Related Submissions (Second Six-Month Period of 2022).

⁷ See REG-2 Copies of Letters for Compliance-Related Submissions (Second Six-Month Period of 2022).

from select households built between 1983 to 1987 (self-identifying as a home with a formula-fed infant), pre-LSL replacement investigative water quality samples and post-LSL replacement water quality samples.

Summary of Actions Taken to Reduce Drinking Water Exposure to Lead at Locations with Elevated Lead Levels [7.B.i.a, b (2019), 7.B.i.a (2022)]

In 2020, Denver Water set the elevated lead investigative response level at 15 and 25 µg/L in LCR compliance and customer requested samples, respectively, under its Elevated Lead Response Plan approved by CDPHE and EPA. Denver Water provides a description in the monthly report of actions taken when this occurs. Denver Water continues to sample the first liter under the LCR, but will transition to fifth-liter sampling in 2024 to meet the requirements of the LCRR.

All customer-requested samples with first draw concentrations above 25 µg/L analyzed by month during the second half of 2022 are listed in Table 7; a detailed summary of responses is provided in the monthly reports for all properties reviewed as part of the Elevated Lead Response Plan.⁸ A lead result over 25 µg/L in the first sample bottle for a customer’s home will trigger follow up and investigative sampling, as outlined in the Corrosion Control Treatment Implementation Plan.⁹ Lead was measured above 25 µg/L in one sample during the reporting period for the second six months of 2022.

TABLE 7. COUNT OF PROPERTIES WITH ELEVATED LEAD CONCENTRATIONS IN LCR AND CUSTOMER REQUESTED SAMPLES¹

Description (Based on Sampling Date)	July 2022	August 2022	September 2022	October 2022	November 2022	December 2022	Response
Properties with Lead >25 µg/L in first 1 L sample bottle	0	0	0	1	0	0	Reported to CDPHE within 10 days and again in monthly report. See Appendix. ¹⁰

¹ Although the Elevated Lead Response Plan applies only to LCR and eligible customer requested samples, the features of the plan are applied to results generated from pre-LSL replacement water quality samples obtained from properties included in the LRP for a consistent customer experience. The actions taken at these properties to investigate elevated lead are described in Appendix CCT-5, Summary of Response to Elevated Lead Levels (Second Six-Month Period of 2022) per the definition used in the Order. Data reflect samples analyzed by Dec. 20, 2022, with actions updated through Jan. 10, 2022.

⁸ See Appendix CCT-5 Summary of Response to Elevated Lead Levels (Second Six-Month Period of 2022) for elevated lead measured in the first bottle of the 3-bottle test.
⁹ See Corrosion Control Treatment Implementation Plan re-submitted to CDPHE on June 4, 2020.
¹⁰ See Appendix CCT-5 Summary of Response to Elevated Lead Levels (Second Six-Month Period of 2022).

Lead Sampling Results from LCR Compliance and Customer Requested Sampling and 90th Percentiles [7.B.i.c (2019), 7.B.i.b and c (2022)]

Data for LCR compliance and customer requested sampling are provided in the individual monthly reports for July through December 2022.¹¹ Data used to calculate the 90th percentile lead concentration in the annual report align with reporting requirements of the LCR. This value may be updated by CDPHE pending their review of data used to calculate the 90th percentile lead concentration for LCR reporting needs.

Per the Dec. 1, 2022, Variance, “90th percentile lead levels overall, for LSLs, and for copper with lead solder sites” are required for reporting. The cumulative 90th percentile lead concentration for LCR compliance samples for the Fall 2022 compliance period (July 1 through Dec. 31, 2022) is presented in Table 8. Denver Water staff continues to collect LCR compliance samples inside customer homes.

TABLE 8. SUMMARY OF LCR 90TH PERCENTILE LEAD CONCENTRATIONS (JULY 1 TO DEC. 31, 2022)

LCR Compliance Results for Lead – Fall 2022 Compliance Period	Result	Number of Homes
LCR Compliance 90th Percentile Lead¹	3.1 µg/L	110
Overall 90th Percentile Lead Concentration using LCR Compliance + Customer Requested Samples²	3.7 µg/L	340 (278 + 62)

¹ Includes results for all LCR compliance samples (from 1951 and older homes plus 1983 to 1987 homes with copper piping and lead solder) and reported in LIMS for the July 1 to Dec. 31, 2022, compliance period. This number matches the December monthly report.

² Includes results from customer requested samples reported in LIMS between July 1 and Dec. 31, 2022, and submitted via the monthly reports. Sampling to support the ALSLR Program is excluded from the compliance calculation by definition. This number matches the December monthly report.

Results from customer requested sampling are included in the overall 90th percentile lead concentration reported in Table 8 and detailed calculations are available in the monthly reports.

¹¹ See Appendix REG-2 Copies of Letters for Compliance-Related Submissions (Second Six-Month Period of 2022).

FIGURE 2. CORROSION CONTROL TREATMENT PERFORMANCE FOR LCR COMPLIANCE AND CUSTOMER REQUESTED SAMPLES

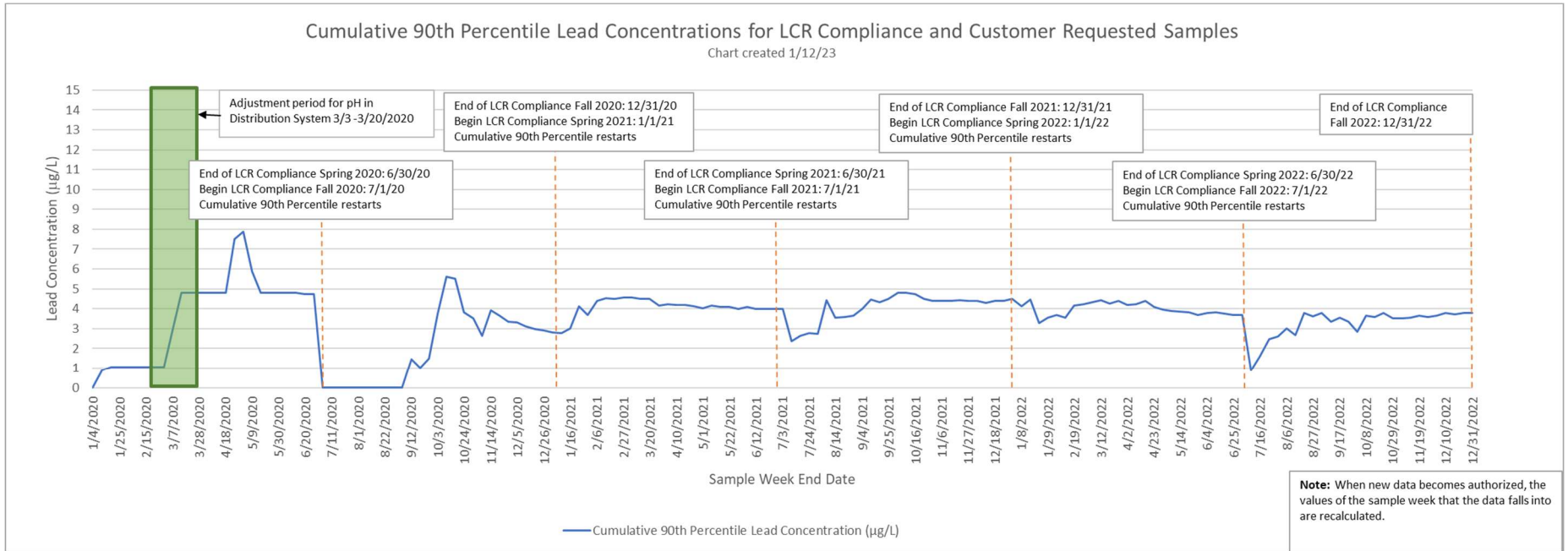
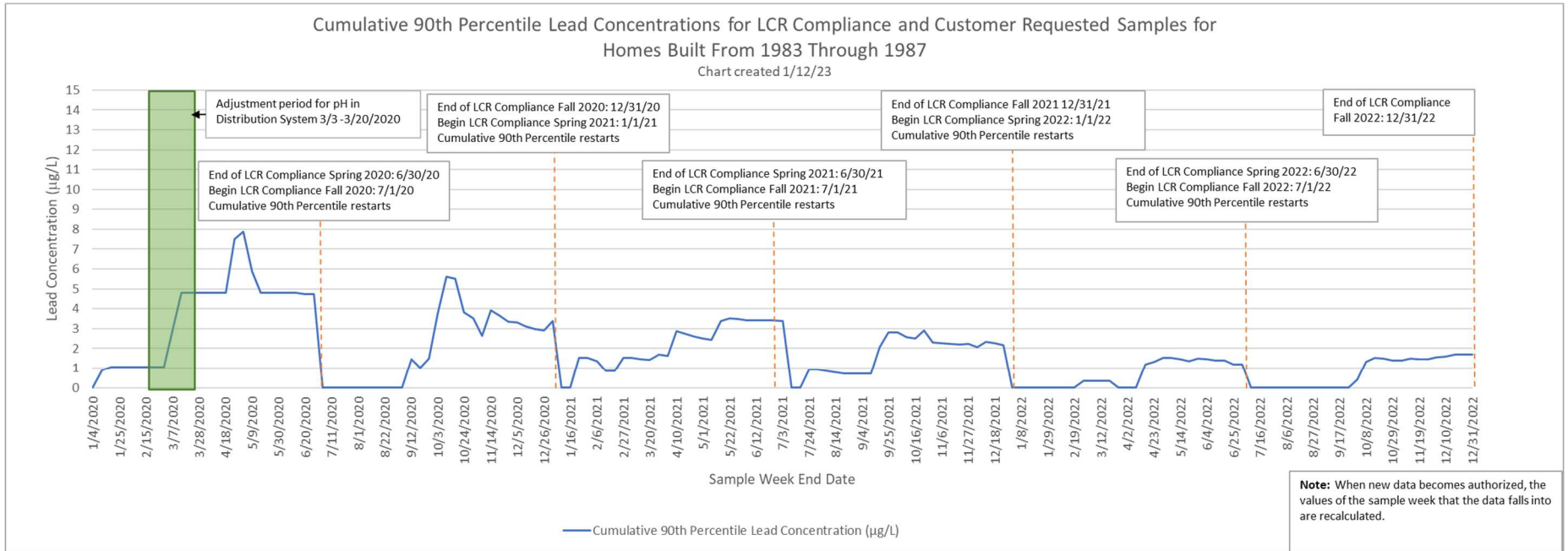


FIGURE 3. CORROSION CONTROL TREATMENT PERFORMANCE AT PROPERTIES WITH COPPER PLUMBING AND LEAD SOLDER



Corrosion Control Treatment Water Quality Parameters for pH and Alkalinity [7.B.i.d]

Chemical feed systems were brought into service for enhanced pH CCT on March 3, 2020, at the Marston and Foothills Water Treatment Plants and on May 1, 2020, at the Moffat Water Treatment Plant. Trends for pH and alkalinity are included in monthly reports since Jan. 1, 2020; operating data with adjusted pH are included in the monthly reports since March 2020. Data for pH in treated water from the active WTPs and the distribution system are summarized in Table 9 based on the lowest daily average pH measured each month from each sampling point. On Aug. 13, 2020, Denver Water wrote to CDPHE that steady state performance of CCT was achieved in the distribution system. One year of data to describe CCT performance was provided to CDPHE on May 6, 2021, including pH and alkalinity data. The treatment targets for pH and alkalinity in the effluent of the three treatment plants and across the distribution system were announced by CDPHE on June 9, 2021. CDPHE established a target of 8.8 ± 0.2 for pH in treated water, 8.8 ± 0.3 for pH in the distribution system, and alkalinity greater than or equal to 20 mg/L as CaCO_3 , all effective July 1, 2021.¹²

TABLE 9. MINIMUM DAILY AVERAGE PH REPORTED EACH MONTH¹

Description	July 2022	August 2022	September 2022	October 2022	November 2022	December 2022
Effluent Variance Requirement	pH 8.8 +/- 0.2 in WTP effluent					
Marston Water Treatment Plant Effluent	8.8	8.8	8.8	8.8	8.8	8.8
Foothills Water Treatment Plant Effluent	8.8	8.8	8.8	8.8	NA ²	8.8
Moffat Water Treatment Plant Effluent	8.8	8.7	8.7	8.7	8.7	8.7
Distribution System Variance Requirement	pH 8.8 +/- 0.3 in distribution system					
Distribution System	pH levels in the distribution have been within 8.8 +/- 0.3 since March 12, 2020. ³					

¹ See monthly reports submitted previously for detailed pH data.

² The Foothills Water Treatment Plant went offline on Oct. 26, 2022, for maintenance and returned online Dec. 14, 2022.

³ See monthly reports from March 2020 through December 2022.

Water Quality Sampling Results from Pre-LSLR Sampling [7.B.i.e]

Results from water quality sampling can provide an indication of lead at single-family residential properties and, when reviewed with additional results from field methods, the status of a service line can be changed in the inventory (i.e., from likely LSL to confirmed LSL).¹³ The three-bottle test is performed¹⁴ at properties in the City and County of Denver and the distributors:

¹² See Appendix REG-2 Copies of Letters for Compliance-Related Submissions (Second Six-Month Period of 2022) for monthly reports.

¹³ See discussion in Section 7.B.ii LSL Inventory.

¹⁴ See individual monthly reports for details and results for pre-LSL replacement sampling efforts.

- To confirm the service line material before LSL replacement at properties included in the 2022 ALSLR Task Orders where lead has not been confirmed (i.e., p-value < 1¹⁵).
- To inform the inventory and predictive model at properties in the City and County of Denver with a likely LSL (i.e., p-value ≥ 0.5 and < 1).
- To support the designation of the service line material at all single-family residential properties within a distributor boundary identified with a likely LSL (i.e., p-value ≥ 0.5 and < 1).¹⁶
- To validate customer comments on the presence (or absence) of an LSL and requests to opt into (or out of) the LRP.

Lead results over 3 µg/L in the second or third sample bottle will trigger a review of inclusion in the LRP, and the property will be added to the list for LSL replacement and added to the Filter Program if not already enrolled.¹⁷ A summary of the water quality results prior to LSL replacements is presented in Table 10. One property measured 1,870 µg/L in the first bottle in October 2022 and had its service line replaced in October 2022.

TABLE 10. SUMMARY OF WATER QUALITY RESULTS¹ PRE-LSL REPLACEMENT AT SINGLE-FAMILY RESIDENCES USING THE 3-BOTTLE TEST

Water Quality Sampling for Investigation (pre-LSL Replacement)	Result for 2022 Year-to-Date	Unit
Total Number of Kits Mailed Out²	15,518	Kits
Total Number of Kits Received and Analyzed to Investigate the Service Line Material³	4,862	Kits
Maximum Lead Concentration Measured Year-to-Date⁴	1,870	µg/L
Average Lead Concentration (in second and third bottles only)⁵	1.9	µg/L

¹ Results from pre-LSL replacement sampling from investigation, verification, and customer requested sampling are included in monthly reports.

² If a sampling kit is re-sent to a property, it is counted twice.

³ As reported in LIMS by Dec. 31, 2022, sample kits collected in 2022 are included in the metric.

⁴ The highest value measured in the second six months of 2022 was 1,870 µg/L (measured in Bottle 1 on Oct. 10, 2022). Pre-LSLR samples, although managed in accordance with the Elevated Lead Response Plan, are documented in the monthly reports and therefore are not documented in Appendix CCT-5, Summary of Response to Elevated Lead Levels (Second Six-Month Period of 2022).

⁵ If a value was reported as less than the detection limit (i.e., < 1 ppb) the measured value was taken as 0.5 µg/L for calculation of the average concentration.

¹⁵ Since July 22, 2020, kits are sent to all properties with a p-value of 0.5 to 0.9. Any property with a p-value < 1 is verified in the field before replacement, using visual inspection of materials at the interior connection and/or potholing on the exterior.

¹⁶ This approach applied to all distributors with one exception. Sampling kits were delivered to 500 residential properties in Consolidated Mutual, although any customer can request a sample kit.

¹⁷ The threshold used as an indicator for a lead service line was reduced to reflect the impact of corrosion control treatment with pH adjustment on lead release measured in water quality samples. Samples collected on May 1, 2020, and after with lead measured about 3 µg/L are considered lead. Samples collected prior to May 1, 2020, are assessed using the original threshold of 5 µg/L.

Water Quality Sampling Results for Post-LSL Replacement [7.B.i.e]

Water quality sampling is offered to all customers approximately four months after LSL replacement. For LSL replacements completed prior to Dec. 31, 2019, letters were mailed to customers to offer post-replacement sampling four months after LSL replacement to single-family, multi-family and commercial properties. Customers could then call Denver Water to request a sampling kit. This process was discontinued on April 2, 2020.

For LSL replacements completed between Jan. 1 and Dec. 31, 2020, single-family residential property customers were automatically mailed a 3-bottle sampling kit approximately four months after replacement and multi-family and commercial properties were mailed a letter offering post-LSL replacement sampling inviting the customer to request a sampling kit. The letter was sent to every unit in a multi-family building.

For LSL replacements completed after Jan. 1, 2021, all single-family, multi-family, and commercial properties receive an offer letter for post-LSL replacement sampling. If the customer elects to participate, single-family properties receive a 3-bottle sampling kit and multi-family and commercial properties receive a 1-bottle sampling kit. A summary of post-LSL replacement sampling offers is provided in Table 11. As of July 2021, only those single-family properties with replacements completed by Denver Water Transmission and Distribution (T&D) crews automatically receive a 3-bottle sampling kit, with offer letters continuing to be mailed to all other residential, multi-family and commercial properties.

**TABLE 11. SUMMARY OF POST-REPLACEMENT SAMPLING OFFERS AND WATER QUALITY
(THROUGH DEC. 31, 2022)**

Water Quality Sampling after LSL Replacement	Count ¹						TOTAL
	July 2022	August 2022	Sept 2022	Oct 2022	Nov 2022	Dec 2022	
Total Number of Letters Mailed to Offer Post-LSL Replacement Sampling^{2,3}	235	143	0	0	861	0	1,239
Total Number of Kits Mailed Out^{2,3}	224	506	549	630	179	9	2,097
Total Number of Kits Received and Analyzed to Confirm post-LSL Replacement Water Quality^{2,4}	19	33	81	93	116	24	366
Total Number of Kits Received and Analyzed to Confirm post-LSL Replacement Water Quality Not Previously Reported	28	0	0	0	0	0	28
Number of Properties with Lead > 15 µg/L in First Bottle² (triggers additional investigation effort)	0	0	1	3	0	0	4
Number of Properties with Lead ≥ 5 and < 15 µg/L in the Second and/or Third Bottle⁵ (triggers additional investigation effort)	0	0	0	0	1	1	2
Number of Properties with Lead ≥ 5 and < 15 µg/L in First Bottle² (triggers customer education)	1	0	1	0	3	3	8

¹ Counts are based on the month of sample collection, per the Order. Not applicable to “Total Number of Letters Mailed to Offer Post-LSL Replacement Sampling” or “Total Number of Kits Mailed Out”, which are based on the date of mailing.

² Applies to single-family and multi-family residences.

³ If a duplicate letter or sampling kit was sent to a property/customer, it is counted twice.

⁴ Total number of kits analyzed refers to results available in LIMS by Dec. 31, 2022, with samples collected since Jan. 1, 2022.

⁵ Applies to single-family residences only.

During this reporting period, 263 properties with a completed LSL replacement did not receive an offer letter or sampling kit and required additional review due to the replacement being performed by a third party, data discrepancies, tap status changes, mailing address errors, etc. In many circumstances, a homeowner or contractor elects to replace a service line as part of redevelopment or renovation, a process that can take several months to complete. Once the data are reconciled, a water quality sampling kit or offer letter is sent to these properties. Due to the added time spent on the additional reviews required, 27 properties did not receive their offer letter within the six-month post-replacement timeline. A detailed list of properties that did not receive the offer and explanation is provided in Appendix CCT-7, including follow-up activities.¹⁸

Post-replacement sampling offer letter mailing lists are created every month by compiling a list of properties from the inventory where the p-value status changed to 0 due to replacement of the LSL four months prior to the month the mailing list is created. The Quality

¹⁸ See Appendix CCT-7 Post LSL Replacement Sampling – Summary of Incomplete Offer to Test (Cumulative since LRP Inception).

Assurance/Quality Control process to determine valid addresses includes evaluating who completed the replacement (i.e., Denver Water T&D crews or ALSLR contractors), if the property is CASS¹⁹ certified, and the initial status of the property in the inventory.

Water Quality Results from Select Households (1983 to 1987 Homes) [5.D]

Section 5.D of the Variance provides that:

... If a formula-fed infant/child up to 24 months of age resides in a Select Household, upon customer request Denver Water must offer free drinking water lead testing. If the water quality results in the first draw sample show lead concentrations above 3 ppb, Denver Water must offer a filter and enough replacement filters and cartridges to last the customer until the child at the Select Household exceeds the age of 24 months. Denver Water will develop and implement a communications, outreach and education program focused on Select Households to make them aware of the opportunity for testing and filters.

Text is taken verbatim from the Order, dated Dec. 16, 2019.

Outreach to customers residing in all households built between 1983 and 1987 was launched in August 2020, with a second round of outreach performed in November 2021. “Select households” are defined as homes built between 1983 to 1987 with copper piping and lead solder and that self-identify as having a formula-fed infant under the age of 24 months. If a customer from a 1983 to 1987 home requests a water quality sampling kit, Denver Water will mail a kit whether or not a formula-fed infant resides at the property. If lead is measured above 3 µg/L, and the customer self-identifies as having a formula-fed infant, the customer is invited to enroll into the Filter Program.

Outreach for water quality sampling in 1983 to 1987 homes was initiated in fall 2020 and resulted in sample requests through early 2021 that were reported in the first 2021 semi-annual report. Follow-up outreach to those properties was conducted in November 2021 to remind customers of the opportunity to request a free water quality sampling kit if they have a formula-fed infant in the home. In 2022, 84 sample kit requests were received, and 45 sample kits were subsequently returned and analyzed. Lead was measured greater than 3 µg/L in the first bottle for three properties, but none of these new properties defined as a select household were enrolled in the Filter Program.²⁰ Results recorded in LIMS by Dec. 31, 2022, are presented in Table 12. The annual reminder mailing to customers in 1983 to 1987 homes on the opportunity for water quality sampling was distributed on Oct. 14, 2022.²¹

¹⁹ CASS (Coding Accuracy Support System) is used by the United States Postal Service to verify and improve the accuracy of an address and its associated zip code.

²⁰ See Appendix CCT-8 Summary of Water Quality Sampling Results from Select Households (1983 to 1987 Homes, Cumulative since LRP Inception).

²¹ See Appendix COE-18 1983-1987 Homes Reminder Postcard.

TABLE 12: SUMMARY OF WATER QUALITY RESULTS FROM SELECT HOUSEHOLDS

Year	Number of Customers Contacted by Mail	Number of Customer Requested Samples ¹	Number of Kits Received and Analyzed for Lead	Number of Properties with Lead > 3 µg/L	Number of Properties Self-Identified with Formula-fed Infant and Enrolled in Filter Program ²
2020	38,477	319	150	7	2
2021	36,723	197	100	8	1
2022 ³	36,723	84	45	3	0

¹ Number of Customer Requested Samples is based on the Test Kit Sent Date.

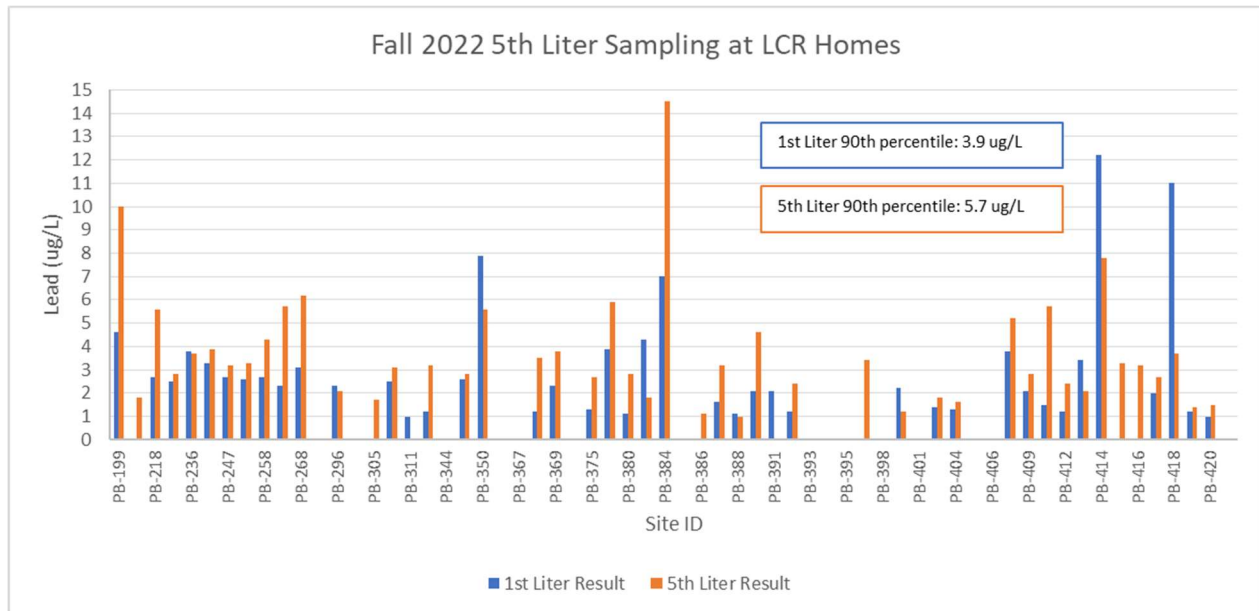
² Select Households receive enough replacement filter cartridges to meet the formula preparation needs for infants up to 24 months and distribution of additional replacement filter cartridges are not provided as part of the Filter Program.

³ Total number of kits analyzed refers to results available in LIMS between Jan. 1 to Dec. 31, 2022.

5th L Sample Collection

During the fall 2022 LCR compliance sampling round, technicians collected five 1 L sequential samples at 62 properties with an LSL included in the LCR study pool in preparation for new sampling protocols described in the EPA Lead and Copper Rule Revisions (LCRR) published in January 2021. Results are shown in Figure 4 and Table 13. Lead was measured less than 1 µg/L in the 5th L at 17 properties, most of which also measured less than 1 µg/L in the first draw. The results of Figure 4 were compared to results described in the LRPP which included sampling using ten sequential samples. In general, the 5th L profile sampling suggests the first draw (i.e., the compliance sample under the existing LCR) does not capture the highest lead concentrations within a service line. One home had concentrations as high as 14.5 µg/L in the fifth draw and two homes had concentrations greater than 10 µg/L but less than 15 µg/L in the first draw. All results are an indication that the CCT component of the LRP is effective and CCT practices are expected to meet the needs of the LCRR.

FIGURE 4. FIRST AND FIFTH LITER RESULTS FOR LCR SAMPLES COLLECTED FOR THE LEAD AND COPPER STUDY¹



¹ If there is no date shown for a site, results were <1.0 µg/L. For the purpose of the 90th percentile calculation, these results were replaced with 0 µg/L.

TABLE 13. OVERVIEW OF 5TH LITER SAMPLING DATA IN FALL 2022

5 th L Sampling in 2022		Count
Total Number of Properties Sampled for 5th L		62
Number of Properties with inconclusive data (all results <1.0)		16
Number of Properties where the 5th L < 1st L concentration		7
Number of Properties where the 5th L > 1st L concentration		36

7.B.ii LSL Inventory

Section 7.B.ii of the Variance requires that Denver Water maintain records and report the following information with respect to its LSL Inventory:

ii. LSL Inventory.

- a. total number of service lines;*
- b. the total number of replaced LSLs during the variance;*
- c. the total number of known, suspected, and possible LSLs;*
- d. the total number of unlikely LSLs;*
- e. the total number of non-LSLs, indicating the number designated as non-LSLs solely based on statistical factors;*
- f. the number of Investigations conducted each year, demonstrating that the minimum 1.4% verification rate has been met;*
- g. an updated service line inventory map; and*
- h. the rationale for a change in the status of a service line in the inventory (e.g., Investigation, replacement, water quality data).*

Text is taken verbatim from the Order, dated Dec. 16, 2019.

An overview of the LSL Inventory reporting requirements is shown in Table 14.

TABLE 14. OVERVIEW OF 7.B.II REQUIREMENTS

Paragraph Reference	Description	Refer to
3.A	Continue to maintain on an ongoing basis an inventory of the material of each service line connected to the public water distribution system that is a confirmed or likely LSL. By October 16, 2024, Denver Water must have conducted an initial inventory that complies with the service line inventory requirements in 40 C.F.R. § 141.84(a).	Refer to Table 15. In progress.
3.C	Continue to provide public access to its LSL inventory on its external customer website and update at least annually. By October 16, 2024, the inventory must list by specific street address which service lines are lead, galvanized requiring replacement, non-lead, or lead status unknown.	Re-posted on Jan. 3, 2023, using data through Dec. 28, 2022. In progress.
7.B.ii.a.1	Total number of LSLs and GRR.	Refer to Table 15. See Appendix. ²²
7.B.ii.a.2	Total number of replaced LSLs during the Variance.	Refer to Table 16.
7.B.ii.a.3	Total number of confirmed and likely LSLs.	Refer to Table 15.
7.B.ii.a.4	Total number of unlikely LSLs.	Refer to Table 15.
7.B.ii.a.5	Total number of non-LSLs. Total number of non-LSLs determined solely by statistical methods.	Refer to Table 15. Described after Table 15.
7.B.ii.b 3B, 3.D	Number of investigations that supports a determination of the material of the service line and that are performed independently of an LSL replacement or not at the request of the customer.	Refer to Table 21.
LRPP III.B (p 51)	Use results from investigations to update the predictive model which is used to plan and prioritize efforts of the COE Plan, ALSLR Program and Filter Program.	See Section 7.B.vii.
7.B.ii.c	Updated LSL Inventory Map.	https://www.denverwater.org/your-water/water-quality/lead
7.B.ii.d	Rationale for change to status of the service line in the LSL Inventory.	See Appendix. ²³

Current LSL Inventory [7.B.ii.a, c, d, and e (2019), 7.B.ii.a, b, c, and d (2022)]

The initial LSL Inventory designating known, suspected, and possible LSLs was submitted on Feb. 5, 2020. The base LSL Inventory was updated using additional information and further analysis of the data presented in the September 2019 LRPP (see Table 15). Adjustments to the status of a service line (i.e., lead or non-lead) are made based on a desktop assessment completed with Denver Water records, customer records, and individual distributor records (i.e., total service, read and bill, and master meter); potholing results; and water quality sampling

²² See Appendix INV-6 Summary of Service Line Status and p-Value (Second Six-Month Period of 2022).

²³ See Appendices INV-7A Line by Line p-Value Changes: Status Descriptions and Notes (Second Six-Month Period of 2022) and INV-7B Line by Line p-Value Changes by Status (Second Six-Month Period of 2022).

results. The information presented in Table 15 is used to compare the current understanding of the inventory with the original base inventory submitted in September 2019. The inventory is used to establish the total number of estimated lead services and the mandated annual number of replacements. Therefore, the total number of “confirmed LSLs” includes the number of properties with a known lead service that remain in the ground and those that have been replaced by the LRP.

The LCRR defines Galvanized Requiring Replacement (GRR) as where a galvanized service line is or was at any time downstream of a LSL or is currently downstream of a “Lead Status Unknown” service line. Currently, Denver Water does not have a defined method to prove that lead was never upstream and that a galvanized line does not require replacement. Denver Water replaces all galvanized service lines where found as a precaution. If lead is identified in any part of the service line (main to meter, meter to home, interior inspection), regardless of another material being identified, the service line is categorized as an LSL and is replaced. Because of this protocol, there are technically galvanized service lines that require replacement that are categorized as an LSL and not a GRR. It is important to note that Denver Water’s service area contains a substantial number of properties with lead found main to meter and galvanized found meter to home. Ongoing investigations have also shown that there are a substantial number of properties where only copper is found to be upstream of a galvanized section of service line.

Consequently, the program currently defines GRRs as properties that are a combination of galvanized with copper or another material (i.e., PEX), but do not contain any known lead. Denver Water continues to explore these properties through record review, water quality sampling, potholing, and interior inspections to identify trends.

In order to prepare for the Oct. 16, 2024, deadline which establishes new requirements for an initial inventory, GRRs have been included below in Table 15.

TABLE 15. LEAD SERVICE LINE INVENTORY AS OF DEC. 31, 2022

Status of Service Line	Sept. 6, 2019 Submittal (Aug. 8, 2019 Data)	Feb. 5, 2020 Submittal (Jan. 28, 2020 Data)	Jan. 29, 2021 Submittal (Dec. 30, 2020 Data)	Jan. 28, 2022 Submittal (Dec. 30, 2021 Data)	Feb. 10, 2023 Submittal (Dec. 31, 2022 Data)
	BASE INVENTORY ¹	INITIAL INVENTORY	2020 ANNUAL REPORT ²	2021 ANNUAL REPORT ²	CURRENT INVENTORY ³
Confirmed LSL <i>(previously referred to as Known Lead)</i>	1,066	1,149	7,507 ⁴	13,275 ⁴	14,421 ⁴
GRR⁵	<i>(Included with Confirmed LSL count)</i>				2,760
Likely LSL <i>(Suspected Lead + Possible Lead)</i>	83,480	82,337	74,072	66,732	58,405
<i>Suspected Lead⁶</i>	61,374	60,549	54,178	48,224	--
<i>Possible Lead⁶</i>	22,106	21,788	19,894	18,508	--
Unlikely LSL	89,388	90,745	88,475	88,049	87,589
Non-LSL⁷	145,766	146,528	150,642 ⁷	152,623 ⁷	157,535 ⁸
Total Number of Services	319,700	320,759	320,696	320,679	320,710
TOTAL ESTIMATED Number of Lead Service Lines	63,955	63,195	63,211	63,276	60,788⁹

¹ The “base inventory” is the basis for the 7% LSL replacements per year.

² The “annual inventory” is used in the application of the equivalency model to evaluate the performance of the LRP.

³ The “current inventory” is the basis of enrollment in the Filter Program (calculated as the sum of the properties with a confirmed or likely LSL, plus distribution of additional filters to multiple units at the same property and less the number of vacant properties).

⁴ The 2020 Annual Report, the 2021 Annual Report, and the current inventory counts for “confirmed LSL” include properties that are either known to be lead or that have had a LSL replaced. The 13,733 properties categorized as “confirmed LSL” in the current inventory were replaced since program inception (see Table 16 and Table 24). Due to ongoing data integration and QC processes, 50 of the 13,733 properties identified as confirmed replacements remain to be integrated into the LRP database to drive a p-value change to 0. Of these 50, one remains as “unlikely LSL”, 28 as “likely LSL”, three as “confirmed LSL”, and 18 are described as non-active or non-potable (coded as NULL). The counts for these categories in the current inventory (most right column) have been reduced accordingly.

⁵ Previous inventory reporting counted GRRs under the “confirmed LSL” count. GRRs include galvanized-galvanized (19 properties), copper-galvanized (2,687 properties), and galvanized-copper (54 properties) service lines. Properties with galvanized (and no lead) identified in potholing but had water quality results > 2.5 ppb lead are included in this number.

⁶ The terms “suspected” and “possible” lead will not be used within this table in 2023.

⁷ The “non-LSL” count currently does not include properties where galvanized was identified but did not require replacement (lead was never upstream of the galvanized service line). Denver Water plans to assess their processes in 2023 for galvanized service lines to identify which galvanized service lines require replacement.

⁸ The 2020 Annual Report, the 2021 Annual Report, and the current inventory counts for “non-LSL” do not include the properties at which the LSL was replaced as part of the LRP (see Table 16 and Table 24), as these are already included in the count for “confirmed LSL”.

⁹ See Appendix INV-6 Summary of Service Line Status and p-Value (Second Six-Month Period of 2022) for details on how this was calculated.

Of the 157,535 service lines identified as non-lead in the current inventory (see Table 15), 107,567 are included in this category based solely on statistical assumptions such as the age of

the house, history of development in the Denver Water service area, operating rules requiring copper at post-1971 properties, water main tap date, etc.²⁴ Properties built or connected between 1951 and 1971 are considered “unlikely LSL” based on historical records and evidence of non-lead materials.²⁵

Number of LSL Replacements Completed and Incorporated into the Inventory [7.B.ii.b (2019), 7.B.ii.d (2022)]

The total number of LSLs replaced between June 4 and Dec. 31, 2022, is shown in Table 16. Denver Water does not count the replacement of copper service lines (i.e., non-LSL) toward the total number of LSL replacements for compliance purposes.²⁶

TABLE 16. NUMBER OF LSL REPLACEMENTS BETWEEN JUNE 4 AND DEC. 31, 2022

Description	Count ¹
Number of LSLs Replaced in June 2022 (June 4 to June 30, 2022)	558
Number of LSLs Replaced in July 2022	626
Number of LSLs Replaced in August 2022	744
Number of LSLs Replaced in September 2022	599
Number of LSLs Replaced in October 2022	595
Number of LSLs Replaced in November 2022	342
Number of LSLs Replaced in December 2022	99
Total Number of LSLs Replaced in the Second Six Months of 2022	3,563
Total Number of LSLs Replaced in 2022	5,119
Number of LSLs Replaced not Previously Reported ²	14
Total Number of LSLs Replaced since inception of LRP on Jan. 1, 2020	15,447

¹ The number of replacements identified in the “Lead Replacement” column of Appendix INV-7B (Line by Line p-Value Changes by Status, Second Six-Month Period of 2022) does not match the number of LSL replacements shown in Table 16 due to a lag in the quality assurance review during data integration from field replacements to LRP database.

² This includes the net change to the number of LSL replacements completed in the first six months of 2022 not previously reported (13 added), LSL replacements completed in 2021 not previously reported (one added), and previously reported LSL replacements that upon review were removed (no deductions); see Appendix LSL-9 Addresses and Types of Replacements for Properties Not Previously Counted and Duplicates (From 2021 and First Six-Month Period of 2022) for details.

Investigations of Service Line Material [7.B.ii.f (2019), 7.B.ii.b (2022)]

Section 3.D of the Dec. 1, 2022, Order requires that “Denver Water . . . [i]nvestigate a cumulative average of 1.4% of the total estimated number of unknown service lines in the inventory each Program Year. . . .”

²⁴ This is the number which retains the original number of non-lead properties (p-value = 0) from the inventory in the Lead Reduction Program Plan (see Appendix III.B.2, Preliminary Identification of Lead Service Lines).

²⁵ See Appendix II.B.2 of the Lead Reduction Program Plan for details and assumptions.

²⁶ See paragraph 4.B of the Variance Order and the notes for the column “Actual Previous Materials” in Appendix LSL-6 Addresses and Types of Replacements (Second Six-Month Period of 2022).

Denver Water continues to conduct investigations of LSLs and make refinements to the LSL Inventory of service line materials connected to its water system. Investigations are performed at properties to improve the assumptions that were used to develop the LSL Inventory.

Investigations are counted by investigation type and may include desktop evaluation of available data from Denver Water, assessors, permits, distributors, and customers; water quality sampling; potholing and/or visual investigation. After 15 years of the LRP, there should be no remaining properties in the LSL Inventory categorized as likely LSL and all confirmed LSLs should be replaced.

Definitions used to categorize the service line material:²⁷

Confirmed LSL	based upon direct evidence that gives a 100% estimated probability per the LRPP that a service line is an LSL or a “galvanized requiring replacement” service line.
Likely LSL	based upon available data that provides an estimated probability value between 50 to 99% that a service line is an LSL or a “galvanized requiring replacement” service line.
Unlikely LSL	based on conflicting or missing data that provides an estimated probability value between 1% to 49% that a service line is an LSL based on the LRPP; or a “galvanized requiring replacement” service line.
Non-Lead	0% likelihood of finding lead.

The number of investigations to support a determination of the service line material are counted toward the required 1.4% of the LSL Inventory investigated each year.

An investigation is counted if all the following conditions apply:

- 1) The property is originally classified as a likely LSL.
- 2) The investigation was performed independently of LSL replacement and not as part of the 2022 ALSLR Plan²⁸.
- 3) The investigation was not the result of a customer requested water quality sample.

A three-point investigative process is used to determine the status of a service line:

- 1) Pothole between the main to water meter and again between the water meter to the building.
- 2) Visual inspection inside the building where the service line enters.

²⁷ As defined in paragraphs 1.C, 1.P, and 1.X of the Order, dated Dec. 1, 2022, for confirmed LSL, likely LSL, and unlikely LSL, respectively. Note that the definition of non-lead was not provided in the Order. These are consistent with the terminology used on Denver Water’s public inventory, which was first published in March 2020.

²⁹ The 2022 ALSLR Plan accounts for replacements completed by the ALSLR contractors and Denver Water’s T&D on planned water main projects. Material verification efforts undertaken at properties included in the 2022 ALSLR Plan do not count toward the mandatory number of investigations of clause 3.D.

3) Sample for water quality.

Potholing can be used in combination with other investigative methods to determine that a property is designated “lead” or “non-lead” (i.e., p-value of 1 or 0, respectively). To confirm “non-lead”, there can be no lead or galvanized visually observed from potholing and interior inspections and there can be no contradictions with the desktop records review and/or water quality sampling results.

In some cases, additional investigative steps are necessary to confirm non-lead. A four-point or five-point investigative process is used when either the interior inspection is not possible and/or water quality testing is inconclusive (between 1 and 3 µg/L) or not available.

A four-point investigative process may be used to determine the material of a service line and includes four visual confirmations of the material:

- 1) Two potholes from the main to water meter.
- 2) Two potholes from the water meter to the building.

A five-point investigative process may be used to determine the material of a service line and includes the following confirmations of the material:

- 1) Two potholes from the main to water meter.
- 2) Two potholes from the water meter to the building.
- 3) Inspection at the interior connection OR a non-detect water quality sample result (less than 1 µg/L).

Verification potholing is used at properties included in the 2022 ALSLR Plan to confirm the material of the service line before replacement. Investigative potholing is used at properties to improve the knowledge of the inventory at properties that are not included in the 2022 ALSLR Plan. As of Aug. 10, 2020, all likely LSLs ($p\text{-value} \geq 0.5 < 1$) are verified prior to replacement, with potholing and/or water quality sampling, to reduce the likelihood of replacing a non-LSL.

Results from verification potholing are presented in Table 17 along with the next steps to either replace a service line that is confirmed to be lead or to pursue additional investigative methods. If copper is observed at three or more points used for verification (e.g., copper is observed at two exterior potholes and at the interior connection), the service line is not categorized and the p-value is not adjusted; rather, the property is subjected to additional investigation efforts (i.e., water quality sampling, data review, additional potholing) to identify the service line material.

**TABLE 17. OUTCOMES FROM VERIFICATION POTHOLING¹ AS PART OF THE 2022 ALSLR PLAN
(JUNE 4 TO DEC. 31, 2022)**

Service Line Status before Potholing	Potholing Outcome	Update Inventory and Follow-up Action
Initial Status $p \geq 0.8$ (total 2,833)	1,994 confirmed lead (lead observed in at least one point).	Property is confirmed for 2022 ALSLR Plan.
	471 inconclusive (copper observed at three or more points).	Review historical and water quality data to confirm status. ²
	368 incomplete (could not pothole the minimum three points).	Return to property or find a way to obtain third point. Or proceed with other investigation to confirm status.
Initial Status $0.5 \leq p < 0.8$ (total 582)	207 confirmed lead (lead observed in at least one point).	Property is confirmed for 2022 ALSLR Plan.
	229 inconclusive (copper observed at three or more points).	Review historical and water quality data to confirm status. ²
	146 incomplete (could not pothole the minimum three points).	Return to property or find a way to obtain third point. Or proceed with other investigation.
Total Number of Properties Potholed and Included in the 2022 ALSLR Program (Verification Potholing)		3,441 ³

¹ Potholing to verify the material of the service line at premises included in the 2022 ALSLR Plan does not contribute to the required 1.4% investigations. See Appendix INV-8 Results from Potholing for Verification as part of the 2022 ALSLR Program (Second Six-Month Period of 2022).

² In some cases, the standard for the five-point investigative process was met, meaning water quality may not have been needed to confirm non-lead status.

³ Includes 26 premises with initial p-values less than 0.5 in the Feb. 20, 2020, Inventory (from Table 15) that were subsequently increased to greater than or equal to 0.5 and therefore eligible for potholing as part of the ALSLR Plan. Five of the 26 premises have p-values that remain greater than or equal to 0.5, three had their p-values changed to 0 due to potholing, and 18 had their p-values changed to 0 due to replacement as part of the ALSLR Plan (3,415 + 26 = 3,441).

During the second six months of 2022, investigative potholing was performed at 1,116 properties not included in the 2022 ALSLR Plan.²⁹ Results are included in Table 18, 72 of which confirmed copper, and 431 of which confirmed lead. Denver Water investigated critical customer properties in advance of replacement: if lead is found, the property is scheduled for replacement in 2022 and therefore the investigation is considered a verification pothole and does not contribute to the required number of annual investigations.

²⁹ See Appendix INV-9 Results from Potholing for Investigations not part of the 2022 ALSLR Program (Second Six-Month Period of 2022).

TABLE 18. OUTCOMES FROM INVESTIGATIVE¹ POTHOLING INDEPENDENT OF THE 2022 ALSLR PLAN FROM JUNE 4 TO DEC. 31, 2022

Service Line Status before Potholing	Potholing Outcome²	Update Inventory and Follow-up Action
Initial Status $0.5 \leq p \leq 0.9$ (total 1,114)	431 confirmed lead (lead observed in at least one point).	Add property to list for LSL replacement.
	611 confirmed copper (copper observed at all points).	If water quality is non-detect, then remove property from LRP.
	72 incomplete (could not complete observation at all points).	Return to property to obtain all observation points. Or proceed with other investigation.
Initial Status $p < 0.5$³ (total 2)	0 confirmed lead (lead observed in at least one point).	Add property to list for LSL replacement.
	0 confirmed copper (copper observed at all points).	Remove property from LRP.
	2 incomplete (could not complete observation at all points).	Return to property to obtain all observation points. Or proceed with other investigation.
Total Number of Properties Potholed Independent of the 2022 ALSLR Program (Investigative Potholing, Second Six Months Only)		1,116

¹ Potholing to investigate the material of the service line at properties not included in the 2022 ALSLR Plan contributes to the count of the required 1.4% investigations.

² The number of potholes completed as shown in Appendix INV-7B Line by Line p-Value Changes by Status (Second Six-Month Period of 2022) does not match data shown in this table due to a time lag between field activities and the data being collected, reviewed, confirmed, and added to the LRP database.

³ This includes critical customers that were originally assigned a p-value < 0.5. Two critical customers under this category were potholed in the second six months of 2022.

Results for water quality sampling at properties included in the 2022 ALSLR Plan are presented in Table 19 (i.e., verification pre-LSL replacement sampling) and results from properties not included in the 2022 ALSLR Plan are presented in Table 20 (i.e., investigative sampling). As of Feb. 25, 2021, results from water quality sampling are assessed against a reduced threshold concentration used to indicate lead in pre-LSL replacement samples. A lower threshold was selected because of the degree of lead reduction achieved when pH is consistently maintained at 8.8 ± 0.3 across the distribution system.³⁰ This means that any sample collected on or after May 1, 2020, with lead measured above 3 µg/L in the second or third bottle of the 3-bottle test is considered conclusive for an LSL. Lead measured below this threshold at properties with an initial status of likely LSL (i.e., p-value ≥ 0.5) is inconclusive for non-lead and additional investigations or review of data are needed to determine the status of the service line material. Lead measured below this threshold at properties with an initial status of unlikely lead (i.e., p-value < 0.5) is considered conclusive for non-lead and no additional investigations are undertaken and the property is not added to the LRP. Finally, lead measured below the detection limit of 1 µg/L is also considered indicative of non-lead when and only when copper is observed at three or more points. In summary, whereas water quality sampling above 3 µg/L is conclusive

³⁰ See monthly reports and Appendix REG-2 Copies of Letters for Compliance-Related Submissions (Second Six-Month Period of 2022).

for lead, additional steps are taken to confirm non-lead and the p-value is not reduced to 0 based on water quality results alone.

TABLE 19. OUTCOMES FROM WATER QUALITY INVESTIGATIONS¹ AS PART OF THE 2022 ALSLR PLAN (JUNE 4 TO DEC. 31, 2022)

Service Line Status in Base Inventory	Water Quality Sampling Outcome	Update Inventory and Follow-up Action during Second Six-Month Period of 2022
Initial Status 0.5 ≤ p ≤ 0.9 (total 175)	48 confirmed lead (lead measured > 3 µg/L in the second or third sample bottle from the 3-bottle test).	Add property to list for LSL replacement.
	127 inconclusive (lead measured ≤ 3 µg/L in the second or third sample bottle from the 3-bottle test).	Review historical and potholing data to confirm status. Or proceed with other investigation.

¹ Excludes customer requested sample results. These samples were collected at properties included in the 2022 ALSLR Plan (and therefore do not count toward the required 1.4% investigations).

TABLE 20. OUTCOMES FROM WATER QUALITY INVESTIGATIONS¹ INDEPENDENT OF THE 2022 ALSLR PLAN (JUNE 4 TO DEC. 31, 2022)

Service Line Status in Base Inventory	Water Quality Sampling Outcome	Update Inventory and Follow-up Action during Second Six-Month Period of 2022
Initial Status 0.5 ≤ p ≤ 0.9 (total 2,819)	557 confirmed lead (lead measured > 3 µg/L in the second or third sample bottle from the 3-bottle test)	Add property to list for LSL replacement.
	2,262 inconclusive (lead measured ≤ 3 µg/L in the second or third sample bottle from the 3-bottle test)	Review historical and potholing data to confirm status. Or proceed with other investigation.

¹ Excludes customer requested sample results. These samples were collected at properties independent of the 2022 ALSLR Plan and therefore do count toward the required 1.4% investigations, if the conditions that define an investigation are met.

All other investigations that support the determination of a service line material that count toward the 1.4% required investigations were made using desktop methods, as shown in Table 21. In summary, desktop investigations were used to support the determination of material designation of likely LSL at 47 properties during the second six-month period of 2022.³¹

³¹ See Appendix INV-7B Line by Line p-Value Changes by Status (Second Six-Month Period of 2022).

TABLE 21. NUMBER OF INVESTIGATIONS PERFORMED TO DETERMINE THE MATERIAL OF THE SERVICE LINE BETWEEN JUNE 4 AND DEC. 31, 2022

Number of Properties Investigated	Count
Required Number of Investigations (2019 Variance)	1,169 (1.4% of all suspected and possible lead services from the September 2019 inventory)
Required Number of Investigations (2022 Variance)	2,421 (cumulative 1.4% of all unlikely and likely LSLs from the September 2019 inventory)
Number of Investigative Potholing in the Second Six Months of 2022 as reported in the LRP database (from Table 18) ¹	1,116
Number of Investigative Water Quality Sampling in the Second Six Months of 2022 as reported in the LRP database (from Table 20) ²	2,819
Number of Desktop Investigations in the Second Six Months of 2022	47
Total Number of Investigations Completed in the Second Six Months of 2022	3,982
Number of Investigations Not Previously Reported	0
Total Number of Investigations Completed in 2022	4,918

TABLE 22. YEAR OVER YEAR COMPARISON OF INVESTIGATIONS

	2020	2021	2022
Total Number of Investigations	3,326	4,562	4,918
Number of Investigations Reported after Submission of the Annual Report³	0	0	0
Cumulative Total Number of Investigations	3,326	7,888	12,806
Cumulative Average Annual Investigations at End of Program Year⁴	3,326	3,944	4,269 (2.5% of 172,868)

¹ From the Annual Report for 2020.

² From the Annual Report for 2021.

³ Investigations in 2020 and 2021 not previously reported occurred at properties confirmed after the data cut-off used to prepare the reports.

Updated LSL Inventory Map [7.B.ii.g (2019), 7.B.ii.c (2022)]

On March 5, 2020, the LSL Inventory was made publicly available on the Denver Water lead website (<https://www.denverwater.org/your-water/water-quality/lead>).

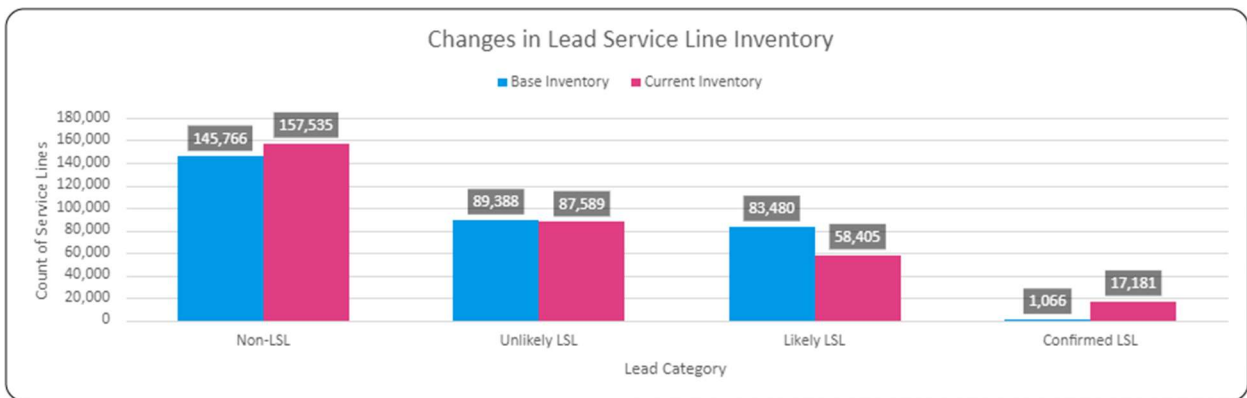
On Jan. 3, 2023, the publicly available map was updated and reposted, incorporated the Dec. 28, 2022, LSL Inventory. An updated inventory summary table is provided with each semi-annual report.³² The website map is updated quarterly to reflect these changes to the LSL Inventory and will be updated and re-posted in the spring.

³² See Appendix INV-6 Summary of Service Line Status and p-Value (Second Six-Month Period of 2022).

Summary of Changes to the LSL Inventory [7.B.ii.h (2019), 7.B.ii.d (2022)]

Between June 4 and Dec. 31, 2022, updates to the LSL Inventory continued as additional data were gathered and reviewed. During this period, 6,278 changes were made to the LSL Inventory of which 6,254 were changes to the status of the service line (i.e., p-value).³³ This included changes based on confirmation from Denver Water, customers, and distributors; review of historical data; direct evidence such as water quality and/or potholing; and replacements. In addition to material status changes, seven service lines were removed from the inventory as tap cuts or non-potable service connections. Service lines previously deemed inactive were added back to the inventory upon review of the data, affecting 17 properties in this reporting period.³⁴ These changes are shown in Figure 5 and are accounted for in Table 15.

**FIGURE 5. CHANGES IN THE BASE AND CURRENT INVENTORY
(JUNE 4 TO DEC. 31, 2022, USING DATA FROM COLUMNS 2 AND 5 FROM TABLE 15)¹**



¹ Confirmed LSL is the count of the Current Inventory in Table 15 for “Confirmed LSLs” plus “GRRs” (14,421 + 2,760 = 17,181). Table 15

³² See Appendix INV-7B Line by Line p-Value Changes by Status (Second Six-Month Period of 2022).

³⁴ See Appendix INV-7B Line by Line p-Value Changes by Status (Second Six-Month Period of 2022).

7.B.iii LSL Replacements

Section 7.B.iii of the Variance requires that Denver Water report and maintain records of LSL replacements, including the following:

iii. LSL Replacements.

- a. the address and date of all LSL replacements occurring during the variance, including by year;*
- b. the type of LSL replacement (full, partial including galvanized, by third party);*
- c. the unique customer identification number of Customer Premises on the refusal list and documented attempts to contact the property owner; and*
- d. those Customer Premises where Denver Water performed a partial LSL replacement due to an emergency repair and property owner consent could not be obtained.*

Text is taken verbatim from the Order, dated Dec. 16, 2019.

Replacements under the ALSLR Program started on March 5, 2020, and results from June 4 to Dec. 31, 2022, are described in this section. An overview of the LSL replacement requirements is shown in Table 23.

TABLE 23. OVERVIEW OF 7.B.III REQUIREMENTS

Paragraph Reference	Description	Refer to
4.E	Offer post-LSL replacement sampling within six months.	Ongoing.
7.B.iii.a	Address and date of all replacements.	See Appendix. ³⁵
7.B.iii.b	Type of replacement.	See Table 24 and Appendix. ³⁶
7.B.iii.c 4.H	Refusal list with service point ID and documented attempts for customer contact. Track changes in customer account holders against Service Line Refusal List.	See Appendix. ³⁶
LRPP III.D (p 62)	Provide education and filters to residents of multi-family properties on the Service Line Refusal List.	Not applicable for this reporting period. ¹
7.B.iii.d	Number of properties where a partial replacement was performed, and consent was not granted by the property owner to replace a lead service line in full.	See Table 24 and Appendix. ³⁷
LRPP III.D (p 57)	Replace LSL at properties with consistently high lead release and critical customers.	Described in this section.
LRPP III.D (p 58)	Complete approximately 2,000 investigations per year in the first five years of the Lead Reduction Program to update the predictive model and improve the quality of information in the LSL Inventory.	See Table 21.
LRPP III.D (p 60)	Property owners will be reminded via English and Spanish signage placed at the limits (ends of streets) within geographic work areas four to five weeks in advance of construction.	Implemented July 20, 2020.
LRPP III.D (p 60)	Provide flushing instructions following LSL replacement.	Provided to all customers in post-LSL replacement education package. ³⁸

¹ There were five multi-unit properties added to the Refusal List in 2022. These customers are in the Filter Program, received mailed educational materials (both with the replacement filters and via the annual filter reminder postcard), and will receive sampling kits in early 2023.

Summary of LSL Replacement Activity during the Reporting Period including Address and Date of Replacement [7.B.iii.a]

Denver Water T&D crews started LSL replacements in the third program year on March 8, 2022, and ALSLR contractors started on Jan. 2, 2022. The ALSLR contractors focused primarily on geographic task order work areas, with newly consented properties from adjacent task orders from previous program years. Newly consented properties include properties that had an ownership change that resulted in the new owner providing consent, or properties that were either a refusal or no response that recently changed to consented. A total of 12 geographic task orders each with approximately 300 to 500 properties each were developed and issued to three

³⁵ See Appendix LSL-6 Addresses and Types of Replacement (Second Six-Month Period of 2022).

³⁶ See Appendix LSL-7 LSL Replacement Refusal List (Second Six-Month Period of 2022).

³⁷ See Appendix LSL-8 Properties with a Partial Replacement (Cumulative since LRP Inception).

³⁸ See Appendix COE-21 Updated Post-Replacement Flushing Instructions.

ALSLR contractors. A list of addresses and dates for each replacement can be found in the appendices.³⁹

Denver Water T&D completed LSL replacements as part of water main replacement work and emergency repairs and assisted with geographic-area LSL replacements. Denver Water T&D crews continue to target critical customers at schools, daycare centers, and child care facilities within City and County of Denver to confirm the status of the service line and replace lead where found. The properties originally included in the 2020 and 2021 ALSLR Plans that required additional follow-up to make three reasonable attempts at contact were included in the 2022 ALSLR Plan. Any daycare or child care facility added to CDPHE’s licensed child care facility dataset since 2020 was added to the 2022 ALSLR Plan. At the start of the year, the critical customer list included 1,335 properties verified as critical customers within the City and County of Denver; most of these were properties from the 2020 and 2021 ALSLR Plans with a small number of newly identified critical customers for the 2022 ALSLR Plan. Since the start of the year, 20 properties were removed from the critical customer list upon confirmation of a non-LSL via investigation and three LSLs were replaced in the 2022 ALSLR Plan. At the end of this reporting period, 114 critical customers remain with either likely or confirmed LSLs. For these remaining properties, all contact attempts have not resulted in a response or the property is slated for future activities. Investigation of service line materials and replacement (as needed) will be completed as consent is received.

As part of the Elevated Lead Response Plan, Denver Water T&D crews perform individual replacements within approximately two weeks at properties where lead is measured above 150 µg/L and within approximately two months at properties where lead is measured above 25 µg/L if the property is not already scheduled for replacement as part of the 2022 ALSLR Plan.

Type of LSL Replacements Completed during this Reporting Period [7.B.iii.b]

Section 4.A of the Dec. 1, 2022, Order provides that “[e]ach Program Year, Denver Water shall achieve a minimum replacement rate of at least 7.0% of the estimated number of LSLs and GRRs in its distribution system based on a cumulative average.” The overall intention of this requirement is to ensure that all LSLs are replaced within 15 years following the effective date of the Dec. 16, 2019, Order.

For the period of Jan. 1 through Dec. 31, 2022, Denver Water fully achieved this metric replacing 5,119 LSLs. The data for the year-end inventory⁴⁰ are summarized as follows:

- Replacements completed by ALSLR contractors between Jan. 2 and Dec. 2, 2022, the last day of the year that contractors worked in the field.⁴¹

³⁹ See Appendix LSL-6 Addresses and Types of Replacement (Second Six-Month Period of 2022).

⁴⁰ See Appendix INV-7B Line by Line p-Value Changes by Status (Second Six-Month Period of 2022) and previous semi-annual reports.

⁴¹ Properties with a p-value ≥ 0.5 in the 2022 ALSLR Plan are verified prior to replacement and are not counted as replaced if copper is observed upon full excavation or pulling the entire service.

- Replacements completed by T&D between March 8 and Dec. 28, 2022, including from water main projects, emergency repairs, and critical customers (such as schools and child care facilities).⁴²
- Replacements completed by third parties, including tap cuts (cut and reactivated in 2022), reimbursements and properties inspected by Denver Water completed between Jan. 1 and Dec. 31, 2022.⁴³
- There were 29 replacements documented in areas served by distributors.

Based on the base LSL Inventory set forth in Table 15, 7% is equivalent to 4,477 LSL replacements per year and this was maintained as the target for 2022. The number and dates of replacements are used as an input to the equivalency model. The total number of replacements presented in Table 24 is the types of replacements completed between June 4 and Dec. 31, 2022, and the total replacements for 2022 are summarized in Table 25. Denver Water maintains a detailed list of the type of LSL replacements completed and the associated addresses.⁴⁴

⁴² The last replacement of 2022 was on Dec. 28, 2022. T&D replacements are counted as an LSL replacement if i) the initial p-value is ≥ 0.5 regardless of what field crews report for the “prior” material or ii) documentation from another source indicates that lead or galvanized is observed.

⁴³ The last tap cut and reactivation replacement was on Dec. 19, 2022. The last reimbursement and the last inspection of a third-party replacement was on Dec. 20, 2022, and Dec. 19, 2022.

⁴⁴ See Appendix LSL-6 Addresses and Types of Replacement (Second Six-Month Period of 2022).

TABLE 24. TYPE OF LSL REPLACEMENTS (JUNE 4 TO DEC. 31¹, 2022)

Type of LSL Replacement June 4 to Dec. 31, 2022	Denver Water (Water Main, Emergency, and ALSLR) ²	Third Party (Developer, Homeowner, and Other) ³	Total
Full Lead Replacement⁴	1,794	238	2,032
Partial Lead Replacement, such that no Lead Remains After Replacement⁵	1,069	6	1,075
Full Galvanized Replacement	4	0	4
Partial Galvanized, such that no Lead or Galvanized Remains After Replacement⁶	450	2	452
TOTAL REPLACEMENTS in Reporting Period, with no Lead Remaining After Replacement	3,317	246	3,563
TOTAL REPLACEMENTS Not Previously Reported⁷	6	9	15
TOTAL REPLACEMENTS completed since LRP Inception	14,324	1,123	15,447
Emergency Repair, Partial Replacement (i.e., where consent was NOT granted and lead may remain in the ground)⁸	110	5	115

¹ Properties that had a replacement on or before Dec. 31, 2022, may not have been captured in the database for this report due to the time necessary to QA the data following the replacement date. Replacements affected by this time lag will be reported in the First Semi-Annual Report of 2023.

² Includes LSL replacements completed as part of water main projects, emergency repairs, scheduled repairs, and ALSLR individual and geographic replacements completed by Denver Water or its contractors.

³ Includes LSL replacements completed by developers, property owners and other government agencies as identified in Appendix LSL-6 (Addresses and Types of Replacement (Second Six-Month Period of 2022)).

⁴ Includes replacements of service lines described as lead-lead, lead-galvanized, lead-unknown and galvanized-unknown. This also includes service lines designated as either unknown-unknown or copper-copper with p-value ≥ 0.5 at properties where a service line replacement was completed by someone other than the ALSLR contractors (such as third party).

⁵ Includes replacements of service lines described as lead-copper, lead-PEX, lead-PVC and copper-unknown. If verification reveals copper at three or more locations, the service line is counted as replaced if the p-value is ≥ 0.5 . See Appendix LSL-6 (Addresses and Types of Replacement (Second Six-Month Period of 2022)).

⁶ Includes replacements of service lines described as copper-galvanized, galvanized-copper, and galvanized-PEX.

⁷ This includes replacements completed in the first six-month period of 2022 but not previously reported (14 added); see Appendix LSL-9 (Addresses and Types of Replacements for Properties Not Previously Counted and Duplicates (from 2021 and First Six Month Period of 2022)).

⁸ Includes all properties cumulative since program inception; see Appendix LSL-8 (Properties with a Partial Replacement (Cumulative since Program Inception)).

The annual replacement rate, defined in the Dec. 16, 2019, Order, and the cumulative average annual replacement rate, defined in the Dec. 1, 2022, Order, that were achieved in 2022 are calculated in Table 25.

TABLE 25. LSL REPLACEMENT RATES FOR 2022

	2022
Total Number of Replacements	5,119
Annual Replacement Rate Achieved	8.0% of 63,955
Cumulative Total Number of Replacements¹	15,477
Cumulative Average Annual Replacement at End of Program Year²	5,159
Cumulative Average Annual Replacement Rate	8.1% of 63,955

¹ 5,287 replacements (from the 2020 Annual Report) + 4,794 replacements (from the 2021 Annual Report) + 277 replacements (not previously reported in original annual reports) + 5,119 replacements (from this report).

² Per the Order, the cumulative average must be calculated using the total number of LSLs replaced during the term of the Order divided by the total estimated number of confirmed and likely LSLs, consistent with the initial LSL inventory. The average of 15,477 replacements over three years is 5,159 replacements per year. As a percentage, 5,159 of 63,955 is 8.1%.

Customer Consent and Refusal List for LSL Replacement [7.B.iii.c]

Distribution of notification letters, including consent forms, was initiated on Dec. 6, 2021, to property owners included in the 2022 ALSLR Plan. Since then, notifications were mailed to all properties identified in the geographic work areas of the 2022 ALSLR Plan, after which multiple contacts are made to obtain signed consent forms.⁴⁵ Reconnaissance or pre-construction meetings are conducted with each property owner to plan the LSL replacement work and schedule the replacement.

A summary of the number of property owners contacted and number of signed consent forms returned is presented in Table 26. Between June 4 and Dec. 31, 2022, a total of 361 property owners refused to participate in the ALSLR Program or were non-responsive following multiple attempts at contact. At least three attempts to obtain voluntary consent from a property owner are undertaken before work can start to replace the LSL.

⁴⁵ See Appendix LSL-7 LSL Replacement Refusal List (Second Six-Month Period of 2022).

TABLE 26. SUMMARY OF CONSENT AND LSL REFUSAL LIST (JUNE 4 TO DEC. 31, 2022)

Description	Customer Consented ¹	Customer Refused ²
Total Number of Properties for which Consent was Given or Refused during the Second Six Months of 2022	3,292	361
Total Number of Properties for which Consent was Given or Refused Year-to-Date	6,076	677

¹ The total number of signed consent forms represent only the ALSLR contractors. Detailed consent collection activity is not comprehensively tracked for replacements other than ALSLR contractors. A revised procedure to track all T&D consents is under development for implementation in 2023.

² The total number of refusals year-to-date includes attempts made by the ALSLR contractors (346 properties during the second six months of 2022, 639 properties year-to-date) and T&D efforts (15 properties during the second six months of 2022, 38 properties year-to-date). These include properties with descriptions of “consent not granted due to refusal” and “non-responsive” after at least three attempts were made and the task order goes through administrative close out. When a customer refuses or is non-responsive, the service point ID is provided to the COE team for follow-up. See explanations in Appendix LSL-7 LSL Replacement Refusal List (Second Six-Month Period of 2022).

A range of outreach methods is used to contact property owners.⁴⁶ At least two attempts at contact by mail plus one attempt at contact in person is made before a property is considered non-responsive. While the ALSLR contractors are in an area with active construction activity, additional attempts such as door knocking, phone calls and emails may be made to contact the property owner to seek consent. If an owner refuses to participate in the ALSLR Program, the property is added to the LSL Replacement Refusal List, along with an explanation for refusal, if available. If a property owner declines due to a previous undocumented service line replacement, additional information may be requested from the owner to document a past replacement to support the removal of the property from the LRP.

When a property owner declines to participate, Denver Water is committed to continuing engagement with the property owner to encourage participation. A database is maintained to track attempted contacts at properties where consent to replace the LSL has not been provided.⁴⁷ An outreach approach was identified for customers with properties on the 2020 and 2021 Refusal List who have not had ownership change and been contacted through the ownership change follow-up process. Investigative potholes occurred the second half of 2022 at properties from the 2020 and 2021 Refusal Lists within or adjacent to identified 2022 Task Orders provided there is no conflict, no street moratoriums or the property is already identified as lead as part of 2022 Task Orders. A four-point investigation was performed at non-responsive properties and two main-to-meter potholes were performed at refusal properties where possible to identify the service line material. Previous refusals that could be identified as non-lead under a four-point investigation were removed from the inventory. Previous refusals where lead was found will continue to have outreach efforts in order to gain consent and perform a replacement despite previous contact attempts and refusal. This investigative effort will continue in 2023 to investigate all refusal and non-responsive properties active in a task order and properties from 2020 and 2021 Refusal Lists that had previous conflicts preventing investigation or were not

⁴⁶ See Appendix COE-15 2022 COE Plan included with the Second Semi-Annual Report of 2021.

⁴⁷ See Appendix LSL-7 LSL Replacement Refusal List (Second Six Months of 2022).

close to an active work area. Additionally, any change to the property ownership triggers additional outreach to obtain consent to replace the LSL. Between June 4 and Dec. 31, 2022, one change in ownership occurred at a property on the Refusal List. Follow up is underway to gain consent for replacement from the new owner within 91 days of the change of ownership.⁴⁸

A property is described as “non-responsive” while the task order for the affected work order remains open (i.e., there is ongoing construction activity). A property is added to the Refusal List as task orders for a work area are closed out (i.e., the construction crew demobilizes).⁴⁹ This process is part of administrative closeout of the task order.

There are circumstances where consent has been given, but an inspection of the property reveals a safety or security hazard that prevents the LSL replacement from being performed. The property owner is informed both verbally and in writing that the hazard must be addressed within 14 days of receiving the notification. If the problem is not fixed within that time frame, the property is treated as not responsive and is added to the list of “non-responsive” until the issue is resolved, and the LSL can be replaced.⁴⁹

Emergency Repairs Resulting in a Partial LSL Replacement [7.B.iii.d]

During this reporting period, 39 partial replacements occurred as a result of emergency repair, water main replacement, or third-party contractor work (i.e., some lead may remain in the ground). This affected a total of 115 properties since program inception in January 2020 as a result of:⁵⁰

- No consent or no available contact information for the property owner and therefore consent could not be obtained at the time of the work (this affected seven properties).
- The property owner declined replacement at the time of the work (this affected 24 properties).
- No consent to perform the full replacement due to no response from the property owner (this affected 68 properties).
- Restricted access due to the interior plumbing arrangement (this affected seven properties).
- Property redevelopment (two properties).
- To be rescheduled because property owner was not comfortable with replacement during COVID-19 (three properties).
- Restricted access due to gas station logistical constraints (one property).

⁴⁸ See Appendix LSL-10 Ownership Changes for Properties on the Refusal List.

⁴⁹ See Appendix COE-D.12 Safety or Repairs Needed Notification Letter of Second Quarter Report (2020).

⁵⁰ See Appendix LSL-8 Properties with a Partial Replacement (Cumulative since LRP Inception).

- Meter to main replaced, meter to building potholing and/or replacement scheduled for a later date (three properties).

Attempts to obtain consent to complete the replacement in full were made and outreach with the property owner continues in order to seek consent or address any safety issues that currently bar entry to the property. Based on revised language in the Dec. 1, 2022, Variance, partial replacements in the future may occur when property owner consent cannot be obtained or the property cannot be accessed during circumstances of planned infrastructure work or emergency repairs.

7.B.iv Filters

Section 7.B.iv of the Variance requires that Denver Water report and maintain records related to its filter distribution program. Specifically, Section 7.B.iv requires reporting and recordkeeping of the following:

iv. Filters.

- a. addresses of Customer Premises where filters and replacement cartridges have been provided, and certification of the number of homeowners with known, suspected, or possible LSLs that are not part of filter program because they use their own filter or bottled water;*
- b. the total number of filters and replacement cartridges distributed per Program Year;*
- c. the percent filter adoption for each year of the variance, and the method used to determine this rate;*
- d. a list of unique customer identification numbers reporting the use of bottled water or a filter certified NSF/ANSI (53) for removal of lead, and any changes in the list;*
- e. a list of unique customers identification numbers for customers enrolled in the filter program who have refused a filter or replacement cartridges or have opted out of enrollment in the filter program;*
- f. filter lead sampling results collected under paragraph 5.F above;*
- g. information about filter use under paragraph 5.E; and*
- h. Denver Water shall notify CDPHE and EPA within 10 Days if data indicate measurable lead in filtered drinking water and shall provide the measured levels of lead in filtered water.*

Text is taken verbatim from the Order, dated Dec. 16, 2019.

The Filter Program targets properties with confirmed and likely LSLs (i.e., with p-values 0.5 and higher). The Filter Program includes the distribution of pitcher filters, ongoing outreach and education to encourage pitcher filter use and the distribution of filter cartridge replacements. Using the current LSL Inventory from Table 15, it is estimated that Filter Program participants consist of approximately 89,843 Denver Water household units.

This section summarizes the milestones of the Filter Program to date, including filter refusals/opt-outs, six-month supply of replacement filters distributed post-LSL replacement, filter survey results from the ALSLR Program, and filter performance testing in the field. An overview of the filter reporting requirements is shown in Table 27.

TABLE 27. OVERVIEW OF 7.B.IV REQUIREMENTS

Paragraph Reference	Description	Refer to
7.B.iv.a	Summary of addresses of all customers enrolled in the Filter Program and provided with filters and cartridges. Certification of number of customers with a confirmed or likely LSL that use their own filter or bottled water.	See Table 28.
7.B.iv.b	Total number of filters and cartridges distributed per year.	See Table 28.
7.B.iv.c	Percent filter adoption rate per year. Description of method to determine the filter adoption rate.	See Appendix. ⁵¹
7.B.iv.d	Maintain list of addresses and Service Point Identification that use a filter or bottled water and any changes to the list.	See Appendix. ⁵²
7.B.iv.e 5.A	Maintain Filter Refusal or Opt-Out List. Maintain list of addresses and SP IDs that have refused enrollment in the Filter Program or opted out.	See Appendix. ⁵³
7.B.iv.f 7.B.iv.g 5.F.ii	Confirmation of filter performance in the field (50+ locations included in the LCR compliance sampling). Collect samples using a protocol approved by EPA and CDPHE. Collect additional information regarding the use and operation of the filter.	See Appendix ⁵⁴ for sample results from March 21 to June 2, 2022. Protocol for filter sample collection approved July 17, 2020, by EPA. Included in this section.
7.B.iv.h	Notify CDPHE and EPA within 30 days of receiving sample results indicating measurable lead in filtered samples.	See Appendix. ⁵⁵
5.B	Distribute replacement cartridges to customers enrolled in the Filter Program per the filter manufacturers' recommended replacement rate and until six months after LSL replacement.	See this section. Distribution as part of Filter Program since March 24, 2020.
5.C	Provide education materials within two weeks of a change in customer account. Provide filters and replacement cartridges within 35 days of a change in customer account.	See Appendix. ^{55,56}
5.D	Offer filters to 1983 to 1987 households with a child up to 24 months of age and lead > 3 µg/L in the first bottle of the 3-bottle test. Develop COE plan to focus on this audience.	See this section and results in section 7.B.i CCT. See 2020, 2021, and 2022 COE Plans.

⁵¹ See Appendix FIL-21 Formal Filter Adoption Survey Detailed Responses.

⁵² See Appendix FIL-14 Filter Program Opt-Outs (Second Six-Month Period of 2022).

⁵³ See Appendix FIL-15 Filter Program Refusals (Second Six-Month Period of 2022).

⁵⁴ See Appendix FIL-16 Confirmation of Filter Performance in Field Results (Second Six-Month Period of 2022).

⁵⁵ See Appendix FIL-17 Occupancy Changes – COE Distribution (Second Six-Month Period of 2022).

⁵⁶ See Appendix FIL-18 Occupancy Changes – Pitcher Filter Distribution (Second Six-Month Period of 2022).

Paragraph Reference	Description	Refer to
5.E.i	Survey enough customers enrolled in the Filter Program to receive a minimum of responses from remaining program participants that is consistent with a 95% confidence level and 3% margin of error. Seek approval from CDPHE and EPA for the filter adoption survey questions prior to distribution.	See Annual Report. Approved on Sept. 10, 2020. ⁵⁷
5.G	Document contact to provide lead outreach and education materials to at least 95% of customers enrolled in the Filter Program each year.	See this section.
LRPP Executive Summary (p 9) and III.C (p 56)	If the localized filter adoption rate is less than 75%, additional outreach and education will be provided to that area.	Not applicable for this reporting period.
LRPP III.C (p 55)	Survey filter use as part of ALSLR Program following LSL replacement.	See this section and Appendix. ⁵⁸

Initial Filter Distribution to All Customers Enrolled in the Filter Program [7.B.iv.a]

Denver Water began filter distribution on Feb. 12, 2020, with distribution to customers included in the ALSLR Program in 2020 (year 1). Denver Water initiated broader filter distribution on March 28, 2020, to all customers enrolled in the Filter Program. Initial filter distribution was completed on Sept. 21, 2020.

Pitcher filter distribution continues for occupancy changes and customer requested replacements for broken or missing pitcher filters, as shown in Table 28 for pitcher filter distribution.

⁵⁷ See Third Quarter Report of 2020 (Appendix FIL-29 OMB Approved Filter Adoption Survey Questions).

⁵⁸ See Appendix FIL-19 Informal Filter Adoption Survey Results Summary (Second Six-Month Period of 2022).

TABLE 28. SUMMARY OF FILTER DISTRIBUTION (JUNE 4 TO DEC. 31, 2022)

Description	Count	Comment
Initial Pitcher Distribution for Customers Enrolled in 2022	47	
Total Number of Households Provided with a Filter Kit between June 4 and Dec. 31, 2022¹	5,260	
Number of Households that Use their own NSF-Certified Filter or Bottled Water between June 4 and Dec. 31, 2022	15	See Appendix. ⁵⁹
Number of Households that Declined to Use a Filter or Bottled Water between June 4 and Dec. 31, 2022¹	115	See Appendix. ⁶⁰
Total Number of Households Provided with a Filter Kit in 2022	8,312	
Number of Households that Use their own NSF-Certified Filter or Bottled Water in 2022	25	
Number of Households that Declined to Use a Filter or Bottled Water in 2022	158	

¹ This value is significantly larger than what was reported in the First Semi-Annual Report of 2022. This is due to the implementation of the Denver Water Online Filter Form which increased requests and customer involvement.

New customers enrolled in the Filter Program in 2022 are included in the count for initial distribution of pitcher filters in Table 28, along with customers that were previously enrolled in the Filter Program but that failed to receive their initial pitcher filter. Together, this represents approximately 6% of the current 89,843 customers enrolled in the Filter Program. In general, the customers did not receive a pitcher filter due to either missing or erroneous address or unit number information:

- 1) At residential properties with a general address to allow customers to receive filters.
- 2) At multi-unit commercial properties with a general address to allow customers to receive filters. Some of these were identified from customers calling in to alert Denver Water of additional units or through review of unit numbers for completeness.

Addresses where filters could not be delivered were investigated for accuracy and a filter kit and program introduction booklet were sent once the address could be confirmed. Corrective actions have been implemented to reconcile all known addresses, identify incorrect addresses, and distribute pitcher filters as required. As part of this exercise, 2,869 properties were reviewed during the second six-month period of 2022.

An analysis of return-to-sender addresses was performed in 2020 and described in the Third Quarterly Report for 2020; this exercise was not repeated in 2021 or 2022. However, throughout 2022, return-to-sender addresses continued to be investigated and upon reconciliation, a filter kit is re-sent to the correct address or if vacant, the property is removed from the LRP.

⁵⁹ See Appendix FIL-14 Filter Program Opt-Outs (Second Six-Month Period of 2022).

⁶⁰ See Appendix FIL-15 Filter Program Refusals (Second Six-Month Period of 2022).

Replacement Filter and Replacement Filter Cartridge Distribution to Customers Enrolled in the Filter Program [7.B.iv.b]

Between June 4 and Dec. 31, 2022, replacement filters were distributed to an additional 5,260⁶¹ customers enrolled in the Filter Program.

During this same period, 131,867 replacement filter cartridges were distributed to customers enrolled in Filter Program in accordance with the manufacturer’s recommendation for replacement within six months.⁶² Replacement filters mailed to 369 properties were returned to sender.⁶³ An unsuccessful delivery prompts an investigation, and, upon reconciliation, a replacement filter is re-sent to the correct address or if vacant, the property is removed from the LRP. Following the improvements made in July 2021 to address late filter distribution, all properties enrolled in the Filter Program received replacement filter cartridges within the six-month replacement interval.⁶⁴ A summary of distribution of post-LSL replacement filters is provided in Table 29.

TABLE 29. SUMMARY OF SIX-MONTH SUPPLY POST-LSL REPLACEMENT FILTER DISTRIBUTION (JUNE 4 TO DEC. 31, 2022)

Description	Count	Comment
Number of Households Provided with Six-Month Supply of Filter Replacements Post-Lead Service Line Replacement between June 4 and Dec. 31, 2022^{1,2}	2,155	This includes emergency repairs and replacements performed by Denver Water and third parties.

¹ This value may not match the number of LSL replacements completed between June 4 and Dec. 31, 2022: for example, if a customer received their initial filter pitcher and replacement filters within two months of having their LSL replaced, additional replacement filters are provided on the six-month replacement schedule and not as part of the LSL replacement activities.

² This value includes filter distribution to properties where the LSL replacement was completed by a third party, as identified in Table 24.

Occupancy Changes [5.C]

Denver Water was notified of 2,711 occupancy changes between June 4 and Dec. 31, 2022.⁶⁵ Occupancy changes are tracked daily to provide multiple mailings per week to allow new occupants to receive their LRP Introductory Letter and LRP Overview Booklet within 14 days of the change in occupancy. Occupancy changes are added to weekly filter distribution batches to allow new occupants to receive a pitcher filter within 35 days of notice of new occupancy. Both the introductory materials and the filter were distributed within 14 and 35 days respectively, at all properties where a change in occupancy occurred for this reporting period.⁶⁶

⁶¹ This number refers to the number of properties that received a new filter based on occupancy changes, high-capacity, broken filters, lost filters, etc. The number of filters distributed to these properties totals 5,960.

⁶² The number of replacement filter cartridges with duplicates is 140,072.

⁶³ See Appendix FIL-20 Filter Program Replacement Cartridge Returns (Second Six-Month Period of 2022).

⁶⁴ See the First Semi-Annual Report of 2021.

⁶⁵ See Appendix FIL-18 Occupancy Changes – Pitcher Filter Distribution (Second Six-Month Period of 2022).

⁶⁶ See Appendix FIL-18 Occupancy Changes - Pitcher Filter Distribution (Second Six-Month Period of 2022).

Filter Distribution to Formula-fed Infants in Select Households [5.D]

As described in Table 12, no 1983 to 1987 households with children under 24 months of age requested enrollment in the Filter Program during the second six-month reporting period of 2022 (i.e., a select household as identified in paragraph 5.D of the Variance).⁶⁷

Formal Filter Adoption Survey [7.B.iv.c and 7.B.vi.c (2019), 7.B.iv.c (2022)]

Filters are used to reduce exposure to lead before the LSL is replaced and for six months following LSL replacement. The rate of filter adoption by customers enrolled in the LRP is used as an input in the equivalency model.

Filter adoption assumes customers are accepting, installing, using, and maintaining their pitcher filter properly, including replacing the filter cartridge at the appropriate time and using the pitcher filter for drinking, cooking, and infant formula, as applicable. The minimum filter adoption rate identified in the LRPP necessary to match the performance of the orthophosphate alternative is 65%.

⁶⁷ See Appendix CCT-8 Summary of Water Quality Sampling Results from Select Households (1983 to 1987 Homes, Cumulative since LRP Inception).

Estimate the Filter Adoption Rate

Under section 5.E.i of the Dec. 1, 2022, Order, “Denver Water must conduct a survey in 2023 and every other program year of randomly selected customers enrolled in the Filter Program to receive a minimum of responses from remaining program participants that is consistent with a 95% confidence level and 3% margin of error. The survey must inquire whether the customer has used the filter for water to make infant formula (if applicable); cooking and drinking; or is using bottled water or a filter device that is certified National Sanitation Foundation/American National Standards Institute 53 for lead removal not provided by Denver Water for infant formula, cooking and drinking.”

It was previously determined that for a filter adoption rate of at least 60%, a minimum of 1,059 filter adoption survey responses are required to estimate the filter adoption rate with at least 95% confidence and no more than 3% error.⁶⁸

The formal Filter Adoption Survey was approved by EPA on Sept. 10, 2020. The survey for 2022 was distributed on March 7, 2022, to 15,000 properties or about 16% of customers enrolled in the Filter Program.⁶⁹ The Filter Adoption Survey participants submitted survey

SURVEY QUESTIONS:

1. **Do you always, or most of the time, use your pitcher provided by Denver Water for drinking water?**
 - Yes.
 - No – I use unfiltered tap water.
 - No – I use bottled water, or a different type of filtration system certified to remove lead in accordance with NSF/ANSI 53 standards (e.g., fridge, under the sink filter, sink-mounted filter).

2. **Do you always, or most of the time, use your pitcher when you are cooking foods where water is a base ingredient (examples: making rice, beans, soup)?**
 - Yes
 - No
- 2a. **If your answer to No. 2 above is no, why are you not using the pitcher for cooking?**
 - Prefer to use unfiltered tap water.
 - Prefer to use bottled water for cooking food.
 - Prefer to use a different type of filtration system certified to remove lead in accordance with NSF/ANSI 53 standards (e.g., fridge filter, under the sink filter, sink-mounted filter).
 - Do not cook.
 - Other

3. **Do you have a formula-fed infant (under 24 months of age) in your household?**
 - Yes
 - No
- 3a. **If yes, what water do you always use to mix the formula (select all that apply)?**
 - Not applicable (I don't feed formula to my infant, or use pre-mix/ready mix)
 - Water from the pitcher filter
 - Bottled water
 - Water filtered by an alternative filter device (fridge filter, under the sink filter, sink-mounted filter or other filter) certified to remove lead in accordance with NSF/ANSI 53 standards
 - Unfiltered tap water

⁶⁸ See Appendix III.C.1 (Filter Adoption) of the Lead Reduction Program Plan.

⁶⁹ See Appendix FIL-21 Formal Filter Adoption Survey Detailed Responses.

responses online or mailed in hard copy responses. Survey respondents had to answer questions one through three (regarding filter adoption for filter water used for drinking, cooking, and infant formula) to be included in the analysis and calculation of the overall percent adoption. A total of 1,512 survey responses were received between March 7 and May 13 (Table 31).⁷⁰ The overall adoption rate is incorporated into the equivalency model presented in the annual report.

Definitions Used to Calculate the Filter Adoption Rate

Definitions are provided in Table 30 to describe the consistent application of the data from the filter adoption survey when measuring the filter adoption rate. The percentage filter adoption for drinking and/or cooking and infant formula is used as a single input in the equivalency model.

TABLE 30. DEFINITIONS FOR FILTER ADOPTION RATE AS USED IN THE EQUIVALENCY MODEL

<p>YES to filter use for drinking water = Q1 yes pitcher filter + Q1 alternative filter/bottled water</p>
<p>YES to filter use for cooking = Q2 yes + [Q2 no <u>and one of</u> Q2a bottled water + Q2a alternative filter + Q2a do not cook + applicable Q2a other]</p>
<p>YES to formula-fed infant¹ = Q2 yes + [<u>and one or more of</u> Q3a N/A + Q3a pitcher filter + Q3a bottled + Q3a alternative filter]</p>
<p>TOTAL Filter Adoption Rate = 1 x (yes drinking, yes cooking, yes formula-fed infant) (as defined in the Order) + 0.5 x (yes drinking, yes formula-fed infant only) ÷ total eligible responses</p>
<p>Percent filter adoption for drinking = (YES to filter use for drinking water) ÷ total eligible responses</p>
<p>Percent filter adoption for cooking = (YES to filter use for cooking) ÷ total eligible responses</p>
<p>Where total eligible responses = mailed responses with answers to Q1, Q2 and Q3 + electronic responses using the “submit” button</p>
<p>¹ Includes customers that responded that they do not have a formula-fed infant in their household and customers that are not expecting.</p>

Using the definitions of Table 30 and in accordance with paragraph 5.E.ii of the Order, the total filter adoption rate for 2022 is calculated at 83%, as shown in Table 31. This percentage is used in the equivalency model and shown with the year-over-year comparison shown in Table 32. Filter adoption rates for drinking, cooking and formula preparation are provided in Table 31.

⁷⁰ See First Semi-Annual Report of 2022 for results, or see this section.

TABLE 31. 2022 FILTER ADOPTION RATE ESTIMATED FROM FILTER ADOPTION SURVEY

Question	Total Responding Yes	Total Responses to Question	Percent Yes
Q1. Filtered or bottled water used for drinking water	1,411	1,512	93%
Q2. Filtered or bottled water used for cooking¹	1,097	1,512	73%
Q3. Filtered or bottled water used for formula-fed infant in households that self-identify as an existing or expecting family	49	52	94%
Total Filter Adoption Rate as used in the equivalency model²			83%

¹ Includes those customers that responded that they do not cook.

² As described in paragraph 5.E.ii the Order and the number used in the equivalency model.

TABLE 32. YEAR-OVER-YEAR COMPARISON OF FILTER ADOPTION RATE ESTIMATES

Question	Percent 2020 ¹	Percent 2021 ²	Percent 2022
Q1. Filtered or bottled water used for drinking water	93%	94%	93%
Q2. Filtered or bottled water used for cooking ³	68%	71%	73%
Q3. Filtered or bottled water used for formula-fed infant in households that self-identify as an existing or expecting family ⁴	97%	93%	94%
Total Filter Adoption Rate as used in the equivalency model⁵	80%	81%	83%

¹ From the Annual Report for 2020.

² From the Annual Report for 2021.

³ Includes those customers that responded that they do not cook.

⁴ Although the number of respondents using unfiltered tap water for formula preparation remained the same (i.e., three in 2020, three in 2021, and three in 2022), the calculated percentage declined since 2020 because the total number of responses to question 3 declined (83 responses in 2020 compared with 44 in 2021 compared with 49 in 2022). This had the effect of magnifying the impact of each “no” response.

⁵ As described in paragraph 5.E.ii the Order and the number used in the equivalency model.

Informal Filter Adoption Survey [7.B.vi.c (2019)]

Informal surveys of filter use are conducted during ALSLR pre-construction meetings and during virtual meetings asking customers about filter adoption and use. Responses from 729 participants were captured in the LRP database from the pre-construction meetings.^{71,72} This accounts for 14% of all customers who had their LSLs replaced in 2022 and suggests that most customers are using filtered or bottled water for drinking, cooking and infant formula:

- Of the 729 responses, the majority of customers indicated that they used filtered or bottled water for drinking (97%) and cooking (95%).

⁷¹ See Appendix FIL-19 Informal Filter Adoption Survey Results Summary (Second Six-Month Period of 2022).

⁷² See Appendix FIL-22 Informal Filter Adoption Survey Detailed Responses (Second Six-Month Period of 2022).

- All households with a formula-fed infant indicated that they used filtered water when preparing formula.

Informal surveys of overall filter use and barriers to using filtered water for cooking are conducted as part of virtual community meetings when those meetings focus on filter use. Two virtual community meetings focused on filter use occurred in the second half of 2022. The results of the informal surveys are presented in the Section 7.B.vi of this report.

Filter Opt-Out List of Customers using Bottled Water or an Alternate Filter [7.B.iv.d]

The number of properties that chose to opt-out of the Filter Program to date is relatively small. Customers that opt-out of the Filter Program are contacted by Denver Water to understand the reason for opting out. Of the 131 customers that have opted out since the launch of the Filter Program, 17 use bottled water as an alternative to the filter and 26 use their own filter certified NSF 53 for lead removal. For the 88 remaining customers, Denver Water was unable to confirm if the customer was using an NSF 53-certified filter.⁷³ A summary of the Filter Program opt-outs is shown in Table 33. Contact with customers continues to be attempted as part of an annual reminder to customers that have opted out or refused to participate in the Filter Program.⁷⁴

TABLE 33. SUMMARY OF FILTER PROGRAM OPT-OUTS

Program Year	Number of Properties			
	Total Opt-Outs	Confirmed Using Own Supplied NSF 53 Certified Filter	Confirmed Using Bottled Water	No Confirmation of NSF 53 Certified Filter or Bottled Water
2020 (Jan. 1 to Dec. 31, 2020)	63	9	6	48
2021 (Jan. 1 to Dec. 31, 2021)	43	6	5	32
2022 (Jan. 1 to Dec. 31, 2022)	25	11	6	8
Total Removed from LRP due to Non-Lead Designation or LSL Replacement	17	9	0	8
Total Since LRP Inception	131	26	17	88

Filter Refusal List [7.B.iv.e]

From June 4 to Dec. 31, 2022, notice of refusal to participate in the Filter Program was received for 115 properties.⁷⁵ The reasons given for refusal include the pitcher is too heavy to use or the resident had a water quality test and is not concerned about the low level of lead in

⁷³ See Appendix FIL-14 Filter Program Opt-Outs (Second Six-Month Period of 2022).

⁷⁴ The use of an NSF 53 certified filter could not be confirmed at some properties based on call center records. This affected 29 customers that indicated that they use their own filter; these properties were moved from the Opt-Out List to the Refusal List.

⁷⁵ See Appendix FIL-15 Filter Program Refusals (Second Six-Month Period of 2022).

their water. This brings the total number of refusals to 261 since the inception of the LRP. A summary of the refusals to date is shown in Table 34.

TABLE 34. SUMMARY OF FILTER REFUSAL LIST

Reporting Period	Number of Properties Refusing to Participate
2020 (Jan. 1 to Dec. 31, 2020)	30
2021 (Jan. 1 to Dec. 31, 2021)	73
2022 (Jan. 1 to Dec. 31, 2022)	158
Total Removed from LRP due to Non-Lead Designation or LSL Replacement	4
Total Since LRP Inception	261

Summary of Data to Document Filter Distribution and Filter Program Participation

Additional details related to filter kit distribution are provided in the Appendices:

- List of premise addresses and service point identification numbers for all households that refuse to participate in the Filter Program.⁷⁶
- List of premise addresses that have returned replacement cartridges to sender.⁷⁷
- Filter adoption survey results summary from informal filter use surveys conducted in the field as part of LSL replacement and virtual meeting filter survey summary.⁷⁸
- Detailed responses from the informal filter use field survey responses collected as part of LSL replacement activities.⁷⁹
- Confirmation of pitcher filter performance in the field.⁸⁰
- List of premise addresses and service point identification numbers for all households that opt-out of the Filter Program.⁸¹
- Occupancy changes for pitcher filter distribution.⁸²

⁷⁶ See Appendix FIL-15 Filter Program Refusals (Second Six-Month Period of 2022).

⁷⁷ See Appendix FIL-20 Filter Program Replacement Cartridge Returns (Second Six-Month Period of 2022).

⁷⁸ See Appendix FIL-19 Informal Filter Adoption Survey Results Summary (Second Six-Month Period of 2022).

⁷⁹ See Appendix FIL-22 Informal Filter Adoption Survey Detailed Responses (Second Six-Month Period of 2022).

⁸⁰ See Appendix FIL-16 Confirmation of Filter Performance in Field Results (Second Six-Month Period of 2022).

⁸¹ See Appendix FIL-14 Filter Program Opt-Outs (Second Six-Month Period of 2022).

⁸² See Appendix FIL-18 Occupancy Changes - Pitcher Filter Distribution (Second Six-Month Period of 2022).

- Occupancy changes for filter education information.⁸³

The Dec. 1, 2022, Variance removes the reporting requirement of detailed address lists for filter pitcher distribution, filter cartridge distribution, and proof of 95% outreach to customers enrolled in the Filter Program. These records will be maintained by Denver Water and can be provided upon request.⁸⁴

Confirmation of Filter Performance in the Field [7.B.iv.f]

Field sampling is conducted by Denver Water in conjunction with LCR compliance sampling (see section 7.B.i). All samples collected to meet this requirement for the second six-month compliance period of 2022 are included in this reporting period. Samples were collected from 52 properties between Sept. 13 and Nov. 9, 2022. Samples are collected using a protocol with three sample bottles to differentiate between lead measured in the first draw LCR compliance sample and lead measured in water used in filter testing and referred to as the filter influent sample. The third sample is collected from filter effluent and used with the filter influent sample to calculate the percentage of lead removal. Per the Variance, if measurable lead is detected in filtered drinking water, Denver Water must report to EPA and CDPHE within 10 days. Under the Dec. 1, 2022, Variance, measurable lead is defined as a water quality lead result of 5 ppb and above, and must be reported within 30 days.

Lead was measured in the unfiltered tap water at less than 1 µg/L in 16 samples collected on the same day the filter effluent sample was collected. Lead was measured below the detection limit in filtered water at 48 of the 52 properties and below 3 µg/L at all properties with no exceptions⁸⁵. If lead is measured above 10 µg/L from a filter, the filter is removed from the property, the customer is provided with a new filter, and the “old” filter is sent to the Denver Water lab for additional testing (using the water supplied from the lead pipe rack). Zero properties in this reporting period had lead measured above 10 µg/L in the filter effluent sample.

Results from filter testing in the field are also reviewed to identify properties with elevated lead in the first bottle for inclusion in the Elevated Lead Response Plan. There were no properties with lead measured above 15 µg/L in the first bottle.⁸⁶

Information About Filter Usage and Maintenance Collected during Filter Performance Testing [7.B.iv.g and 7.B.vi.c (2019), 7.B.iv.g (2022)]

Observations of filter use during filter performance testing in the field are reported with sampling results. When there are customers who are identified for inclusion in the filter performance testing in the field that do not use their filter, a sample is not collected from the

⁸³ See Appendix FIL-17 Occupancy Changes - COE Distribution (Second Six-Month Period of 2022).

⁸⁴ See Appendices ADD-1 through ADD-5 for voluntary reporting of detailed address lists.

⁸⁵ See Appendix FIL-16 Confirmation of Filter Performance in Field Results (Second Six-Month Period of 2022).

⁸⁶ When lead is measured above 15 µg/L in the first draw sample, the property is scheduled for LSL replacement within two months.

filter. For this reporting period, four customers indicated that they did not use the filter provided by Denver Water.

Confirmation of Direct Contact with 95% of All Customers Enrolled in the Filter Program [5.G]

In 2022, proof of contact with customers enrolled in the LRP is measured based on the mailing of filter reminder postcards. The postcards were mailed in September and October and are discussed in Section 7.B.vi.⁸⁷

⁸⁷ See Appendix COE-23 Filter Use Reminder Postcard.

7.B.v Compliance Metrics per Paragraphs 2.C, 3.D, 4.I, 5.G, 6.B (2019, 2022)

Section 7.B.v of the Variance requires that Denver Water report and maintain records of the following compliance metrics:

v. Compliance Metrics. Results achieved under the compliance metrics in paragraphs 2.C [CCT Metric], 3.D [LSL Inventory Compliance Metric], 4.I [Accelerated LSL Replacement Compliance Metric], 5.G [Filter Communication Compliance Metric], and 6.B [Comprehensive LRPP Performance Metric] above.

Text is taken verbatim from the Order, dated Dec. 16, 2019.

A summary of the performance metrics that will ultimately be used to evaluate the overall performance of the LRP is presented in Table 35. This section also includes Section 6.C of the Dec. 1, 2022, Order.

TABLE 35. SUMMARY OF COMPLIANCE

Paragraph	Description	Comment
2.C	C. Corrosion Control Treatment Metric.	See Section 7.B.i
3.D	D. LSL Inventory Compliance Metric.	See Section 7.B.ii
4.I	I. Accelerated LSL Replacement Compliance Metric.	See Section 7.B.iii
5.G	G. Filter Communication Compliance Metric.	See Section 7.B.vi
6.B	B. Comprehensive LRPP Performance Metric.	See Part 3
6.C	C. Health Equity and Environmental Justice (HE and EJ) Compliance Metric.	See Section 7.B.vii

7.B.vi Communications, Outreach and Education

Section 7.B.vi of the Variance requires that Denver Water report and maintain records for COE activities:

- vi. Communications, Outreach and Education. A summary of activities conducted under the Communications, Outreach and Education program, including the updated communications, outreach and education plan for the new Program Year. The summary will include, at a minimum:*
- a. a description of outreach activities conducted, including copies of the outreach materials provided;*
 - b. a list of any partner organizations who conducted, or were involved in the implementation of the communications, outreach and education plan; and*
 - c. if in-person or telephone surveys are conducted, the answers to filter usage survey questions that were asked, and the data and time of call.*

Text is taken verbatim from the Order, dated Dec. 16, 2019.

During the last six months of 2022, Denver Water continued its public outreach and engagement efforts based on the strategies described in the 2022 COE Plan. This included hosting three virtual community meetings on proper filter use and an overview of the LRP, convening the Stakeholder Advisory Committee for two quarterly meetings, launching a new online filter request form and outreach to 1983 to 1987 homes. COE efforts specific to each LRP element are also included in those element sections of this report and are detailed in Table 36.

TABLE 36. OVERVIEW OF 7.B.VI REQUIREMENTS

Paragraph	Description	Comment
7.B.vi	2020 COE Plan 2021 COE Plan 2022 COE Plan 2023 COE Plan	See First Quarter Report of 2020. See Fourth Quarter Report of 2020. See Second Semi-Annual Report of 2021. See Appendix. ⁸⁸
7.B.vi.a	Description of COE activities conducted. Copy of materials.	Discussed in this section. See Appendices for copies of materials included. ⁸⁹
7.B.vi.b	Ambassador Program Overview.	See Section 7.B.vii.
7.B.vi.c	Response, date and time of in-person surveys of filter adoption and use.	See Section 7.B.iv. See Appendix. ⁹⁰
8.G	Notify customers enrolled in Filter Program of LRP and launch multi-media campaign.	Multi-media campaign launched March 23, 2020.
LRPP III.E (p 64)	Targeted messaging to homes with copper piping and lead solder to flush the tap after periods of non-use.	See 2020, 2021 and 2022 COE Plans.
LRPP III.F (p 74)	Stakeholder Advisory Committee	Discussed in this section.

Outcomes of COE Activities between June 4 and Dec. 31, 2022 (unless otherwise noted) [7.B.vi.a]

- Denver Water hosted three bilingual, one-hour virtual community meetings in July and September 2022 focused on an overview of the LRP, including the federal funding opportunity, and information on properly using filters and pitchers. In total, 2,069 customers participated in a virtual community meeting during the last six months of the year and 3,021 participated in a meeting during 2022.
- In addition, Denver Water received requests for LRP presentations and/or attendance at community events from eight local, state and national organizations and held these presentations at various times during this reporting period. In total, 18 presentation requests were fulfilled during 2022.
- Information was sent to all customers in 1983 to 1987 homes reminding them of the opportunity to request a water quality sampling kit.⁹¹
- In September and October, a filter use reminder postcard was mailed to all Filter Program enrollees to encourage proper filter use and maintenance, fulfilling the

⁸⁸ See Appendix COE-17 2023 COE Plan.

⁸⁹ See Appendices COE-3 through COE-6, and COE-8 through COE-16 for a copy of materials.

⁹⁰ See Appendix FIL-13 Informal Filter Adoption Survey Detailed Responses (First Six-Month Period of 2022).

⁹¹ See Appendix COE-18 1983-1987 Homes Reminder Postcard.

requirement for direct contact with at least 95% of Filter Program enrollees each program year.⁹²

- The Stakeholder Advisory Committee convened for two quarterly meetings on July 20 and Oct. 12. The meetings covered progress updates on the LRP including federal funding and Variance extension, a tour of the Denver Water Operations Complex, an opportunity for committee members to interact in-person, an overview of 2022 filter adoption survey results and a preview of 2023 plans and work areas. The next meeting will be held in the first quarter of 2023. The previous quarterly meetings were held on Jan. 20 and April 17 and are described in the First Semi-Annual Report for 2022.
- Contact was made on 49 occasions with Denver City Council and Mayor's Office as well as officials in suburban jurisdictions to share information and updates on the LRP, upcoming work areas and construction activities. During 2022 contact was made on 59 occasions with these stakeholders, with the majority of engagement happening during the second half of the year to communicate about program progress and expectations for 2023.
- The LRP website received 325,300 visits and 584,120 page views since the launch of comprehensive LRP information on March 5, 2020.⁹³ In 2022 alone, the website received 81,474 visits and 140,307 page views.
- LRP TAP stories published on denverwater.org/TAP received 5,226 views, totaling 9,677 views during 2022.⁹⁴
- Denver Water social media activity reached 12,937 individuals, totaling 119,847 individuals reached during 2022.
- The LRP was mentioned in 424 news media stories, with a potential aggregate readership of 2.6 billion across online news, and television, totaling 474 stories with a potential aggregate readership of 2.9 billion during 2022.⁹⁵

In addition to these outreach activities, Denver Water developed its 2023 COE Plan. The plan identifies goals, target audiences and strategies/tactics that will guide COE outreach efforts in the third year of the LRP.⁹⁶

The following section highlights COE program activities carried out in 2022 from June 4 through Dec. 31 (unless otherwise noted), organized by strategy type.

⁹² See Appendix COE-23 Filter Use Reminder Postcard.

⁹³ See Appendix COE-29 Website Traffic.

⁹⁴ See Appendix COE-27 TAP Stories Published.

⁹⁵ See Appendix COE-25 Earned Media Report.

⁹⁶ See Appendix COE-17 2023 COE Plan.

Public Outreach

Overview of activity grouped by outreach component:

- Virtual Meetings
 - Denver Water hosted three bilingual, one-hour construction preparedness virtual community meetings on July 26, Sept. 20 and Sept. 22. This included one meeting to overview the LRP and federal funding opportunity and two meetings to overview proper filter use.
 - To promote the meetings on filter use, 45,833 outbound calls were made and 83,247 emails ⁹⁷sent to all customers enrolled in the Filter Program, with bilingual voicemail messages left for those who did not answer.⁹⁸ The meeting on the federal funding opportunity and LRP overview was promoted through emails to customers and in The Denver Post, per federal funding application requirements. Over 90,000 emails were sent to customers to promote the meeting. In total, 2,069 customers participated in these virtual community meetings.
 - Presentations to organizations were conducted upon request to provide an overview of the LRP, gather feedback and identify areas for potential coordination. These meetings included the following:
 - Public Relations Society of America, Colorado Chapter Webinar – Equitable Community Engagement through Education, Communication and Outreach (June 21).
 - Sunnyside Neighborhood Meeting (July 14).
 - SUNI Sippers, Sunnyside Neighborhood Meeting (Aug 16).
 - Berkeley Regis United Neighbors Board Meeting (Sep. 20).
 - Lead Service Line Collaborative Panel Participation – Rental Properties: Overcoming Barriers to Lead Service Line Replacement (Sept. 29).
 - Heart of Five Points Neighborhood Meeting (Oct. 12).
 - Greater Metro Denver Ministerial Alliance Membership Meeting (Oct. 20).
 - RE/MAX of Cherry Creek Staff Meeting (Nov. 2).
- Stakeholder Advisory Committee

⁹⁸ See Appendix COE-30 Virtual Community Meetings Email Invitations

- The Stakeholder Advisory Committee met for its third and fourth quarterly meetings of 2022 on July 20 and Oct. 12.
 - Representatives reflected a diverse group of organizations, including health care, education, nonprofit and government.⁹⁹
 - At the July meeting, the committee took a tour of the Denver Water Operations Complex and shared dinner while discussing meeting topics. Denver Water provided an overview of LRP progress, including service line replacements and material investigations, and updates on federal funding and the Variance extension. The meeting also included an overview of 2022 filter adoption survey results.
 - At the October meeting, Denver Water provided an update on LRP progress, the Variance extension process and pursuit of federal funding. This included an overview of the proposed changes to the Variance. Denver Water also shared a preview of 2023 plans and work areas, including what to expect with the potential receipt of federal funding.
- Government Relations
 - 49 proactive contacts and/or meetings were held with local government officials and staff, including Denver City Council and Mayor’s Office, as well as officials in suburban jurisdictions, to share information and updates for the LRP.
 - Now that the LRP is well underway, most of these updates included information on upcoming work areas and construction in respective Denver City Council Districts as well as updates on issues potentially impacting customers.
 - Outside of the proactive updates, staff continues to be responsive to questions from government officials, as needed.
- Distributor Communications
 - An update on the LRP was provided at the Sept. 20 and Nov. 15 distributor forum meetings.
 - Updates on the LRP were published in the September distributor newsletter.
 - Intergovernmental agreements with the City of Edgewater and Bancroft-Clover Water & Sanitation District are being extended through 2024 to allow for reimbursement of service line replacements occurring in conjunction with those distributors’ capital improvement projects.

⁹⁹ See First 2022 Semi-Annual Report, Appendix COE-1 Stakeholder Advisory Committee 2022 Membership List.

- Distribution of water quality sampling kits and results continues when requested by distributors' customers. Distributor LRP customers also receive replacement filters and, when there is a change in occupancy, a new filter kit.
- Paid Media
 - The successful paid media strategy implemented since program launch was continued during this reporting period to promote the LRP with focus on areas where residents may not be using filtered water as commonly as others.
 - Following an initial campaign in the first half of 2022, a second campaign ran from July 25 through Aug. 21, generating 3.6 million impressions through digital ads and driving over 4,600 visits to the LRP website. A third campaign ran from Nov. 21 through Dec. 11, generating 1.8 million impressions through digital media and driving over 2,700 visits to the LRP website.¹⁰⁰
- Earned Media
 - The LRP was covered in digital, print and broadcast news, including 9News, The Colorado Sun, The Washington Post, El Comercio de Colorado and U.S. News & World Report, among others.¹⁰¹
 - There were 11 posts about the LRP on social media channels in this reporting period, resulting in 12,937 impressions. Ambassador Program partners also shared Denver Water social media posts on their own networks.
 - Denver Water also provided content for organization and neighborhood newsletters on request.
- Digital Communications
 - Denver Water distributed emails on Sept. 16 and Dec. 15 to a database of over 56,000 subscribers. The emails shared information about upcoming virtual community meetings, best practices for proper filter use and how to request a replacement filter if needed, recent TAP stories on the LRP, updates on federal funding and 2023 work areas.¹⁰²
 - Eleven TAP stories were published on denverwater.org/TAP that included content related to the LRP. As of Dec. 31, these stories received a total of 5,226 views.¹⁰³
 - The LRP website, denverwater.org/Lead (English) and denverwater.org/Plomo (Spanish), was updated with the recordings of the federal funding and filter use virtual community meetings, monthly dashboards, an updated LSL inventory and

¹⁰⁰ See Appendix COE-24 Paid Media Campaign Overviews.

¹⁰¹ See Appendix COE-25 Earned Media Report.

¹⁰² See Appendix COE-26 Subscriber Emails.

¹⁰³ See Appendix COE-27 TAP Stories Published.

an updated pipe replacement map with the work areas for 2023. Since the launch of the LRP, denverwater.org/Lead has received 325,300 visits and 584,120 page views. There were 36,604 unique website visits from June 4 to Dec. 31, 2022. Since launching in October 2021, denverwater.org/plomo (the Spanish version of the website) has received 2,757 visits and 4,369 page views. There were 1,092 unique website visits from June 4 to Dec. 31, 2022.¹⁰⁴

Material Development and Owned Media [7.B.vi.a]

The following materials were developed from June 4 to Dec. 31, 2022:

- The public-facing dashboard was updated to share progress and key metrics for the LRP through November 2022, with the December 2022 dashboard to be posted in early January 2023.¹⁰⁵ The updated dashboard is posted monthly to denverwater.org/Lead and is available in both English and Spanish.
- Information on the LRP was included in the September 2022 and December 2022 issues of WaterNews. The September issue thanked customers for their support of the LRP through using filters, working with Denver Water on service line replacement and providing other information, such as water quality samples. The December issue provided an overview of the LRP as part of the 2023 rates update.¹⁰⁶
- Filter Program
 - A new online form (denverwater.org/Filter) was launched, allowing customers to request a replacement pitcher and/or filter if theirs is broken or missing. Customers may now request a replacement by submitting the online form as well as by calling or emailing Denver Water Customer Care.
 - A filter use reminder postcard was mailed to all enrollees in the Filter Program to emphasize the importance of and encourage proper filter use and maintenance.¹⁰⁷
- ALSLR Program
 - The service line replacement consent form was updated to include information on historic preservation, per coordination with the State Historic Preservation Office, and to insert a line for customers who decline replacement to provide an email address for follow up.¹⁰⁸

¹⁰⁴ See Appendix COE-29 Website Traffic.

¹⁰⁵ See Figure 1.

¹⁰⁶ See Appendix COE-19 September and December Issues of WaterNews.

¹⁰⁷ See Appendix COE-23 Filter Use Reminder Postcard.

¹⁰⁸ See Appendix COE-20 Updated Consent Form for Lead Service Line Replacement.

- Post-replacement flushing instructions were updated to include additional information on cleaning aerators and to provide a QR code which links to a video on proper flushing.¹⁰⁹

Internal Communications and Coordination

The following summarizes efforts to continue to educate Denver Water’s employees and contractors about the components and messaging of the LRP. This ongoing engagement supports the ability of Denver Water staff and representatives to provide customers with accurate information and enhances efforts to make the LRP accessible by all.

- Internal trainings and information-sharing sessions continued to be held as needed or requested to update Denver Water teams and departments on the LRP and prepare them for handling customer or community inquiries as appropriate. Nineteen sessions were held between Jun. 4 and Dec. 31.
- Talking points continue to be developed and updated for Customer Care and other customer-facing groups to support consistent and timely responses to customer inquiries.

Above and Beyond Stories

- In June, a homeowner who had received a service line replacement reported that their backflow broke and was spraying water. The homeowner was able to reach the contractor over the weekend, and the contractor worked to resolve the issue even though he was out of town. Ultimately, the contractor came back that Monday to fix the issue.
- In July, water was accidentally released into a homeowner’s basement during the service line replacement, covering the floor which included carpet. While they could have dried the carpet overnight using fans, the contractor instead replaced it with new carpet that same day.

¹⁰⁹ See Appendix COE-21 Updated Post-Replacement Flushing Instructions.

7.B.vii Health Equity and Environmental Justice

Section 7.B.vii of the Variance requires Denver Water to report and maintain records related to activities implemented to achieve its HE&EJ principles:

- vii. Health Equity and Environmental Justice. A summary of activities conducted and designed to address HE and EJ principles set forth in the LRPP, including:*
- a. a description of how the HE and EJ principles are being incorporated into the accelerated LSL replacement program, lead filter program, and communications, outreach and education plan;*
 - b. socioeconomic or demographic data collected through the survey that may inform the filter adoption rate by neighborhood or demographic group to the extent practical;¹¹⁰*
 - c. socioeconomic or demographic data collected from outside sources (e.g., census data, local public health agencies) to target communications, outreach and education programs to specific neighborhoods, demographic cohorts, or non-English speaking groups;*
 - d. documentation that outreach and education materials have been provided to at least 95% of the households enrolled in the filter program.*

Text is taken verbatim from the Order, dated Dec. 16, 2019.

A commitment to HE&EJ informs all aspects of the LRP, supporting accessibility, awareness and equitable participation for all customers. An overview of HE&EJ reporting requirements is presented in Table 37.

¹¹⁰ See Appendix HEJ-5 of the First Semi-Annual Report for 2022 for a summary of socioeconomic and demographic indicators from the 2022 formal filter adoption survey.

TABLE 37. Overview of 7.B.vii Requirements

Paragraph Reference	Description	Refer to
7.B.vii LRPP V (p 77)	Summary of activities conducted and designed to address HE&EJ principles.	Described in this section. See LRPP (p 77).
7.B.vii.a	Description of how HE&EJ principles were incorporated into the implementation of the: <ul style="list-style-type: none"> • ALSLR Program. • Filter Program. • COE Plan. 	See First Quarter Report of 2020 and updates in this section.
7.B.vii.b	Socioeconomic or demographic data collected from other sources to target communications, outreach and education programs to specific neighborhoods, demographic cohorts, or non-English speaking groups.	See this section for how data informed COE activities.
7.B.vii.c (2022 Variance)	Description of values used to calculate compliance with the HE&EJ compliance metric for LSLR and lead outreach and education materials.	Described in this section.
7.B.vii.d	Summary of information showing that outreach and education materials have been provided to at least 95% of the households in HE&EJ areas of concern enrolled in the Filter Program.	See Section 7.B.vi.a. and this section.
LRPP V (p 77)	Commitment to continue to consult and collaborate with the organizations and HE&EJ experts, stakeholders, community members and customers to continually improve upon integration of the HE&EJ principles with the Lead Reduction Program.	See this section.
LRPP V (p 79)	Collaborate with other agencies to address lead exposure from all sources.	Described in this section.

The following sections describe how HE&EJ principles were integrated into the various components of the LRP during the second half of 2022.

[Incorporating HE&EJ Principles via Communications, Outreach and Education \[7.B.vii.a, 7.B.vi.b and to support 7.B.vii.c\]](#)

Ambassador Program

Denver Water’s Ambassador Program is a partnership with community organizations to educate customers in historically underserved geographic or cultural communities about the LRP. These customized collaboration efforts expand the LRP’s reach, build awareness of program requirements and create momentum for behavior change in the appropriate culture and language most valued in harder-to-reach communities. There are three components of the Ambassador Program:

- **Contract Partners:** Conduct extensive on-the-ground outreach using culturally appropriate messaging with tailored outreach strategies to reach enrolled customers in prioritized communities.

- **Sponsorship Awards:** The sponsorship awards initiative launched in 2021 and provides funding to community organizations to either leverage their existing programs/services/events or create new opportunities to promote the LRP in targeted communities.
- **Information Partners:** Community organizations are recruited for their willingness to use their communication channels to promote the LRP.

Contract Partners

- [CREA Results](#) is a community organization that specializes in the Latinx community. This group supported community outreach activities in the following neighborhoods:
 - Athmar Park
 - Barnum
 - Barnum West
 - Clayton
 - Elyria-Swansea
 - Globeville
 - Harvey Park
 - Highlands
 - Mar Lee
 - Sunnyside
 - Valverde
 - Westwood
- During the second six months of 2022, CREA Results engaged in the following work:
 - Participated in 60 in-person or virtual events to educate residents within CREA’s targeted neighborhoods about the LRP with an estimated reach of 12,461 people.
 - Conducted email, phone and/or door-to-door outreach to 402 customers in targeted neighborhoods to encourage customers in the LRP to participate in the program and answer questions.
 - Hosted four radio show interviews about proper filter use and what to expect before, during, and after LSL replacements on KNRV (1150 AM), a Spanish language radio station, with an estimated reach of 10,000 listeners per show.
 - Secured six articles in El Comercio de Colorado, a prominent Spanish-language publication with an estimated circulation of 25,000 readers per issue.¹¹¹
 - Re-posted three LRP videos in Spanish on CREA’s Facebook page, which has 1,700 followers.

¹¹¹ See Appendix HEJ-7 Ambassador Partner Spanish Language Articles.

- Included LRP information in four CREA monthly newsletters with a distribution of over 900 readers per issue.

Sponsorship Awards

During the last six months of 2022, the following community organizations participated in the Ambassador Program as sponsorship awardees:

- [Denver Public Schools](#) is the public school system for the City and County of Denver.
 - Shared LRP information with DPS families at community events hosted at DPS' regional Community Hubs, reaching approximately 1,025 individuals.
 - Included a page on the LRP in their annual Enrollment Guide, which is mailed to all transition-grade students and their families. The content encouraged families at homes in the LRP to use filtered water for drinking,¹¹² and preparing infant formula.¹¹³
- The [Center for African American Health](#) offers African American and Black Metro Denver communities culturally responsive resources that support them in overcoming the root causes of health problems so they can maximize their individual and family health.
 - Featured the LRP in its December e-newsletter with a distribution of approximately 8,000 people.
 - Distributed information on and/or discussed the LRP with 385 people through various community outreach activities, including health clinics, community open houses and church outreach.
- The [Greater Metro Denver Ministerial Alliance](#) is an 82-year-old African American Civil/Human Rights Clergy organization committed to the fight for community and social justice.
 - Included information about the LRP in two newsletters sent in November and December to over 90 pastors in the Denver metro area.
 - Promoted the LRP on Facebook to their 550 followers garnering 130 likes.
 - Conducted an overview of the LRP during their Executive Council Meeting with 10 churches and their respective congregations in attendance.
- The [National Association for the Advancement of Colored People](#) (NAACP) - Denver Branch is the community-focused branch of the national organization in the Denver

¹¹³ See Appendix HEJ-6 DPS Enrollment Guide.

area. The NAACP’s mission is to ensure political, educational, social, and economic equality of rights of all persons, and to eliminate race-based discrimination.

- Hosted four community events where information on the LRP was shared with 760 attendees. Meetings took place in the Five Points and Montbello neighborhoods.
- Promoted the LRP on Facebook and Instagram to their 2,000 followers.
- Collaborated with 9News to host a reoccurring segment featured on a monthly broadcast to promote the LRP and environmental justice.
- [Una Mano, Una Esperanza](#) is a community organization that specializes in the Latinx community. This group supported community outreach activities in the Barnum, Barnum West, Swansea, and Westwood neighborhoods.
 - Hosted a dinner event to reach Spanish-speaking families and include information on the LRP and encourage proper filter use, with 90 participants.
 - Promoted the LRP at four community events, including block parties and school events, and reached a combined total of 1,530 people.
 - Promoted the LRP on Facebook to their 1,640 followers.

Examples of Partners in Action:

- CREA results represented Denver Water at dozens of community events throughout 2022. At these events, CREA answered questions from the community (in both English and Spanish) about whether specific properties were in the LRP, how to use the water pitcher and filter and how to contact Denver Water for more information. These conversations included a heavy emphasis on encouraging customers to use filtered water for cooking.
- During fall 2022, NAACP recommended that Denver Water give a presentation on the LRP to the Greater Denver Metro Area Ministerial Alliance. Following the presentation, the Ministerial Alliance expressed interest in forming a partnership with Denver Water to conduct outreach in the communities and congregations its ministers serve. This resulted in a new community partner for the LRP who is reaching new audiences through a trusted voice.

Virtual Community Meetings

Spanish interpretation has been available for every virtual community meeting held during the program, including the federal funding meeting in July and during the meetings on proper filter use in September. Meetings were fully bilingual, from the initial meeting promotion to the meeting presentation, poll questions and Q&A responses. The meeting recordings are also available in Spanish and English at denverwater.org/Plomo and denverwater.org/Lead.

Critical Customer Outreach

A combination of outreach efforts, including mailing, email, phone calls and door knocking continues to be conducted in 2022 to complete LSL replacements at critical customer facilities, such as schools and child care centers. These efforts have exceeded the baseline of two mailings and a door knocking as Denver Water continues to work to gain consent for all critical customer facilities.

Materials

All customer-facing materials produced or updated in 2022 have been translated into Spanish. The virtual community meeting presentations, promotional materials and follow-up communications were provided in both Spanish and English. Monthly dashboards for the LRP are available in Spanish and English at denverwater.org/Plomo and denverwater.org/Lead.

The Spanish version of the LRP website, denverwater.org/Plomo, continues to be updated and available to customers. To access the Spanish content, customers may simply click on the green “Español” button in the top right-hand corner of denverwater.org/Lead or visit denverwater.org/Plomo.

Core program materials were also translated into Vietnamese in anticipation of 2023 work areas overlapping with communities which may include Vietnamese speakers. Materials will be used in 2023 outreach.¹¹⁴

Tenant Outreach

Introductory program materials and filter kits continue to be provided to apartment complexes for distribution to tenants upon move-in. Coordination also continues with property managers to track material distribution.

Early Childhood

Through collaboration with Denver Health, information on the LRP continues to be included in “Warm Welcome” bags for families with newborns at Denver Health. Approximately 3,600 Warm Welcome bags are distributed annually. Similarly, through partnership with Tepeyac Community Health Center, information on the LRP is being included in baby bags to families with newborns at their facility. The information allows parents to understand the importance of filtering water when expecting and when preparing infant formula.

Meanwhile, the Denver Water Youth Education Team integrated information on proper filter use into their K-12 classroom visits as appropriate. During the last six months of 2022, the Youth Education Team conducted nine classroom visits where LRP information was shared, engaging 278 students.

¹¹⁴ See Appendix HEJ-8 Vietnamese Customer-Facing Materials.

HE&EJ Principles Applied to ALSLR Program [7.B.vii.a]

Denver Water updated its multicultural training program and delivered it to ALSLR field observers and contractors on Dec. 12 and 14, 2022, to review the customer journey and work through role-playing scenarios to ensure customer satisfaction.

- Denver Water customer journey.
- Multicultural awareness.
- Multicultural principles.
- Self-awareness and working across cultures.
- Audience language discussion.
- Working with customers when English is not a first language and protocol for interpretation.
- Managing behaviors when working in the public sector (in the field and inside homes).
- Key program messages.
- Review of materials customers receive, including new documents developed since the original training in February 2020.

Denver Water continues to evolve its approach around additional outreach efforts in areas with lower consent form return rates for service line replacement. In the second half of 2022, Denver Water coordinated with its construction contracting teams to more efficiently conduct additional phone and email outreach to these customers, going beyond the minimum two mailings and door-knocking attempts. Teams engage with customers in both English and Spanish, and directly answer questions customers may have about the replacement process.

Construction field crews also continue to use the iSpeak poster, which allows customers to select their preferred language from among 64 languages represented in the poster. Crews are then able to work with the customer and Denver Water to provide support in the preferred language.

2023 ALSLR Work Areas

Planning for 2023 ALSLR work areas began by using the LRP's prioritization model to target specific neighborhoods and underserved communities. The model is a risk-based approach that is used alongside long-term construction planning to account for the likelihood of LSLs in a given area, potential for health consequences, sociodemographic indicators, and logistical constraints or opportunities related to construction. If a neighborhood which was included in a previous work area aligned with the prioritization model, it was also included in 2023 ALSLR work areas. This continuity allows Denver Water to leverage existing community

outreach and education efforts and continue work in neighborhoods with high program awareness and engagement. Additional neighborhoods were added based on the outputs of the prioritization model and construction feasibility.

As a result, 2023 ALSLR work areas include continuing replacements in five neighborhoods (Barnum West, Congress Park, East Colfax, Park Hill and Speer) and beginning replacements in four new neighborhoods (Athmar Park, Hale, Sunnyside and West Highland). Neighborhoods from previous years that are not included in the 2023 ALSLR work areas are either included in the Federally Funded Lead Service Line Program (FFLSLP) or will be monitored via the prioritization model for future years.

It is important to note that, due to logistical and construction constraints, properties from some neighborhoods included in previous ALSLR work areas may not have had their LSL replaced and will therefore require the replacement to be scheduled in the future. These properties are referred to as rollover properties. It is anticipated that the need for individual replacements at rollover properties will increase over time based on constraints such as paving moratoriums, future paving commitments, owner changes and delayed return of consent forms. These properties, including non-responsive and refusal properties, will continue to be targeted for outreach and added to 2023 work areas when possible. Approximately 4% of all replacements in 2023 are anticipated to be performed as individual replacements at rollover properties.

The 2023 ALSLR work areas were reviewed with stakeholders, including within and outside of Denver Water, the LRP Stakeholder Advisory Committee, the City and County of Denver and CDPHE. Prior to the start of customer communications, notifications regarding upcoming work areas were communicated to elected officials, distributor partners and other key external stakeholders.

[HE&EJ Principles Applied to Filter Program \[7.B.vii.a\]](#)

All customers enrolled in the Filter Program received their initial filter kit in 2020 with enough replacement filters to last approximately six months. The distribution of additional replacement filters began on Aug. 27, 2020, an approximate five-month cycle following the same schedule used for the initial filter distribution. This distribution continued in 2022.

In 2020, outreach was conducted with leasing offices to support providing filter kits and program materials to new tenants on move-in. This outreach continued in 2022 as described earlier in this section.

[HE&EJ Compliance Metric \[7.B.vii.c \(2022\)\]](#)

Section 6.C of the Dec. 1, 2022, Variance requires Denver Water to ensure that the Program does not result in disproportionate impacts to areas with HE&EJ concerns:

C. Health Equity and Environmental Justice (HE and EJ) Compliance Metric. Denver Water will follow principles of environmental justice and equity in implementing the LRPP overall as reflected in its HE and EJ principles set forth in the LRPP. In addition, Denver Water will ensure that LSLRs are being conducted in a manner that does not result in disproportionate impacts to areas with HE and EJ concerns¹ as of the effective date of this variance. If Denver Water, CDPHE, and EPA determine that the changes in areas with HE and EJ concerns in future program years compared to those identified as of the effective date of the variance are significant, then the variance may be modified under 8.C to update the identified areas with HE and EJ concerns relied upon in this metric.

- i. Denver Water must annually achieve a cumulative Program Year LSL replacement rate in areas with HE and EJ concern that is equal to or greater than the total replacement rate. This calculation is the number of LSLs replaced per year in areas with HE and EJ concerns divided by total number of LSLs in areas with HE and EJ concerns must be equal to or greater than the average number of LSLs replaced per year overall divided by total number of LSLs as of the variance effective date.*
- ii. Denver Water must make direct contact with lead outreach and education materials to more than 95% of customers as identified in areas with HE and EJ concerns enrolled in the filter program in every Program Year.*

¹ For the purposes of this Order, areas with HE and EJ concerns are defined as any census block group with, as of the variance effective date, an 80th percentile ranking or above (when compared to either the U.S. or State) in EPA's EJScreen tool for one or more Supplemental Index.

Text is taken verbatim from the Order, dated Dec. 1, 2022.

The HE&EJ compliance metric is calculated using the equation below.

$$\frac{\text{average number of LSLs replaced per year}}{\text{total number of LSLs}} < \frac{\text{average number of LSLs replaced within HE\&EJ areas per year}}{\text{total number of LSLs within HE\&EJ areas}}$$

An area is defined as having HE&EJ concerns using EPA's EJScreen tool¹¹⁵ with a state or federal 80th percentile ranking or above for one or more of the following Supplemental Indexes:

- Particulate Matter 2.5
- Ozone
- Diesel Particulate Matter
- Air Toxics Cancer Risk
- Traffic Proximity
- Lead Paint

¹¹⁵ Refer to <https://ejscreen.epa.gov/mapper/> for the EJScreen interactive map.

- Superfund Proximity
- Risk Management Plan Facility Proximity
- Hazardous Waste Proximity
- Underground Storage Tanks
- Wastewater Discharge

Using the definition described above, 33,605 out of 63,955 LSL properties were identified within areas of HE&EJ concerns. Table 38 calculates the HE&EJ compliance metric for the 2022 program year. A total of 5,119 replacements were completed in 2022, with 3,284 (over 60%) of those replacements being within areas of HE&EJ concerns. The cumulative replacement rate within HE&EJ areas of concern is 9.4% and is higher than the overall cumulative replacement rate of 8.1%.

TABLE 38. HE&EJ COMPLIANCE METRIC CALCULATION FOR 2022

	Overall	Within Areas of HE&EJ Concern
Total Number of LSL Replacements Completed	15,477 ¹	9,439
Total Number of Properties with LSLs	63,955 ²	33,605 ³
Replacement Rate	8.1%	9.4%

¹ Total number of LSL replacements as of Dec. 31, 2022. Refer to Table 25.

² Total number of LSLs as of the 2019 Variance effective date (Jan. 1, 2020).

³ Calculated using the p-values, from the Sept. 6, 2019, base inventory, of properties that are within areas with HE&EJ concerns, as defined by the EJScreen supplemental indexes as of Jan. 1, 2023.

In addition to replacements within areas of HE&EJ concerns, Denver Water is also required to send outreach to 95% of customers within these areas. As mentioned in Section 5.B, in 2022, proof of contact with customers enrolled in the LRP is measured based on the mailing of filter reminder postcards. The postcards were mailed in the fourth quarter of 2022 and met the required 95% outreach metric for both properties within the Filter Program and properties within areas of HE&EJ concern. Additional outreach to areas of HE&EJ concern is described throughout the HE&EJ section of this report, particularly within the update on Ambassador Program activities.

PART 3: LRP PERFORMANCE USING THE EQUIVALENCY MODEL

Section 7.C of the Order requires a “comprehensive evaluation of the LRPP performance using the equivalency model described in the LRPP with updated inputs based on actual LRPP implementation for: 90th percentile lead levels at LSL and copper with lead solder sites after operation of increased pH and alkalinity adjustment as CCT, number of LSL replacements conducted, filter adoption rate, and filter performance in the field.” The metric is produced using actual performance data for various elements of the LRP to show the program “as implemented continues to be ‘at least as efficient as’ orthophosphate treatment in reducing lead exposure on an annual basis.”

The equivalency model is a statistical model that compares modeled lead concentrations at each service line in the service area for conditions representing LRPP implementation versus the projected performance of orthophosphate, designated as OCCT. LRP conditions include the use of pH and alkalinity adjustment as CCT, accelerated LSL replacement (in addition to replacements routinely carried out as part of water main projects, emergency repairs and by third parties), pitcher filters for lead reduction prior to LSL replacement, and communications, outreach and education. Conditions for OCCT include the use of orthophosphate and the historical average rate of routine LSL replacements.

The equivalency model includes actual data from:

- 1) Lead concentrations from LCR 1) compliance samples and customer requested samples at properties with copper plumbing and lead solder and other sites after operation of increased pH adjustment as CCT.
- 2) Number of LSL replacements conducted.
- 3) Filter adoption rate.
- 4) Filter performance in the field.

Integrating Data for Lead Levels into the Equivalency Model

The equivalency model uses actual lead levels measured from customer taps to represent lead levels from i) properties with copper plumbing and lead solder and ii) properties with no other known source of lead (i.e., non-lead in the LSL Inventory). Additionally, the model uses actual lead levels from filter performance sampling in the field to represent the reductions to lead levels at LSL homes that use a filter.

For properties with an LSL (i.e., confirmed LSL in the LSL Inventory), lead levels are represented by data collected from the pipe rack studies.¹¹⁶ This was necessary because the only data available for orthophosphate treatment applied to LSLs were generated by the pipe

¹¹⁶ See Lead Reduction Program Plan for a description of the pipe rack studies.

rack studies. This is a conservative approximation of lead release, as the pipe rack studies have been shown to release higher concentrations of lead than observed in the field.

Finally, to model lead levels after LSL replacement, the properties are treated as copper plumbing with lead solder because the premise plumbing may still contain lead/tin solder.

Integrating the LSL Inventory into the Equivalency Model

The initial LSL Inventory and the inventory from Dec. 31, 2022, are used as an input to the equivalency model to evaluate performance. An overview of the LSL Inventory is provided in Table 15.

Integrating Filter Adoption and Performance into the Equivalency Model

The filter adoption rate is used in the equivalency model by randomly selecting the number of remaining LSLs equal to the adoption rate. For example, in 2022, there were an estimated 63,276 LSLs at the beginning of the year¹¹⁷, with 5,119 being replaced by the end of the year.¹¹⁸ The adoption rate of 83%¹¹⁹ is interpreted as 4,249 are filtered and 870 are assumed unfiltered. These service lines are assigned lead concentrations randomly drawn from the observed distribution of lead in filter effluent generated from filter performance testing in the field. This reduces lead concentrations assigned to properties with a LSL and protected via the pitcher filter to concentrations far below the expected levels that would have occurred with only the addition of orthophosphate.

The results of the 2022 filter adoption survey were analyzed to identify sociodemographic factors that may correlate to lower or higher filter adoption. Using the survey results,¹²⁰ and efforts to target communities with lower adoption rates and address key themes from the survey are identified.¹²¹

The primary output of the model is an indexed performance of the LRP to the presumed OCCT conditions for each year, as shown in Figure 6. The index is calculated as the 90th percentile lead concentration from the LRP model divided by the 90th percentile lead concentration from the OCCT model. Results less than or equal to 1.0 demonstrate the LRP is “at least as efficient as” OCCT and in compliance with the Order. The points in Figure 6 reflect actual conditions each year (shown as a black X), the lines reflect projected numbers for future years (shown in solid red for the OCCT condition and dashed blue for the LRP condition).

Lead service line replacements for OCCT conditions are based on the historical rate of 1,200 replacements completed annually, which is assumed constant. For the LRP condition, there were 5,119 confirmed LSL replacements in 2022, with future LSL replacements assumed

¹¹⁷ See Table 15.

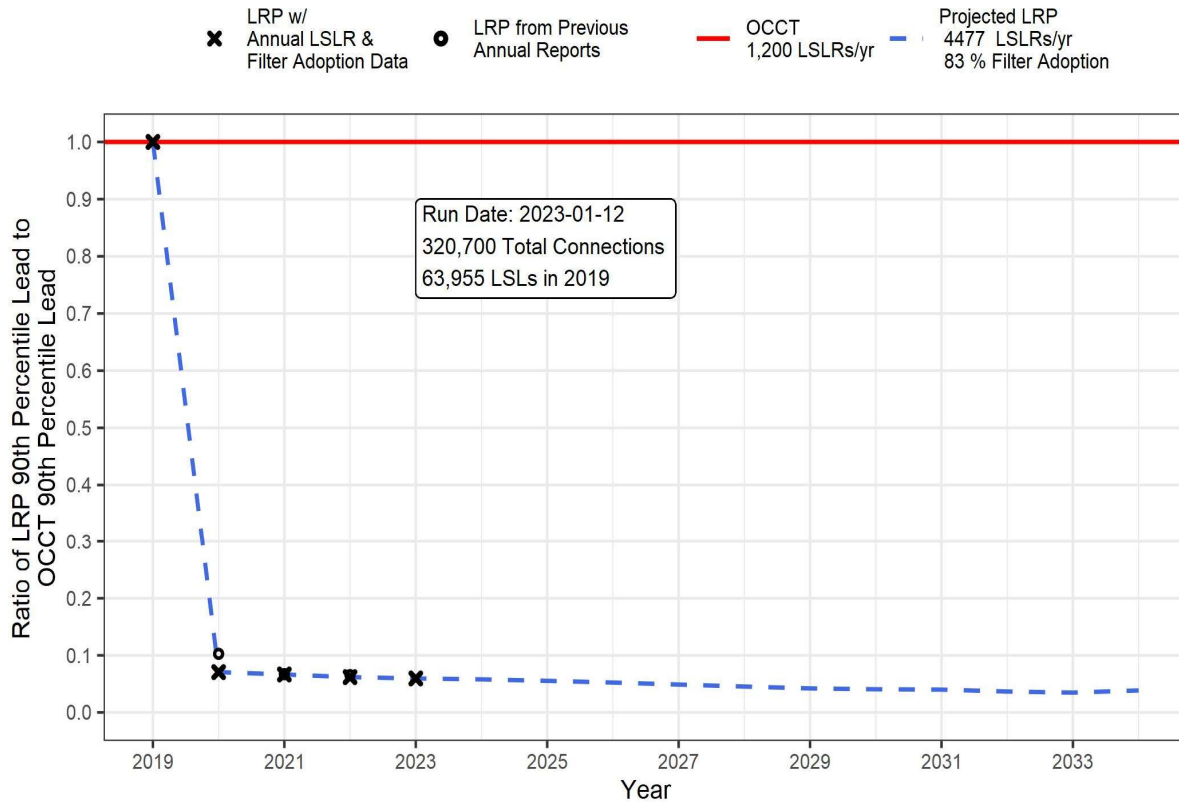
¹¹⁸ See Table 25.

¹¹⁹ See Table 31.

¹²¹ See Appendix A-3 Summary of Sociodemographic Indicators from 2022 Formal Filter Adoption Survey in the 2022 Interim Annual Report.

equal to the 7% mandated annual target (7% of 63,955 = 4,477). A filter adoption rate of 80% was used for each future year based on the 2020, 2021, and 2022 filter adoption rates, and a filter adoption rate of 83% was used for 2022.

FIGURE 6. EQUIVALENCY MODEL OUTPUT FOR 2022



The model outputs of Figure 6 indicate that the LRP approach has resulted in system-wide lead concentrations that are less than 0.10 times the expected OCCT lead concentrations when measured at the 90th percentile. These results indicate that system-wide lead concentrations are lower than they would have been under OCCT conditions. Thus, better performance of the LRPP is demonstrated compared with OCCT for 2022. If the LRP continues to obtain these metrics into the future, the LRP should be more efficient than OCCT for the duration of the program, as shown by the dashed blue line.

The value provided in the past annual reports are shown with the black circles. This value differs from the current prediction because the most current water quality results and LSL replacement data were used. Although the additional LSL replacements were not counted toward the 7% target, they are counted in the model because they were verified to have happened in 2020 and 2021.

The results of Figure 6 indicate that system-wide lead concentrations are lower than they would have been under OCCT conditions. Thus, Denver Water has again demonstrated better performance of the LRP compared with OCCT for 2022.

PART 4: LEARNING BY DOING

Five of the six elements that together make up the LRP are used to evaluate the overall effectiveness of the program (COE Plan, LSL Inventory, Filter Program, ALSLR Program and CCT). The sixth element is Learning by Doing — presented as a strategy (versus a desired outcome), as quantitative performance metrics were not identified in the Variance.

As part of the Learning by Doing element of the LRP, Denver Water is committed to:

- Evaluating the performance of the LRP to improve outcomes.
- Establishing an Advisory Committee to inform Denver Water on more efficient and effective ways to implement the LRP to achieve the Variance goals.

This means that Denver Water incorporates the Learning by Doing approach to improve outcomes during the life of the LRP. During the second six months of 2022, efforts continued to identify potentially more efficient or effective ways to implement the LRP in the Learning by Doing log. The outcomes tracked in the Learning by Doing log are presented as an independent report at the end of each program year.

The following are Learning by Doing activities from the second six months of 2022:

- Workfront tickets are submitted by customers to the LRP team regarding anything from low-priority items (questions about the program) to high-priority items (repairs). It is important to Denver Water to have a quick response time and meet the needs of the customers. To reduce the potential for delays in Workfront ticket responses, in 2022, the Workfront Team developed a “Workfront Report,” which is distributed weekly to the team. The report summarizes the Workfront tickets received that week, the priority level of the tickets, and what the response time was. Focusing on Workfront tickets weekly has reduced the time in the Workfront tickets being received, responded to, and closed out. Denver Water had a 10% reduction goal in tickets compared to 2021 for common issues that can be controlled (e.g., damage during replacement, potholes, sinkholes, restoration) and saw a 20% decrease in 2022, surpassing the goal. The 20% reduction in tickets is due to improved communication with customers — from COE efforts (using social media platforms, local marketing, online information available on Denver Water website, etc.) to documents provided by the contractors during pre-construction meetings with homeowners. The Workfront Team does their best to also answer as many questions as possible about the LRP (consent form, process, expectations, etc.) when calls come in before sending it to the contractor. Generally, the team is able to close out these tickets on the first response, leaving more time for the contractors to focus on responding to and resolving other requests or issues (irrigation system repair, sod restoration, sidewalk repair, etc.) as quickly as possible. The Workfront Team also tracks how many tickets each Field Supervisor currently has open and the overall ticket count over the lifetime of the program.

- Denver Water sought clarification from EPA in 2021 on the definition of what counts toward the 1.4% investigation requirement. Originally, Denver Water only counted investigations that resulted in a p-value change to 0 or 1. After clarification was received, Denver Water counted all investigations independent of the ALSLR Plan, but would only count a property once, even if multiple techniques were implemented to determine the material type. Beginning in 2022, Denver Water began counting a property up to three times, once for each investigation method (potholing, water quality, and desktop reviews). Allowing each method to count toward the metric recognizes the additional efforts made by Denver Water to determine a material type. In addition, counting properties multiple times will be key to meeting the new 1.4% rate, which applies to all unknowns under the Variance, increasing the required cumulative investigation count from 1,169 to 2,420.

Efforts continue to use the Learning by Doing approach to address challenges and improve effectiveness of outreach in hard-to-reach communities.

DEVIATIONS AND CLARIFICATIONS

Under paragraph 7.C of the Orders, Denver Water is required to “document any deviations from the LRPP during the most recent Program year.” During the 2022 Program Year, input was sought from EPA on clarifications and, in certain instances, permission to deviate from the Order to address the administration of the LRP, as summarized below.

Deviations

- There were no deviations from the Variance in the 2022 Program Year.

Clarifications

- As the Program entered the fourth quarter of 2022, the Variance approval for the upcoming program years was anticipated, but not yet final. To be able to move ahead with year-end reporting, on Nov. 17, 2022, Denver Water gave notice to EPA and CDPHE describing the 2022 year-end reporting intent. Denver Water stated the intent to combine the second semi-annual report for 2022 with the 2022 annual report, per the reporting requirements under the new Variance (approved Dec. 1, 2022). Therefore, activities in 2022 were performed under the original 2019 Variance, but for the purposes of this report, are being summarized per the original 2019 Variance and the new 2022 Variance.