

LEAD REDUCTION PROGRAM PLAN

APPENDICES

VOLUME 2 OF 2

APPENDIX III.C.2 - FILTER PILOT

September 2019

TECHNICAL MEMORANDUM

To Denver Water
From Mott MacDonald
Date August 13, 2019
Project No. 507100139
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Subject Denver Water Lead Reduction Program (LRP)
Appendix III.C.2 Filter Pilot Plan

I. PURPOSE

The purpose of this Technical Memorandum (TM) is to summarize the framework for Denver Water's Filter Lead Out of Water (FLOW) Pilot program. The FLOW Pilot targets a subset of premises that will be included in the full-scale FLOW Program. The basis for the FLOW Pilot is twofold:

1. Demonstrate processes and workflows that can be used for the full-scale FLOW Program implementation.
2. Survey customers to obtain feedback on filter use adoption for at least 200 premises.

Presented herein is a summary of the background, processes and workflows, filter distribution methods, customer notifications, filter kit materials, follow-up/survey information, filter use adoption validation basis, schedule, and filter survey summary.

II. BACKGROUND

General

Denver Water serves high-quality drinking water to approximately 1.4 million people and continuously monitors water quality. Drinking water entering the distribution system prior to the connection to the customer's service line is free of lead. However, lead may leach into the drinking water as it stagnates in the customer-owned lead service line and/or premise plumbing.

Denver Water believes there is no safe level of lead in drinking water and is committed to taking steps to optimize its water system for control of lead by implementing a Lead Reduction Program (LRP). One element of Denver Water's LRP is FLOW, which includes the distribution of filters certified to NSF/ANSI Standards 53 to Denver Water households according to Denver Water's service line inventory, as follows:

Denver Water's service line inventory dated August 8, 2019 includes:

- 319,700 service lines used for drinking water in the Denver Water service area.
- 84,546 service lines identified as known, suspected and possible lead service lines – these premises are candidates for FLOW.

Multi-family properties are included in the 84,546 service lines that are part of the filter program. A multi-family property has multiple household units. A household unit is an individual residence that receives a filter. Using available data, it is estimated that Filter

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Program participants consist of 119,250 Denver Water household units, with each household unit receiving a filter.

FLOW is used as the interim treatment barrier to remove lead from customers' drinking water until the lead service line is replaced or confirmed as non-lead. Denver Water is considering providing filters through the end of 15 years as Denver Water progresses through the inventory of lead service line properties and replaces lead service lines. Denver Water households using an NSF certified filter to reduce lead will experience a >97% reduction in lead levels.

Upon LRP approval, it is expected that the full-scale implementation of FLOW will commence immediately following the multi-media public information campaign and customer notification model in accordance with the Communication, Outreach and Education (COE) Plan. The success of the COE and FLOW is paramount to provide Denver Water with information and, also to share information with Denver Water households that does as much as possible to encourage filter use and education.

The goal of the FLOW Pilot is to distribute filters and collect follow-up surveys from at least 200 Denver Water households. The schedule for the FLOW Pilot is:

- General LRP press release by Denver Water on July 1, 2019.
- Distribute approximately 300 filters starting July 9, 2019.
- Collect and analyze follow-up surveys on filter usage from at least 200 Denver Water households by early August 2019.

Filter Type

As part of Denver Water's current practice, a pitcher filter is distributed by Denver Water to a Denver Water household:

- after the replacement of their lead service line, with five (5) months of replacement cartridges; or
- after potholing reveals a lead service line, with five (5) months of replacement cartridges.

Denver Water currently distributes a ZeroWater pitcher filter with the following features:

1. 10-cup capacity
2. NSF/ANSI Standards 42 and 53 certified
3. 5-stage filter with ion exchange that removes 99.6% of detectable dissolved solids, including lead and fluoride
4. filter cartridges replaced based upon average use (approximately 30-days for a Denver Water household)

In addition to pitcher filters, other filters certified to remove lead by NSF include: filters attached to the kitchen faucet and refrigerators filters. Denver Water will be able to purchase filters from multiple vendors that are NSF certified to remove lead and do not remove fluoride. A summary of available pitcher filters and available alternative filter

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types and replacement cartridges for consideration by Denver Water is included in Appendix A.

Although Denver Water’s available inventory of ZeroWater 10-cup pitcher filters remove fluoride, the ZeroWater pitcher filters were distributed for the FLOW Pilot due to the pilot schedule and use of Denver Water’s stock of pitcher filters.

Filter Kit

Each participant of the FLOW Pilot received a kit with the pitcher (including a filter), three replacement filter cartridges (four total filter cartridges), and education/outreach material. Details on the pilot filter kit (education / outreach documents, pitcher filter and cartridge manufacturer instructions, packaging, and other contents) are included in Appendix B.

Filter Distribution Method

Filter kits were distributed to Denver Water households using various methods:

- Direct mail by Denver Water with tracking and delivery confirmation through USPS shipping software, Pirate Ship
 - USPS - Priority Mail (1 to 3 day delivery)
- Hand delivery by Denver Water or contractor
 - Door-to-door canvassing
 - In-person transaction
 - Drop-off

For the FLOW Pilot, Denver Water distributed approximately 300 filter kits as outlined in Table III.C.2-1.

Table III.C.2-1 Kit Distribution Breakdown

Distribution Method	Number of Denver Water households
Direct mail USPS	200
Door-to-door	100

Notification Methods

Notification methods that were employed in the FLOW Pilot are intended to be similar to those proposed for the full-scale implementation of the FLOW Program. Methods include:

- Direct mail and door-to-door delivery of filter kits (Appendix B) with a letter to the customer (Appendix C), detailed instructions regarding the FLOW Pilot, water filter cartridge use and replacement, an informational frequently asked questions (FAQ) explainer, a survey/response form (bilingual), a quick response (QR) code

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for access to Denver Water’s digital registration page (in lieu of mail-in survey/response), a reminder magnet for maintenance of the pitcher, and other related details. For the full-scale FLOW Program, the material will be available on Denver Water’s website.

- Door-to-door canvassing of neighborhoods campaigns, neighborhood meetings, and additional strategic community outreach.
- Robo calls to impacted Denver Water households.
- Follow-up communication using mail, email, phone, and door-to-door survey.
- Offer water quality sampling to quantify the magnitude of lead release, if not previously sampled.
- Interview Denver Water households to determine whether or not an alternative means to reduce lead exposure is employed, such as an existing filter system (confirmed NSF certified to remove lead), or if the Denver Water households rely on bottled drinking water for infant formula, drinking, and cooking.
- Make one additional attempt to encourage the customer to use a filter, based on site specific information for materials of construction and the water quality sampling results.

In addition, water quality sampling and community outreach and education materials will continue to be provided to customers not in the FLOW Pilot, as requested.

Survey

The four categories of surveys for gathering information from FLOW Pilot participants about how filters are used for infant formula, drinking, and cooking activities include:

- **Initial Survey:** The intent of this survey is to obtain initial feedback from the Denver Water household. This survey is included in the hand-delivered and mailed filter kits. The questions in the initial survey are included in Appendix D. If the Denver Water household receives a kit and does not complete the initial survey, follow-up emails and phone calls were performed. A \$15 Amazon gift card incentive was offered to the Denver Water household, upon completion of this survey, to encourage them to complete the survey. The Initial Survey is located at: denverwater.org/Lead-survey. Further details on follow-up are included in Table III.C.2-2.
- **Use Survey:** The use survey was sent to FLOW Pilot participants a week or two after they have received their filter kit. The primary intent of this survey is to confirm if a Denver Water household is using the pitcher filter for infant formula, drinking, and cooking. The survey includes an option if the Denver Water household prefers an alternative filter other than a pitcher filter, such as filters attached to the kitchen faucet or refrigerator filters. The questions in the survey are included in Appendix D. To remind the Denver Water household to complete the survey, Denver Water sent emails and made follow-up phone calls. A \$15 Amazon gift card incentive was offered to the Denver Water household, upon completion

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of this survey, to encourage them to complete the survey. The Use Survey is located at: denverwater.org/FLOW-survey.

- **Alternative Survey:** If a Denver Water household has an alternative filter installed, the alternative survey would be sent to confirm if the Denver Water household is using the alternative filter for infant formula, drinking, and cooking. The questions in the survey are included in Appendix D. If the Denver Water household receives an alternative filter and does not complete the survey, Denver Water sent emails and make follow-up phone calls to remind the Denver Water household to complete the survey. A \$15 Amazon gift card incentive was offered to the Denver Water household, upon completion of this survey, to encourage them to complete the survey. The Alt Survey is located at: <http://bit.do/LSL-AlternativeFilter>. Alternative filter cartridge replacement schedules range from 3 to 8 months.
- **Ongoing Surveys:** The intent of this survey is to confirm if the Denver Water household is continuing to use the filter for infant formula, drinking, and cooking. Surveys will be conducted, monthly, in coordination with a reminder for the Denver Water household to change their pitcher filter cartridge. The survey will obtain feedback of the COE and the FLOW Pilot. The questions in the survey are included in Appendix D. Denver Water will send emails and make follow-up phone calls to remind the Denver Water household to complete the survey. A \$15 Amazon gift card incentive will be offered to the Denver Water household, upon completion of this survey, to encourage them to complete the survey. The Ongoing Surveys are located at: <http://bit.do/LSL-Ongoing>. The schedule for the ongoing surveys is as follows:
 - August 26th - Follow-up phone calls/emails to remind participants to complete Use Survey, obtain feedback, and inform customer that pitcher filter cartridge should be replaced per manufacturer's recommendations*.
 - September 23rd - Survey - follow-up phone calls/emails to complete survey and inform customer that pitcher filter cartridge should be replaced per manufacturer's recommendations*.

** To evaluate the potential filter adoption rate, a survey of all participants of the FLOW Pilot was undertaken to measure filter use and understand reasons for non-adoption.*

For all surveys, Denver Water provides an online survey option that is mobile friendly (Snap Survey). Surveys included a unique website/Uniform Resource Locator (URL) and a Quick Response (QR) code and may be accessed by mobile phones. Each participant has a unique survey access code assigned, so that responses can be tracked to the Denver Water household.

Denver Water will follow-up to provide education on methods to reduce lead exposure; determine whether or not an alternative lead reduction strategy is used; and ultimately encourage the use of the filter for customers that either do not respond to the survey or communicate that the filter was not used.

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Vulnerable Populations

Vulnerable populations, such as expecting families, children, and those of low socioeconomic standing, will be identified, contacted, and tracked using the following methods:

- COE – Outreach to specific groups will be completed using community outreach, meetings, and individual interaction with Denver Water households using the tactics noted in Appendix III.A Communications, Outreach and Education Plan.
- Survey Questions - The survey questions will help identify expecting families and families with infants.

Information will be incorporated into the Lead Service Inventory (LSI) for use with the predictive modelling effort described in Appendix III.B.3 Prediction Model and Prioritization.

Lessons Learned

Other entities have distributed filters to customers for lead and non-lead programs. The lessons learned from distribution of filters for other entities are shown in Table III.C.3-3.

Table III.C.2-2 Lessons Learned in Other Jurisdictions

Item No.	Description
1	Directions for filter use must be clear to ensure proper use of filters.
2	Reach out to Denver Water households through various methods: phone calls, emails, door-to-door, website videos, tables at community events, local TV stations, etc.
3	Impersonators may be an issue. Make sure all staff have ID badges and outreach material spells out what Denver Water households can expect from Denver Water staff.
4	Many man hours are needed for door-to-door delivery of pitchers.
5	Be prepared to field questions of why certain citizens are included in the filter program, and others are not. Make sure the criteria are clear and there is consensus on who is in the filter program and who may be added, as more information is gathered.

General Water Quality - Flushing

To reduce your exposure to lead in drinking water, we recommend flushing following the steps highlighted on [www.denverwater.org](https://www.denverwater.org/water/water-quality/lead/reduce-your-risk) (<https://www.denverwater.org/water/water-quality/lead/reduce-your-risk>).

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When using water for drinking, cooking and making ice, beverages and infant formula:

- *Use cold water. Hot water dissolves lead faster and is likely to contain higher levels of lead.*
- *If water has not been used for a few hours, run the kitchen or any bathroom faucet for a few minutes. You also can run the dishwasher or take a shower.*

III. DENVER WATER HOUSEHOLD IDENTIFICATION/SELECTION OF CANDIDATES

Candidates for the FLOW Pilot are representative of the general Denver Water customer population, including:

- varied income levels, and
- mix of English-speaking and Spanish-speaking.

For the FLOW Pilot, the neighborhoods selected are:

- West Colfax
- Villa Park
- Barnum West
- Barnum
- Westwood
- Valverde, and
- Athmar Park

These neighborhoods are generally considered to have mixed income and include English-speaking and Spanish-speaking Denver Water households.

Candidates for the FLOW Pilot were identified by Denver Water using available GIS data per the following criteria:

- Suspected lead service line
- Premise address is the mailing address
- Owner occupied
- One phone number. Denver Water households with multiple phone numbers on the “Person” table were deleted. Due to the compressed pilot schedule, the use of one phone number will eliminate potential confusion where one tap has many different phone numbers.

Based upon the data query above, Denver Water GIS generated a file of 992 candidates with suspected lead service lines, living in the seven selected neighborhoods. A subset of 300 customers were identified from the 992 candidates. As the 992 customers were not evenly distributed over the seven neighborhoods, customers were proportionally selected based on roughly 3 in 10 customers, while ensuring the proportion of customers in each neighborhood remained close to the original dataset. The records were sorted by

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neighborhood, then every third record was selected until the number of selected records was 30% of the original number of records in that neighborhood. Every third record was selected because it was noted that there was some geographic correlation between the natural order of the records which would have otherwise resulted in geographic bias within each neighborhood. The final selection of 300 customers was reviewed by Denver Water staff to ensure they are suitable for inclusion in the FLOW Pilot program (i.e., have a suspected lead service line).

Maps showing the location of the 300 selected premises are provided in Appendix E.

IV. FILTER PILOT - 5100 SERIES

The framework for the FLOW Pilot consists of the following four (4) stages of processes and workflows:

- 5110 – Initial Distribution
- 5120 – Use Survey & Alternative Filters
- 5130 – Filter Adoption
- 5140 – Filter Cartridge Replacements

The FLOW Pilot – 5100 Series: Workflow/Flowchart that illustrates the sequence of the steps for each stage is included in Appendix F. Below are the details of the key steps for each of the stages.

A. Initial Distribution (5110)

Initial Distribution (5110) is the first stage of the FLOW Pilot with the following steps:

- **5111 - Notify Stakeholders:** In addition to the July 1, 2019 press release, Denver Water notified / informed city, community and neighborhood leaders and stakeholders of the FLOW Pilot.
 - Identify key leaders and stakeholders
 - Contact the leaders and stakeholders via telephone call or email
 - Review details in the press release.
 - Notify / inform leaders and stakeholders of the FLOW Pilot.
- **5112 – Training:** Office and field staff supporting the FLOW Pilot were trained.
 - Finalize filter kit education/outreach material, surveys, phone / in-person scripts, FAQs, and other key references, as included in Appendix G.
 - Conduct in-person training.
- **5113 – Kit Assembly:** The filter kit contents (see Appendix B) were procured, assembled into kits, and stored in Denver Water Building H – Warehouse.
 - 200 kits boxed for mailing
 - 100 kits bagged for hand delivery
- **5114 – Mail Kits:** Two-hundred (200) boxed filter kits with letters were mailed to Denver Water households via USPS Priority Mail. The letter is provided in

Appendix C. Denver Water households that are enrolled in the Denver Water email subscription were also emailed the letter highlighting that the filter kit package has been mailed, encourage participation, and request for the Denver Water household to contact Denver Water if the Denver Water household does not receive the kit within 5 days. Further details on the filter kit distribution and follow-up are included in Table III.C.2-2. For the mailed kits, the intent is to split into four groups with varying levels of follow-up. Field staff carried a Denver Water photo identification and were dressed in safety t-shirts, adorned with the approved Denver Water logo, for ease of identification.

- **5115 – Hand-Deliver Kits:** Bagged filter kits with letters were hand delivered to Denver Water households. The letter is provided in Appendix C. Denver Water households that are enrolled in the Denver Water email subscription were also emailed the letter highlighting that the filter kit package will be delivered, and encourage participation. Further details on the filter kit distribution and follow-up are included in Table III.C.2-2. For the hand-delivered kits, the intent is to split into two groups with varying levels of follow-up. Field staff carried a Denver Water photo identification and were dressed in safety t-shirts, adorned with the approved Denver Water logo, for ease of identification.
- **5116 – Initial Survey**

Table III.C.2-3 FLOW Pilot Distribution Plan

Distribution Method	Number of Denver Water households	Details / follow-up
Direct mail USPS (5114)	50	One (1) phone call follow-up reminder to use filter and request Denver Water household to complete the Initial Survey (5116)
	50	Up to three (3) phone call follow-up reminders to use filter and request Denver Water household to complete the Initial Survey (5116)
	50	Up to three (3) phone calls and one (1) follow-up visit / door hanger to remind the Denver Water household to use filter and request Denver Water household to complete the Initial Survey (5116)
	50	Up to three (3) phone calls and up to two (2) follow-up visits / door hangers to remind the Denver Water household to use filter and request Denver Water household to complete the Initial Survey (5116)
Door-to-door canvassing of	50	Visit 1 - in-person transaction (explain the program and encourage use of the filter, hand-deliver a filter kit, and ask Denver Water household to complete Initial Survey

Table III.C.2-3 FLOW Pilot Distribution Plan

Distribution Method	Number of Denver Water households	Details / follow-up
neighborhood (5115)		One (1) phone call follow-up reminder to use filter and request Denver Water household to complete the Initial Survey (5116)
	50	Visit 1 - in-person transaction (same as above) or leave kit on door Up to three (3) phone calls follow-up reminders to use filter and request Denver Water household to complete the Initial Survey (5116)

B. Use Survey & Alternative Filters (5120)

Use Survey & Alternative Filters (5120) is the second stage of the FLOW Pilot with the following steps:

- **5121 - Analysis/Tracking:** Data gathered from the filter kit distribution, door-to-door visits, surveys, and other feedback received were captured in a centralized database. For this step, data was further analyzed related to the participant’s pitcher filter use and requests for alternative filters.
- **5122 – Use Survey**
- **5123 – Mail Alt Filter:** If an alternative filter has been requested by the Denver Water household and they have opted for a home-owner-installed alternative filter, the alternative filters will be directly mailed to the Denver Water household. The Alt filter option is predicted to be used for alternative filters that are easily installed.
- **5124 – Install Alt Filter:** If an alternative filter has been requested by the Denver Water household and they have opted for Denver Water to install, an appointment will be made and the alternative filter will be installed. Before installing the filter, Denver Water will conduct a visual inspection of the service line as it enters the house. With the aid of the homeowner, the entry point for the service line will be identified. Field staff will carry a Denver Water photo identification and will be easily identifiable.
- **5125 – Alternative Survey**

C. Filter Adoption (5130)

Starting approximately one week following Initial Distribution (5110), the Filter Adoption (5130) stage commenced with the following steps:

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- **5131 - Analysis/Tracking:** Data gathered from the filter kit distribution, door-to-door visits, surveys, and other feedback received were captured in a centralized database. For this step, data was further analyzed related to the Denver Water household's filter use and COE.
- **5132 – Ongoing Surveys**

D. 5140 – Filter Cartridge Replacements

- **5141 – Transition:** When the LRP Variance is approved, the full-scale FLOW Program will be implemented. At this point, the Denver Water household will be transitioned to the Filter Cartridge Replacement: 5200 Series, as part of the full-scale FLOW Program. Filter Cartridge Replacement: 5200 Series will include distribution of replacement cartridges until six (6) months after the replacement of the lead service line. The 5200 Series will continue to have monthly reminders to replace filter cartridges and requests to complete surveys. The tentative transition schedule is as follows:
 - November 8th
 - Distribute next batch of replacement cartridges.
 - Follow-up phone calls/emails to inform customer that pitcher filter cartridges require replacement per the manufacturer's recommendation and the next batch of replacement cartridges was mailed.
 - Finalize transfer of Denver Water household into the Filter Cartridge Replacement: 5200 Series workflow.
- **5142 – Discontinue FLOW Pilot:** If the LRP Variance is not approved, the FLOW Pilot will be discontinued. A letter will be sent to the Denver Water household notifying them.

V. DATA MANAGEMENT

Microsoft SharePoint, Microsoft Excel, and GIS was used to manage data related to the FLOW Pilot. The use of SharePoint and Excel is based primarily on the limited sample size (approximately 300 residences) and the accelerated schedule of the FLOW Pilot, which favors ease of access and customizability compared to more structured data management platforms, like databases, which may have limited access or require advanced knowledge to manipulate. Use of Excel in the SharePoint environment avoids many of the versioning issues resulting from stand-alone Excel files while also taking advantage of distributed access and concurrent editing capabilities. Standards were set for editing information to ensure consistency and facilitate data analysis and reporting, such as applying data validation and locking columns which should not be edited. Quality Assurance/Quality Control (QA/QC) techniques were used to check the accuracy of the data.

Filter recipients were asked to respond to several online surveys related to filter use. The surveys have been administered using the survey tool, Snap Survey, to seamlessly collect data directly from FLOW Pilot participants. The collected survey data was then exported to Microsoft Excel on SharePoint for further analysis/aggregation of results. Excel or PowerBI may be used to produce a dashboard tracking metrics or interest for the FLOW Pilot. The Mott MacDonald Field Inspection Tools (MMFIT) application will not be available during the FLOW Pilot; however, consideration will be given to how data collection efforts may be performed using MMFIT for the full filter program.

VI. FILTER USE ADOPTION SUMMARY

Multiple surveys will continue to be completed by the Denver Water households that are participating in the FLOW Pilot, which include the Initial Survey (5116); Use Survey (5122); Alternative Survey (5125); and Ongoing Surveys (5132). The survey questions and a copy of the surveys are included in Appendix D. Survey results included are supported by a hard copy or an electronic output from the online platform, as shown in Appendix H. Filter use adoption was completed primarily based upon the responses to the following two survey questions:

1. Do you use your filter for drinking water? Yes/No
2. Do you use your filter for water used in cooking? Yes/No

Filter adoption rates and primary sources for drinking water and cooking was tracked during the FLOW Pilot and data collected is included in Appendix H. Filter adoption assumes customers are using the pitcher filter for drinking water and cooking. Denver Water will continue to follow-up with the Denver Water households to complete additional Use Surveys.

A summary of the FLOW Pilot survey responses as of August 13, 2019 is as follows:

1. 247 kits were mailed (187 to original FLOW candidates, 34 to additional FLOW participants who requested kits; 25 re-sent to pilot participants that did not initially receive them; 1 kit sent to resident who requested a second filter for cooking).
2. Kits were mailed on Wednesday, July 10 and hand-delivered on Thursday, July 11, additional kits were mailed July 13, July 23, July 30, and August 2 and hand-delivered on July 27, 30, and 31, 2019.
3. Two kits were refused and mailed back.
4. 93 kits were hand-delivered on Thursday, July 11.
5. 8 kits were hand-delivered during follow-up visits to pilot participants who did not receive their initial kit.
6. 4 kits were hand-delivered during a community resource fair on Saturday, August 10, 2019.
7. All 280 pilot participant houses had at least one follow-up visit.
8. **Initial Survey Responses Received:** 25% - 69 total (out of 280 pilot participants): 52 hard copy surveys and 17 online surveys. Of the 69 surveys received, 5 were completed in Spanish - 7%.

- Use unfiltered tap water for drinking and cooking: 31/69 – 45%
 - Use bottled water for drinking: 16/69 – 23%
 - Use filtered water for drinking: 22/69 – 32%
 - Use filtered or bottled water for cooking: 13/69 – 19%
 - Participants who reported that they had a lead service line:
 - Yes: 13/69 – 19%
 - No: 3/69 – 4%
 - Did not know: 53/69 - 77%
9. **Use Survey Responses Received:** 28% – 79 total (out of 280 pilot participants): 54 hard copy surveys and 25 online surveys. Of the 78 surveys received, 10 were completed in Spanish - 13%.
- Use for drinking water: 72/79 – 91%
 - Use for drinking and cooking: 48/79 – 61%
 - Use for infant formula*:
 - Yes: 19/79 – 24%
 - No: 11/79 – 14%
 - Not Applicable: 49/79 – 62%
- *Survey responses indicated that there may have been confusion regarding the response of “no” or “not applicable” for the infant formula question.*
- Pilot participants who would prefer an alternative filter:
 - Faucet-mounted filter: 36/79 – 46%
 - Larger pitcher filter: 12/79 – 15%
 - Refrigerator filter: 6/79 – 8%

A summary of the resources required and associated cost to implement the FLOW Pilot as of August 13, 2019 is summarized in Table III.C.2-4.

Table III.C.2-4 Flow Pilot Resource Summary

Task Description	No. of Staff	No. of Hours per Staff	Total Hours / Units	Hourly Rate / Unit Cost	Total Cost	Kits / Customers	Cost per Kit
Labor Costs							
Develop COE Materials and Surveys (Kits)	2	100	200	\$175	\$35,000	300	\$120
Develop Maps and Data Tracking Forms (Kits)	1	40	40	200	\$8,000	300	\$30
Assemble for Mailing (Kits)	12	12	144	\$75	\$10,800	200	\$50
Assemble for Hand Delivery (Kits)	12	6	72	\$75	\$5,400	100	\$50
Door to Door Hand Delivery (Kits)	12	8	96	\$75	\$7,200	93	\$70
Door to Door Follow-up (Customers)	9	24	216	\$75	\$16,200	300	\$50
Telephone Calls (Customers)	2	15	30	\$100	\$3,000	300	\$10
Logging Data, Survey Results, and Tracking (Kits)	2	40	80	\$110	\$8,800	300	\$30
Gift Card Distribution and Responses (Customers)	2	4	8	\$110	\$880	142	\$7
Oversight (Kits)	1	80	80	\$110	\$8,800	300	\$30
Total Labor					\$104,080	300	\$450
Direct Costs							
Filter Kits, Replacement Cartridges, Magnets, Bags, Door Hangers, Flyers, Miscellaneous	--	--	300	\$50	\$13,000	300	\$50
Mail Kits (Outside Vendor)	--	--	247	\$12	\$3,000	247	\$12
Gift Cards for Completed Surveys	--	--	142	\$15	\$2,150	142	\$15
Total Direct Costs					\$18,150	300	\$80
Total Pilot Cost					\$122,230	300	\$530

VII. PILOT DEMOGRAPHIC SUMMARY

As part of the use survey, it is important to determine the adoption rate amongst the diverse populations in the Denver Water service area. The American Community Survey (ACS) is part of the U.S. Census Bureau's Decennial Census Program and is designed to provide current social, economic, housing, and demographic estimates throughout the decade. Combining American Census Survey (ACS) data with FLOW Pilot data allowed for the estimation of trends between levels of diversity in a neighborhood and filter adoption rates within the FLOW Pilot neighborhoods. ACS information at the Block Group Level will be taken from the 2013 to 2017 American Community Survey estimates. The information was adjusted for the Hispanic representation included as a category to reflect additional available diversity information. The information was linked to the Survey Census Block Groups to develop a geographic component to the data. The survey data was then evaluated by Diversity Categories By Block Group (ACS Data for B02001) as follows:

- Hispanic alone
- White (Non-Hispanic) alone
- Black or African American alone
- American Indian and Alaska Native alone
- Asian alone
- Native Hawaiian and Other Pacific Islander alone
- Some other race alone

The FLOW Pilot survey results were geolocated based on the address, tap number, or other available spatial information. The geolocation allows the data collected from the FLOW Pilot to be associated to a location and a block group for further analysis of the adoption rates and other survey results compared to the available diverse population statistics for each area. The following evaluations were completed for the Filter Pilot premises:

1. The comparison of the adoption rate noted on completed surveys to the diverse population for each surveyed area.
2. The comparison of areas where surveys were sent but not returned or the adoption rate is low.
3. The identification of specific diverse populations where surveys were sent but not returned or the adoption rate is low.
4. The comparison of the survey results between different areas and diverse groups to establish trends by ethnic population.
5. The populations where filters were sent but surveys not returned.
6. The comparison of adoption rate to the baseline approved adoption metric.

The survey results were then compared to the neighborhood demographics. The COE program can be adjusted if there is a lack of survey results or negative feedback from a certain area are identified. If an area is systemically not participating in FLOW, then the areas' criticality (and thus risk) will be ranked as higher priority in the ALSLR Program.

A summary of the FLOW Pilot demographics evaluation, for three of the seven neighborhoods, is shown in Table III.C.2-5.

Table III.C.2-5 Survey Results by Diversity Analysis (sample results)*

Neighborhood	1	2	3
White Hispanic (%)	62	64	61
White Non-Hispanic (%)	29	16	18.6
Black or African American (%)	3	1	0.1
American Indian and Alaska Native (%)	2	1	0
Asian (%)	0	9	19
Native Hawaiian and Other Pacific Islander (%)	0	0	1
Other (%)	4	9	0.3
Number Using Filter for Drinking	8	4	2
Number Using Filter for Cooking	6	4	2
Initial Survey Completed	7	8	0
Filter Use Survey Completed	9	6	2
Using for Drinking (%)	89	67	100
Using for Cooking (%)	67	67	100
Initial Survey Completed (%)	64	73	0
Filter Use Survey Completed (%)	82	55	9

**The demographic data was developed using limited survey data from August 2, 2019 and available census data. The demographic data is provided as an example and will be further developed for the full-scale filter plan.*

The data indicate that at least 67% of the population surveyed use the filter for drinking and cooking in three (3) of the seven neighborhoods where White Hispanics make up the majority of the population. Other considerations may be affecting neighborhood 3, which shows a markedly lower survey response rate. A geographic strategy analysis will be conducted to determine how the COE plan should be adjusted in neighborhood 3 as opposed to modifying the overall COE efforts specified for the White Hispanic population. Neighborhood 3 has a larger Asian population and this information will be used to provide guidance for increased COE for filter adoption in this neighborhood.

VIII. PILOT LESSONS LEARNED SUMMARY

The intent was to proceed with the FLOW Pilot Distribution Plan described in Table III.C.2-3 but, as a result of the compressed schedule for completion of the pilot, the decision was made to make follow-up home visits to all 280 FLOW Pilot participants. Field staff provided information regarding the program, encouraged program participants to use their filters for infant formula, drinking water, and cooking, and complete the surveys. Door hangers, with educational information, and reminders to use the filters for infant formula, drinking water, and cooking were left on doors of homes with no answer during the door-to-door follow-up field visits. Telephone calls were made to all

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participants that were not home during the follow-up field visits. Outreach via telephone calls and the receipt of survey responses continue, on a daily basis, as of August 7, 2019.

Lessons learned from the FLOW Pilot that will be implemented into the full-scale FLOW Program are shown in Table III.C.2-6.

Table III.C.2-6 Lessons Learned From the Filter Pilot Program

Item No.	Description
1	Provide advance targeted communications, outreach and education prior to filter distribution to introduce the program and explain the importance of filter use.
2	Reinforce the importance of using the filter for cooking and infant formula preparation (in addition to drinking water).
3	Inform participants the filters and replacement cartridges are provided at no cost to the customer for the duration of the program.
4	Provide alternative filters such as refrigerator, larger pitchers, and faucet mount.
5	Provide additional Spanish-speaking staff for field crews for initial distribution and follow-up visits.
6	Have one adoption survey after the participants have been contacted, are aware of the program, and have been using the filter for period of time.
7	Send filters addressed to tenants, not owners of the homes, if renters reside in the household.
8	Print individual participant's survey access codes directly on their survey in order to easily track the participant's responses.
9	Make survey questions clear, so that each answer doesn't have more than one meaning.
10	Have more outreach materials educating customers about how the service line is owned by the homeowner and how they can request a lead test kit.
11	Simplify outreach materials.
12	Update phone numbers in the database as project progresses.
13	Provide alternative filters and additional filters as filling the pitcher is cumbersome and slow.
14	Younger generation prefer online survey responses and electronic communications.
15	Not all residents have email addresses and internet access and hard copy surveys should continue to be provided.
16	Follow-up calls should be made from a Denver Water phone number.
17	Outreach staff should fill out and request a water quality sampling kit for concerned residents.
18	Include lead service line replacement information and talking points with filter program.
19	Follow-up visits and door-to-door outreach is not preferred for all participants. Some have requested communication via email only.
20	Simplify survey questions to prevent confusion.

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In addition to the FLOW Pilot, Denver Water is distributing and will continue to distribute water pitcher filters to customers:

- post lead service line replacement, with five (5) months of replacement cartridges
- potholing program participants when a lead service line is detected, with five (5) months of replacement cartridges

The non-pilot customers will be surveyed and provided additional education/instruction material that is distributed with the FLOW Pilot.

IX. FLOW PILOT TIMELINE

Date	Activity	Milestone
5110 – Initial Distribution		
June 2019	Develop FLOW Pilot Plan	Review FLOW Pilot plan
Week of June 3, 2019	Prepare pitcher filter supply	Confirm pitcher filter supplies
June 13, 2019	COE	Launch Denver Water internal COE plan
June 20, 2019	Kick-off meeting with DW, GWD, and MHYC	Contracts completed Project plan implementation begins
June 24, 2019	Order Filter Kit Supplies (door hangers, instructions, bags)	Filter kit supplies ready for kit assembly
Week of July 1, 2019	Go/No Go	Authorization to proceed with FLOW Pilot program
July 8, 2019	Notify Stakeholders	Stakeholders prepared for roll-out of the FLOW Pilot
July 8 & July 9, 2019	Training/Kit Assembly	GWD and MHYC are given training materials and filter kits are ready for distribution
July 10, 2019	Kit Pick-Up	Filter Kits picked up by USPS Priority Mail (1-3 day shipping)
July 10 to July 14, 2019	Hand-Deliver Kits	<ul style="list-style-type: none"> • Filter Kits hand-delivered • Determination of in-house filter services
July 10 to July 14, 2019	Initial Survey (5116)	Initial Survey (5116) distributed in filter kits (via mail and hand-delivered)
July 11, 2019	Mail & Deliver Kits	Earliest delivery of mailed filter kits to Denver Water households
July 15 to July 17, 2019	External COE	Follow-up phone calls and emails to FLOW Pilot participants

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Date	Activity	Milestone
5120 – Use Survey & Alternative Filters		
Starting July 22, 2019	<ul style="list-style-type: none"> • Analysis/Tracking • Use Survey (5122) 	<ul style="list-style-type: none"> • GWD/MHYC feedback and collection of data • Filter Adoption: Use Survey (5122) • Determine alternative filter type requested
August 19 to September 30, 2019	<ul style="list-style-type: none"> • Mail Alternative Filters • Install Alternative Filters • Alt Survey (5125) 	<ul style="list-style-type: none"> • Order, delivery, and installation of alternative filter equipment • Filter Adoption: Alt Survey (5125)
August 1 to August 2, 2019	Progress Meeting	<ul style="list-style-type: none"> • GWD/MHYC feedback and collection of data
5130 – Filter Adoption		
August 1, 2019 to October 31, 2019	<ul style="list-style-type: none"> • Analysis/Tracking • Ongoing Surveys (5132) 	<ul style="list-style-type: none"> • GWD/MHC feedback and collection of data • Filter Adoption: Ongoing Surveys (5132) • Follow-up phone calls
5140 – Filter Cartridge Replacements		
October 31, 2019	Variance Approved, Yes/No	<ul style="list-style-type: none"> • Variance Approved - Transition to Cartridge Replacement: 5600 Series • Variance Not Approved - Discontinue FLOW Pilot

APPENDIX A – FILTER TYPES

Filter Types

Federal regulations do not exist for residential water treatment filters. Voluntary national standards and National Sanitation Foundation (NSF) / American National Standards Institute (ANSI) protocols have been developed to establish minimum requirements for the safety and performance of residential water treatment filters. NSF/ANSI Standards 42 and 53 are applicable for water quality and lead removal, as described, below.

- **NSF/ANSI 42**

Filters are certified to reduce aesthetic impurities such as chlorine, taste, and odor. Filters can be point-of-use (POU) (faucet filter, water pitcher, etc.) or point-of-entry (POE) (whole house) treatment systems.

- **NSF/ANSI 53**

Filters are certified to reduce a contaminant with a health effect, such as lead. The standard establishes health effects as regulated by the U.S. Environmental Protection Agency (EPA). Both standards 42 and 53 include adsorption and filtration treatment.

NSF established laboratories that may test and certify filters that meet the NSF protocols for lead removal. The certified laboratories include: NSF International, CSA International, Water Quality Association (WQA), International Association of Plumbing and Mechanical Officials, Underwriters Laboratory, Truesdail, and Intertek.

A summary of different types of filters, certification laboratory to NSF/ANSI Standards 42 and 53, and associated filter life is shown in Table A1. The general range of filter life for pitcher filters is 1-6 months and the general range of filter life for alternative filters is 1-10 months. Product detail sheets are attached.

Table A1: Point-of-Use Filter Types

Filter Type	Brand/Model	Certification Laboratory	Filter Life	Percent Lead Reduction at pH 8.5
Pitcher	Brita Monterey (#OB50) 10-cup pitcher with Longlast filter (#OB06) ¹	WQA	6 months	99.6%
	DuPont 8-cup pitcher (WFPT100) with WFPTC100N filter ²	WQA	3 months	97.4%
	DuPont WFTP200 10-cup pitcher with WFPTC100N filter ³	WQA	3 months	97.4%
	ZeroWater 10-cup filter pitcher (ZP-010) ⁴	NSF	1 month	99.0%
	Pur Classic 11-cup pitcher (PPT111WV1) with lead reduction filter (PPF951K) ⁵	WQA	2 months	97.9%
Water Dispenser	ZeroWater 20-cup water filter jug (ZD-20RP) ⁶	NSF	1 month	99.0%
	ZeroWater 30-cup water filter jug (ZD-30RP) ⁷	NSF	1 month	99.0%
	ZeroWater 40-cup water filter jug (ZBD-040) ⁸	NSF	1 month	99.0%

Table A1: Point-of-Use Filter Types

Filter Type	Brand/Model	Certification Laboratory	Filter Life	Percent Lead Reduction at pH 8.5
Water Dispenser	Brita Ultramax 18-cup Dispenser (#OB24) with Brita Longlast filter (#OB06) ⁹	WQA	6 months	99.6%
Faucet-Mount	DuPont WFFM100 Faucet Mount Filter with WFFMC100 or WFFMC300 filter ¹⁰	WQA	5 months	99%
	DuPont WFFM350 with Ultra Protection Filter (WFFMC300) ¹¹	WQA	10 months	99%
	Brita Faucet Filtration System FF-100 with FR-200 filter ¹²	NSF & WQA	5 months	99.3%
	Brita Basic Faucet Filtration System SAFF-100 with FR-200 filter ¹³	NSF & WQA	5 months	99.3%
	Pur PFM400H Faucet with MineralClear Filter (RF9999) ¹⁴	WQA	3 months	99.9%

Table A1: Point-of-Use Filter Types

Filter Type	Brand/Model	Certification Laboratory	Filter Life	Percent Lead Reduction at pH 8.5
Refrigerator Filters	Frigidaire PureSource 3 (WF3CB) ¹⁵	NSF	6 months	99.1%
	Maytag Refrigerator Water Filter (UKF8001) ¹⁶	NSF	6 months	99.3%

Notes:

- https://www.brita.com/water-pitchers/monterey-longlast/?ds_rl=1238837&gclid=Cj0KCOjw9JzoBRDjARIsAGcdIDUj8xyvMENARguLCz_NAqDULgUppLOhm01Pd3XbXRcXZGGWDHWOyLgaAslGEALw_wcB&gclid=aw.dshttp://www.protectplus.com/PD-Water-Filtration-82/DuPont-Traditional-Water-Filter-Pitcher-WFPT100-653
- <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Mirage-Water-Filter-Pitcher-WFPT200-652>
- <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Mirage-Water-Filter-Pitcher-WFPT200-652>
- https://www.zerowater.com/products-10-Cup-Pitcher?gclid=Cj0KCOjw9JzoBRDjARIsAGcdIDWhrdUxnskz0UuAp4CluOcDKJ27qwbOVqxdOPq9XYFa3OJIVwIK2YaAhvzEALw_wcB
- <https://www.pur.com/water-filter-pitchers-and-dispensers/pur-ultimate-pitcher-filtration-system-with-lead-reduction>
- <https://www.zerowater.com/products-20-Cup-Ready-Pour>
- <https://www.zerowater.com/products-30-Cup-Ready-Pour>
- <https://www.zerowater.com/products-40-Cup-Ready-Pour>
- <https://www.brita.com/water-dispensers/ultramax-longlast/>
- <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Premier-Faucet-Mount-Drinking-Water-Filter-WFFM100-647>
- <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Deluxe-Faucet-Mount-WFFM350-646>
- <https://www.brita.com/faucet-systems/complete/>
- <https://www.brita.com/faucet-systems/basic/>
- <https://www.pur.com/faucet-filtration-systems/pur-advanced-faucet-filtration-system-with-mineralclear-filter>
- https://www.frigidaire.com/Filter-Accessories/Filter/water-filters/WF3CB/?gclid=CjwKCAjwuqfoBRAEEiwAZErCsqOkiflHCX2HhuFjxt_hL213qbrqvzOJ96upk87nk6Sla4b2_4hT2BoCuXYQAvD_BwE&gclid=aw.ds
- <https://www.homedepot.com/p/Maytag-UKF8001-Refrigerator-Water-Filter-UKF8001/100671093>

APPENDIX B – FILTER KIT CONTENTS

Filter Kit Contents

Each participant of the Filter Lead Out of Water (FLOW) Pilot will receive a filter kit via direct mail or door-to-door hand delivery. Each filter kit includes the following:

Kit Items:

- FLOW Pilot Letter
- Frequently Asked Question (FAQ) summary for lead service lines and FLOW Pilot program questions
- One (1) ZeroWater 10-cup water pitcher - NSF certified for lead removal with one (1) filter cartridge
- Three (3) pitcher replacement cartridges
- Pitcher filter instructions and maintenance guidelines in English, Spanish, and French
- Initial Survey (5116)
- Reusable bag
- Magnet with reminders to use filtered water for infant formula, drinking, and cooking, cartridge date change information, program contact information, website, and telephone number
- Door hanger

The ZeroWater 10-cup pitcher should be used for all infant formula, drinking water, and cooking. The manufacturer's instructions for use and maintenance should be followed and the filter should be replaced in accordance with the manufacturer's guidelines.

10 CUP PITCHER

WITH FREE WATER QUALITY METER

PRODUCT HIGHLIGHTS:

- ZeroWater's premium 5-stage filtration vs. competitors 2-stage filtration
- Certified by NSF to reduce Lead and other heavy metals
- Removes 99.6% of all dissolved solids, 2X more than leading brand filters
- **FREE** Water Quality Meter included to test your water
- Contoured handle for and non-slip ergonomic grip
- One-hand push to dispense spigot
- 80 oz capacity
- BPA Free

DIMENSIONS: 11.63" x 5.93" x 11" **MSRP:** \$34.99



REMOVES
TDS



NSF
CERTIFIED



REMOVES
LEAD



BPA-
FREE



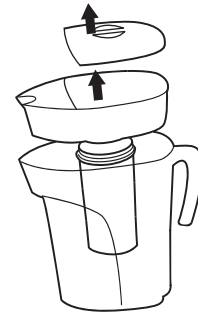
5 STAGE
FILTRATION



5-STAGE FILTRATION

- 1 Removes suspended solids such as dust and rust that make your water appear cloudy
- 2 Removes additional suspended solids
- 3 Removes organic contaminants; pesticides, herbicides, Mercury, Chlorine, Chloramine, and stops bacteria from growing
- 4 Removes inorganic compounds i.e. metals, nonmetals and radiological contaminants.
- 5 Removes remaining suspended solids, holds the resin in place

ASSEMBLY INSTRUCTIONS INSTRUCCIONES DE MONTAJE



- 1 REMOVE** lid and water reservoir from top of the pitcher and remove filter from packaging. Unscrew the blue protective cap (if applicable).
QUITE la tapa y el depósito de agua de arriba de la jarra y retire el filtro del empaque. Desenrosque la tapa protectora azul (cuando proceda).

- 2 TWIST** filter into the bottom of reservoir (from below) and tighten filter to obtain a complete seal with the reservoir. **Do not drop the filter in from above.** Tighten until there is a complete seal between the filter, o-ring and reservoir.

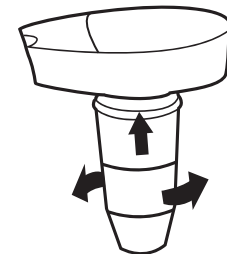
GIRE el filtro en el fondo del depósito (desde abajo) y apriételo hasta que haya un sellado perfecto con el depósito. No deje caer el filtro desde arriba. Apriete hasta que haya un sello completo entre el filtro, el aro en O y el depósito.

- 3 FILL** reservoir by pouring/filling with cold tap water (directly into the filter) and place lid on top. Allow all the water to pass through the filter before filling again.
LLENE el depósito con agua fría de la llave (directamente en el filtro) y coloque la tapa. Permita que el agua pase por el filtro antes de volver a llenar.

- 4 POUR OR DISPENSE** using spigot (if applicable) to fill your cup or glass once the reservoir has emptied into the body.
VIERTA EL AGUA para llenar su taza o vaso utilizando una boquilla (si procede) una vez que el depósito se haya vaciado en el cuerpo de la jarra.

CLEANING INSTRUCTIONS // INSTRUCCIONES DE LIMPIEZA

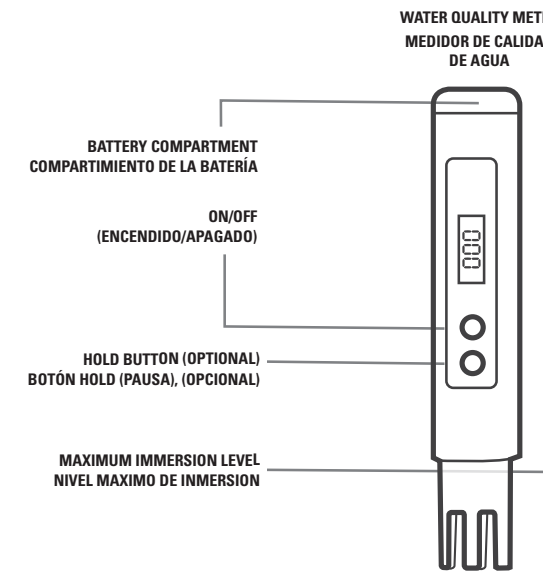
Clean your device in warm water using mild soap. Rinse and dry thoroughly.
Limpie su dispositivo en agua tibia con un jabón suave. Enjuáguelo y séquelo perfectamente.



TDS WATER QUALITY METER MEDIDOR DE TDS PARA CALIDAD DEL AGUA

The TDS meter supplied is intended to detect and measure TDS (total dissolved solids) in PPM. **Test your water regularly.**

El medidor de TDS suministrado está diseñado para detectar y medir TDS (sólidos disueltos totales) en PPM (partes por millón). **Haga pruebas a su agua de manera regular.**



FOR WATER QUALITY METER: Remove cap, turn on, submerge in water, change filter when it reads **006 or higher.**

PARA EL MEDIDOR DE CALIDAD DE AGUA: Quite la tapa, encienda, sumerja en agua, y cambie el filtro cuando la lectura sea de **006 o mayor.**

REPLACEMENT BATTERY INSTRUCTIONS: Meter includes (2) alkaline batteries. Do not mix old and new batteries. Do not mix alkaline, standard or rechargeable batteries.

INSTRUCCIONES DE REEMPLAZO DE LA BATERÍA: El medidor incluye dos (2) pilas alcalinas. No mezcle baterías viejas y nuevas. No mezcle baterías alcalinas, estándar o recargables.

TDS meters included with select ZeroWater pitchers/dispensers
Los medidores de TDS vienen incluidos con ciertas jarras/despachadores ZeroWater

TROUBLESHOOTING TRY THESE TIPS... DETECCIÓN DE PROBLEMAS PRUEBE ESTOS CONSEJOS...

- 1.** Not getting a "000" reading? Ensure that the filter is threaded correctly and fully seated in the water reservoir. Watch for cross-threading and ensure that the rubber gasket is seated properly and has not gotten stuck in one of the threads.

¿No está obteniendo una lectura de "000"? Asegúrese de que el filtro esté roscado correctamente y asentado completamente en el depósito de agua. Observe si está roscado de manera incorrecta y asegúrese de que el empaque de hule esté bien asentado y no se haya atascado en la rosca.

- 2.** Rinse and dry your pitcher/dispenser, TDS meter, and parts completely. Left over tap water, soap residue or a dirty TDS meter may give false meter readings.

Enjuague y seque perfectamente la jarra/despachador, el medidor de TDS y todas las piezas. Si se deja agua de la llave, residuos de jabón o un TDS sucio, el medidor podría dar lecturas falsas.

- 3.** Check the O-ring on your filter. If there is no O-ring present on your filter, unfiltered tap water will flow around the filter and into the dispenser.

Revise el aro en O del filtro. Si no está presente el aro en O en su filtro, el agua de la llave no filtrada podría fluir alrededor del filtro y hacia el despachador.

- 4.** Make sure you are pouring your filtered water into a clean glass. The indicator may pick up trace residue from previous use or soap. Asegúrese de verter el agua filtrada en un vaso limpio. El indicador podría detectar residuos de jabón o de usos anteriores.

- 5.** Check for cracks in the reservoir or filter. If you have a crack, please contact customer service for additional instructions. Revise si el depósito o el filtro tienen grietas. Si tienen alguna grieta, comuníquese con el servicio al cliente para que le den más instrucciones.

For all other issues, please contact our customer service center at **1-800-503-2939** or email customerservice@zerowater.com.

Para otros tipos de problemas, comuníquese con nuestro centro de servicio al cliente al **1-800-503-2939** o envíe un correo electrónico a customerervice@zerowater.com.

FILTRACIÓN PREMIUM EN CINCO ETAPAS

SOLO ZEROWATER DEJA 000 SÓLIDOS DISUELTOS³

PARA EL AGUA CON EL SABOR MÁS PURO²

MEDIDOR INCLUIDO: MIDE LOS SÓLIDOS REMANENTES DISUELTOS³

CERTIFICADO PARA REDUCIR EL PLOMO Y OTROS METALES PESADOS⁴

PREMIUM 5-STAGE FILTRATION

ONLY ZEROWATER LEAVES

000

DISSOLVED SOLIDS³

FOR THE PUREST TASTING WATER²



LIMITED WARRANTY FOR ZEROWATER DISPENSER, PITCHER, BOTTLE FILTRATION SYSTEM, TRAVEL BOTTLE & TDS METER Zero Technologies, LLC warrants the ZeroWater Dispenser, Pitcher, Bottle Filtration System, Travel Bottle and TDS Meter to be free from manufacturing defects for 90 days from the date of purchase, when used in compliance with the Owner's Manual. During this 90-day period, if you discover a manufacturing defect in your ZeroWater Dispenser, Pitcher, Bottle Filtration System, Travel Bottle or TDS Meter (excluding the filter), we will replace the parts free of charge. To file a warranty claim, call 1-800-503-2939 or visit www.zerowater.com/contactsus.aspx. Dated proof of purchase required.

FILTER CARTRIDGE LIMITED WARRANTY Zero Technologies, LLC warrants its filters to be free from manufacturing defects for 30 days from the date of purchase, when used in compliance with the Owner's Manual. During this 30-day period, if you discover a manufacturing defect in your filter, we will replace it free of charge (minus shipping costs). Dated proof of purchase required. To place a claim for a defective filter, you must first call 1-800-503-2939 and speak to customer service to trouble shoot the problem. If a potential manufacturing defect is identified, we will provide instructions on how to return the filter for laboratory testing. If the lab determines that the filter is defective, we will replace it free of charge. If no defect is found, your filter will be returned to you. **NOTE: This warranty does not guarantee the life of the filter for any specific period or volume of use. For more information about expected filter life, see www.zerowater.com/filtration-filter-life.aspx.**

For information about warranty, service or how to use your ZeroWater product, please call Customer Service toll free 8am-8pm CT, Mon-Fri, at 1-800-503-2939, or visit our website at www.zerowater.com.

GARANTÍA LIMITADA EN EL DISPENSADOR DE AGUA ZEROWATER, LA JARRA, EL SISTEMA DE FILTRACIÓN DE BOTELLAS, LA BOTELLA DE VIAJE Y MEDIDOR DE TDS Zero Technologies, LLC garantiza durante 90 días a partir de la fecha de compra, que el dispensador, la jarra, el sistema de filtración de botellas, la botella de viaje y el medidor de TDS de ZeroWater no tienen defectos de fabricación, cuando se utilicen de conformidad con el Manual del Propietario. Si descubre un defecto de fabricación en su dispensador, jarra, sistema de filtración de botellas, botella de viaje o medidor de TDS cargo. Para presentar una reclamación de garantía, llame al 1-800-503-2939 o visite www.zerowater.com/contactsus.aspx. Se requiere comprobante de compra con fecha.

GARANTÍA LIMITADA DEL CARTUCHO DE FILTRO Zero Technologies, LLC garantiza durante 30 días a partir de la fecha de compra, que el filtro no tiene defectos de fabricación, cuando se utilice de conformidad con el Manual del Propietario. Si descubre un defecto de fabricación en su filtro, durante este periodo de 30 días, lo reemplazaremos de forma gratuita (menos los costos de envío). Se requiere comprobante de compra con fecha. Para presentar una reclamación por un filtro defectuoso, debe llamar primero al 1-800-503-2939 y hablar a servicio al cliente para resolver el problema. Si se identifica un posible defecto de fabricación, le proporcionaremos instrucciones sobre cómo devolver el filtro para las pruebas de laboratorio. Si el laboratorio determina que el filtro está defectuoso, lo reemplazaremos sin cargo. Si no se encuentra ningún defecto, su filtro será devuelto. **NOTA:** Esta garantía no cubre la vida útil del filtro por algún periodo o volumen específico de uso. Para obtener más información sobre la vida útil del filtro, visite www.zerowater.com/filtration-filter-life.aspx.

Para obtener información acerca de la garantía, el servicio, o cómo utilizar su producto ZeroWater, llame sin costo a servicio al cliente al 1-800-503-2939 de lunes a viernes de 8 am a 8 pm Hora del Centro, o visite nuestro sitio web en www.zerowater.com.

The ONLY filter certified to reduce Lead & Chromium
El UNICO filtro certificado que reduce el plomo y el cromo

LEAD / PLOMO	Leading Brand (standard model) Marca principal (modelo estándar)	ZeroWater
REDUCCION PORCENTUAL	97.5	✓
CONCENTRACION DE REFERENCIA DE AGUA PROFILADA (mg/L)	2.0 ± 10%	✓
CONCENTRACION DE AGUA FILTRADA (mg/L)	0.05	
CONCENTRACION MAXIMA PERMISIBLE DE AGUA FILTRADA (mg/L)	50% of influent	

Data reflected on this table was derived from the NSF International website. For a complete list visit www.ZeroWater.com. Los datos de esta tabla se tomaron del sitio Web de NSF International. Si desea ver la lista completa visite www.ZeroWater.com.

ZeroWater® PERFORMANCE DATA SHEET. FOR MODELS: ZD-013D, ZD-013W, ZD-018, ZP-001, ZP-006, ZP-010, ZS-008, ZD-010RP, ZD-023-1, ZD-012RP, ZP-007RP, ZR-0810, ZR-0810G, ZBD-040, ZD-030RP, ZD-20RP, ZS-011RP // IMPORTANT NOTICE: Read this Performance Data Sheet and compare the capabilities of this unit with your actual water treatment needs. It is recommended that before purchasing a water treatment unit you have your water supply tested to determine your actual water treatment needs. All contaminants reduced by this water treatment device are not necessarily in your water supply. While testing was performed under standard laboratory conditions, actual performance may vary.

This system has been tested according to NSF/ANSI 42 and NSF/ANSI 53 for reduction of the substances listed below. The concentration of the indicated substances in water entering the system was reduced to a concentration less than or equal to the permissible limit for water leaving the system, as specified in the relevant standard.

Rated service life is 20 gallons. It is recommended to change the filter with replacement element ZR-001/ZF-201 at this point. Service flow rate is 2 gallons per day. Operating temperature is 40-90°F. This water treatment device is intended only for use with potable water. Do not use water that is microbiologically unsafe or of unknown quality without proper disinfection before or after the system.

HOJA DE DATOS DE RENDIMIENTO de ZeroWater® PARA LOS MODELOS: ZD-013D, ZD-013W, ZD-018, ZP-001, ZP-006, ZP-010, ZS-008, ZD-010RP, ZD-023-1, ZD-012RP, ZP-007RP, ZR-0810, ZR-0810G, ZBD-040, ZD-030RP, ZD-20RP, ZS-011RP // AVISO IMPORTANTE: Lea esta Hoja de datos de rendimiento y compare las capacidades de esta unidad con sus necesidades reales de tratamiento de agua. Se recomienda que antes de comprar una unidad de tratamiento de agua haga una prueba de su abastecimiento de agua para determinar sus necesidades reales de tratamiento de agua. No todos los contaminantes reducidos por este dispositivo de tratamiento de agua están necesariamente en su abastecimiento de agua. Aunque las pruebas se realizaron en condiciones estándar de laboratorio, el rendimiento real puede variar.

Este sistema ha sido probado conforme NSF/ANSI 42 y NSF/ANSI 53 para la reducción de las sustancias enumeradas a continuación. La concentración de las sustancias indicadas en el agua que ingresa al sistema se redujeron a una concentración menor o igual al límite permitido para que el agua salga del sistema de acuerdo a como lo especifica la norma correspondiente.

La vida útil nominal es de 20 galones (76 l). En ese momento, se recomienda cambiar el filtro con el elemento de reemplazo ZR-001/ZF-201. El caudal de servicio es de 2 galones (7.5 l) por día. La temperatura de funcionamiento es de 40-90°F (4.4-32.2°C). Este dispositivo de tratamiento de agua está diseñado solo para su uso con agua potable. No se use con agua microbiológicamente antihigiénica o de calidad desconocida sin desinfectar adecuadamente el sistema antes o después.



This system has been tested and certified by NSF International under NSF/ANSI Standard 53 or 42 for the reduction of substances and chlorine taste and odor and against NSF/ANSI Standard 53 for reduction of lead, chromium and mercury. Este sistema ha sido probado y certificado por NSF International bajo las normas NSF/ANSI 53 o 42 para la reducción de sustancias.

SUBSTANCE SUSTANCIA	Overall Percent Reduction	Influent Challenge Concentration (mg/L)	Maximum Effluent Concentration (mg/L)	Maximum Permissible Effluent Concentration (mg/L)
NSF/ANSI Standard 53 - Health Effects				
Norma NSF/ANSI 53 - Efectos sobre la salud				
Chromium, Tri and Hexavalent, pH 6.5	99.6	0.3 ± 10%	0.003	0.050
Chromium, Tri and Hexavalent, pH 8.5	99.6	0.3 ± 10%	0.002	0.050
Lead, pH 6.5	99.7	0.15 ± 10%	0.0005	0.010
Lead, pH 8.5	99.9	0.15 ± 10%	0.0005	0.010
Mercury, pH 6.5	96.7	0.028 ± 10%	0.0002	0.002
Mercury, pH 8.5	96.0	0.006 ± 10%	0.0004	0.002
NSF/ANSI Standard 42 - Aesthetic Effects				
Norma NSF/ANSI 42 - Efectos estéticos (sabor, olor y apariencia)				
Chlorine	97.5	2.0 ± 10%	0.05	50% of influent
Reducción porcentual total		Concentración de referencia de agua perfilada (mg/L)	Concentración máxima de agua filtrada (mg/L)	Concentración máxima permisible de agua filtrada (mg/L)

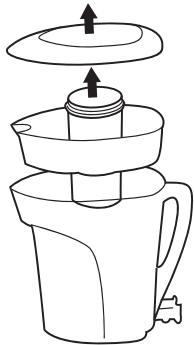


System Tested and Certified by NSF International against NSF/ANSI Standard 42 for reduction of hydrogen sulfide and chlorine taste and odor and against NSF/ANSI Standard 53 for reduction of lead, chromium and mercury. Sistema probado y certificado por NSF International con respecto a la norma NSF/ANSI 42 en reducción de sabor y olor de sulfuro de hidrógeno y cloro, y con respecto a la norma 53 NSF/ANSI en reducción de plomo, cromo y mercurio.

www.zerowater.com



ASSEMBLY INSTRUCTIONS 6 CUP, 8 CUP, 10 CUP, 12 CUP INSTRUCTIONS D'ASSEMBLAGE 6 TASSES, 8 TASSES, 10 TASSES, 12 TASSES

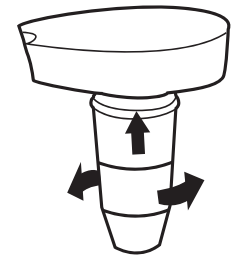


1 REMOVE lid and water reservoir from top of the pitcher and remove filter from packaging. Unscrew the blue protective cap (if applicable).

ENLEVEZ le couvercle et le réservoir d'eau du dessus de la carafe puis retirez le filtre de son emballage. Dévissez le capuchon de protection bleu (le cas échéant).

2 TWIST filter into the bottom of reservoir (from below) and tighten filter to obtain a complete seal with the reservoir. **Do not drop the filter in from above.** Tighten until there is a complete seal between the filter, o-ring and reservoir.

VISSEZ le filtre dans le fond du réservoir (par en-dessous) et serrez-le pour obtenir une étanchéité totale avec le réservoir. **Ne pas installer le filtre en le laissant tomber du dessus.** Serrez jusqu'à ce qu'il y ait une étanchéité totale entre le filtre, le joint torique et le réservoir.

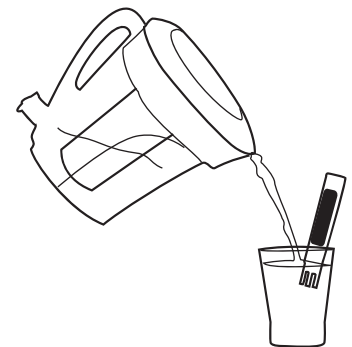


3 FILL reservoir with cold tap water and place lid on top. Allow all water to pass through the filter before filling again.

REMPLEZ le réservoir d'eau froide et placez le couvercle dessus. Laissez toute l'eau s'écouler à travers le filtre avant de le remplir à nouveau.

4 POUR OR DISPENSE using spigot (if applicable) to fill your cup or glass once the reservoir has emptied into the body.

VERSEZ à l'aide du robinet (le cas échéant) pour remplir votre verre une fois le réservoir vide.



CLEANING INSTRUCTIONS

Clean your device in warm water using mild soap. Rinse and dry thoroughly.

INSTRUCTIONS DE NETTOYAGE

Nettoyez votre appareil à l'eau tiède avec un détergent doux. Rincez et séchez complètement.



THANK YOU FOR YOUR PURCHASE OF A NEW ZEROWATER® PRODUCT

Other valuable information enclosed:

- \$30.00 in future filtration savings
- How ZeroWater improves the taste of drinking water

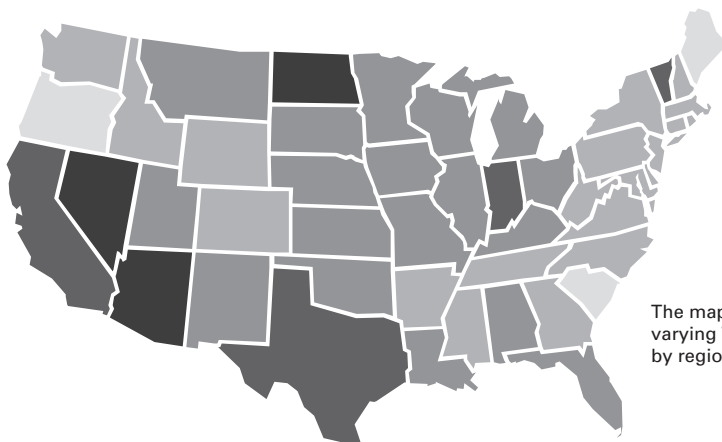


Visit us at www.zerowater.com or find us on Facebook

DO YOU HAVE HIGH TDS?

Very high TDS will reduce filter life more quickly. Since ZeroWater is removing virtually all TDS from your tap water, your filters may wear out faster.

Contact ZeroWater today to find out about saving more on your filter purchases. Call **1-800-503-2939** and ask about the ZeroWater Continuity Program and start saving today!



The map indicates varying TDS levels by region

002-050 051-200 201-300 301-400 401+

ZeroWater customer readings as of May 2010

SHARE & COMPARE

Enter your tap water's TDS reading at www.zerowater.com to save on future filter purchases.

ZEROWATER'S PATENTED 5-STAGE FILTER VS. STANDARD 2-STAGE FILTER



ZeroWater's Patented 5-Stage Filter



2-Stage Filter (Old Technology)

THE BIG DIFFERENCE

Most conventional carbon filters only filter certain substances from your water. ZeroWater's patented Ion Exchange System, with **FIVE** combined technologies, provides the only filtered water that meets the FDA definition of purified bottled water.*

*Filtered potable tap water tested by an independent lab (not the FDA) to meet specifically the water quality requirements for using the label "purified." Compared to water produced by leading gravity fed filters.



ZEROWATER FILTER DISPENSER, PITCHER & TDS METER WARRANTY

Zero Technologies, LLC warrants to the consumer for the period of ninety (90) days from the date of purchase, the ZeroWater Dispenser/Pitcher (except for the filter cartridge which is warranted for 30 days) against all defects in materials and workmanship, when used in compliance with the Owner's Manual. During this 90-day period, if you discover that any parts of the ZeroWater Dispenser/Pitcher are damaged or broken, due to any manufacturing defects, we will replace the parts free of charge by calling: 1-800-503-2939 in the United States. The warrantor assumes no responsibility for incidental or consequential damages; for damages arising out of misuse of the product or the use of any unauthorized attachment. Some states do not allow the exclusion or limitation of incidental or consequential damages, the above limitation or exclusion may not apply to you. To the extent permitted by local law, this warranty is in lieu of any other warranty, express or implied, including any implied warranty of merchantability or fitness and precludes any other obligation on the part of the manufacturer, distributor, or dealer, including any liability for special, incidental or consequential damages. This warranty gives your specific legal rights, and you may also have other rights which vary from state to state in the United States.

REPLACEMENT FILTER CARTRIDGE WARRANTY & RETURN POLICY

Though replacement filter cartridges do have a 30 day warranty for manufacturing defects, there is no money back guarantee otherwise. To place a claim for a defective cartridge, you must first speak to a customer service representative who will help you trouble shoot any problems. If a problem is found that may be due to a manufacturing defect, they will then give you instructions on how to send back the cartridges to be

tested by our laboratory. Depending on whether or not the lab determines the cartridges to be defective, they will either be replaced or returned to you. Please remember that we do not and cannot warrant the life of the filter cartridges since there are many variables that affect the life of each cartridge, including: weather, your local treatment facility, consumption rate, etc. We can only provide estimates based on the experiences of other customers. A shortened cartridge life alone does not necessarily mean that you have a defective cartridge.

RETURN POLICY

We want you to be completely satisfied with your purchase. We stand behind our products with a 30 day, money back guarantee. If for any reason you are not completely happy with the water filter systems that you receive, just return to us within 30 days of receiving the merchandise for a refund of your product purchase price (less shipping and handling). Returns must be received within 30 days of your receipt of the item. Returns after 30 days may not be accepted at all or may be subject to restocking/refurbishing charges. Return policy applies to direct sales only, retail sales do not apply. Please also note that all components of a filter system, including the digital TDS water meter, must be returned in good condition to be accepted as returned merchandise.

Should service be required or you have any questions regarding how to use your ZeroWater product, please call Customer Service toll free 8am-8pm CT, Mon-Fri, at 1-800-503-2939, or visit our website at: www.zerowater.com

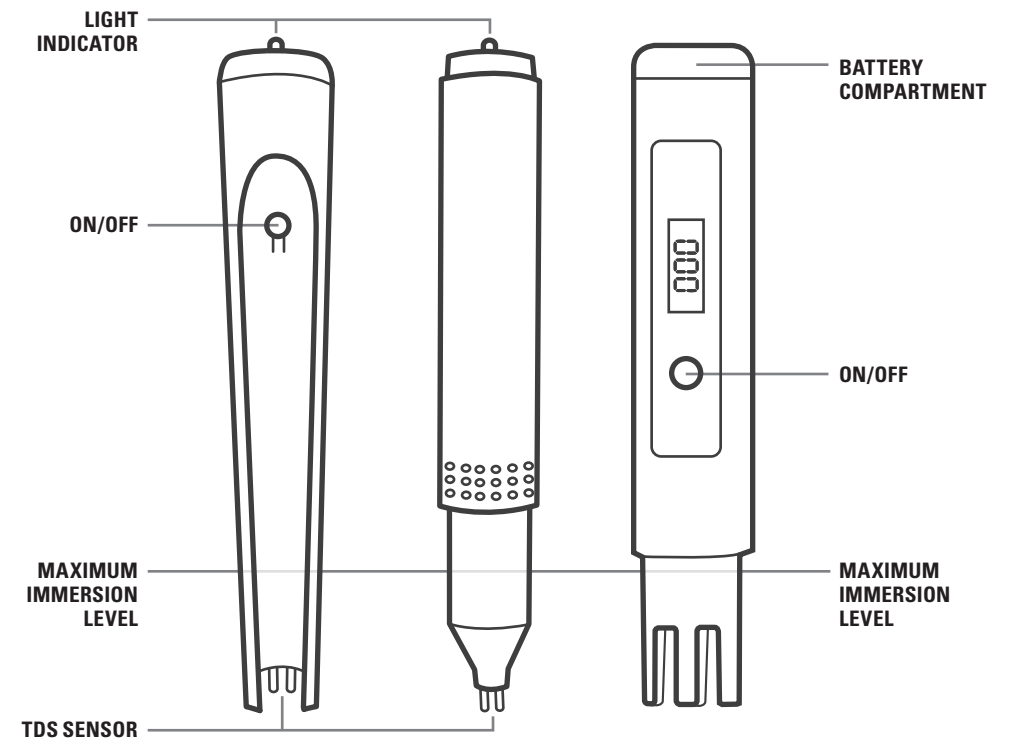
Complete warranty registration at www.zerowater.com

Zero Technologies, LLC,
4510 Adams Circle, Suite G, Bensalem, PA 19020

A TDS METER WILL SHOW YOUR TAP WATER READING

Visit www.zerowater.com and purchase your own TDS meter.

Enter "mymeter" at checkout for a discount.



TDS meters included with select ZeroWater pitchers/dispensers

THREE WAYS TO SAVE!

- 1 Register at zerowater.com OR call customer service at 1-800-503-2939
- 2 Fill out the form below and mail to: **ZeroWater Savings 4510 Adams Circle, Unit G • Bensalem, PA 19020**

Sign me up to receive coupons for ZeroWater® Patented Ion Exchange Filter Replacements by mail.

Name: _____ E-mail: _____

Street Address: _____

City: _____ State/Province: _____ Zip/Postal Code: _____

3 IMMEDIATE SAVINGS

MANUFACTURER'S COUPON EXPIRES 12/31/15

\$2.50 OFF

2-Pack ZeroWater® Replacement Filters storefinder at www.zerowater.com



CONSUMER: Take this coupon to the checkout stand and save \$2.50 on a 2-Pack of ZeroWater Replacement Filters. Limit one coupon per store visit. No doubling of coupon allowed. Coupon cannot be assigned, transferred or reproduced. Coupon good only on product indicated, any other use constitutes fraud. **RETAILER:** You will be reimbursed for the face value of this coupon plus .08 cents handling allowance, if submitted in compliance with Standard Coupon Redemption Policies. Manufacturer reserves the right to request invoices proving purchase of sufficient stock to cover coupons presented for redemption. Void where taxed, restricted, prohibited, or presented by other than retailers of our products. Cash Value: 1/100th of a cent. Coupon must be redeemed by 12/31/15. **MAIL TO:** PMCI \$2.50 Coupon Offer Dept. 6356, PO BOX 5011, Stacy, MN 55078-5011. © 2014 Zero Technologies, LLC.

MANUFACTURER'S COUPON EXPIRES 12/31/15

\$2.50 OFF

4-Pack ZeroWater® Replacement Filters storefinder at www.zerowater.com



CONSUMER: Take this coupon to the checkout stand and save \$2.50 on a 4-Pack of ZeroWater Replacement Filters. Limit one coupon per store visit. No doubling of coupon allowed. Coupon cannot be assigned, transferred or reproduced. Coupon good only on product indicated, any other use constitutes fraud. **RETAILER:** You will be reimbursed for the face value of this coupon plus .08 cents handling allowance, if submitted in compliance with Standard Coupon Redemption Policies. Manufacturer reserves the right to request invoices proving purchase of sufficient stock to cover coupons presented for redemption. Void where taxed, restricted, prohibited, or presented by other than retailers of our products. Cash Value: 1/100th of a cent. Coupon must be redeemed by 12/31/15. **MAIL TO:** PMCI \$2.50 Coupon Offer Dept. 6356, PO BOX 5011, Stacy, MN 55078-5011. © 2014 Zero Technologies, LLC.



MERCI DE VOTRE ACHAT DU NOUVEAU PRODUIT ZEROWATER®

Sont incluses les informations importantes suivantes:

- Économies de 30,00 \$ sur des achats ultérieurs de filtres
- La façon dont ZeroWater améliore le goût de l'eau potable



Visitez notre site à www.zerowater.com ou retrouvez-nous sur Facebook

FILTRE BREVETÉ 5 ÉTAPES DE ZEROWATER VS. FILTRE STANDARD 2 ÉTAPES



Filtre à 5 étapes breveté de ZeroWater



Filtration en 2 étapes (ancienne technologie)

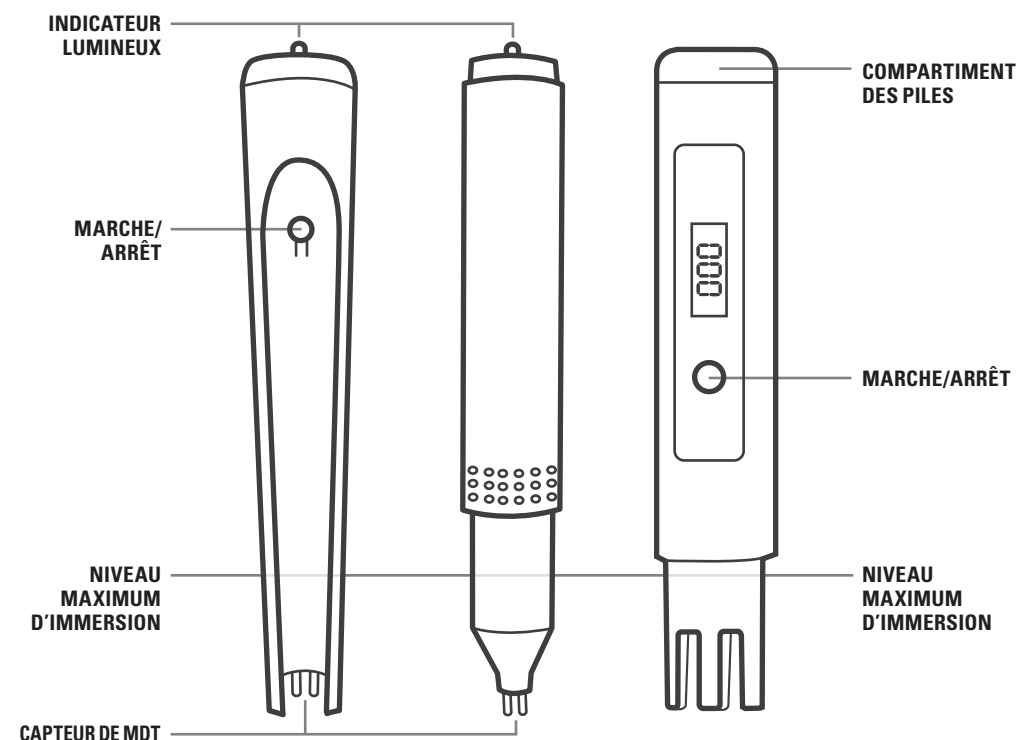
LA GRANDE DIFFÉRENCE

La plupart des filtres carbones traditionnels ne filtrent que certaines substances de votre eau. Le système breveté échangeur d'ions de ZeroWater, avec **CINQ** technologies combinées, offre la seule eau filtrée qui répond à la définition de la FDA de l'eau en bouteille purifiée.*

*Eau du robinet potable filtrée testée par un laboratoire indépendant (qui n'est pas la FDA) afin de satisfaire aux exigences de qualité de l'eau pour pouvoir utiliser le label « purifiée ». Comparée à l'eau produite en conduisant à des filtres d'alimentation par gravité.

UN COMPTEUR DE MTD INDIQUERA LE RELEVÉ DE L'EAU DE VOTRE ROBINET

Consultez notre visite www.zerowater.com pour acheter votre compteur TDS. Saisissez « **mymeter** » lorsque vous passez à la caisse pour bénéficier d'une remise.

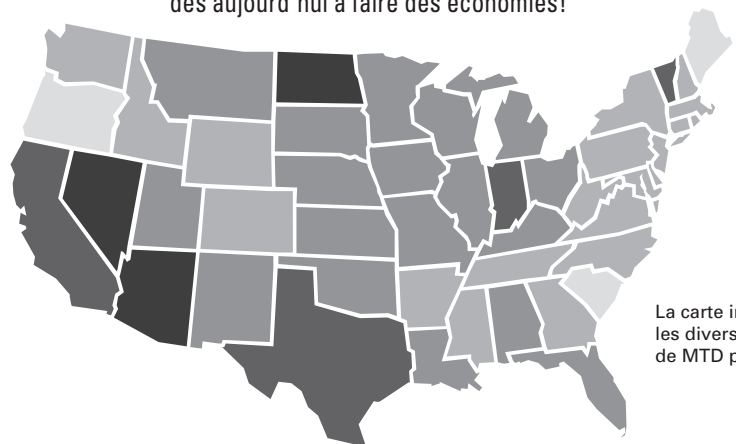


Le compteur de MTD (matières dissoutes totales) inclut un pichet/distributeur ZeroWater

EST-CE QUE VOTRE TAUX DE MTD EST ÉLEVÉ?

Un taux de MTD très élevé réduit la vie utile du filtre. Dans la mesure où ZeroWater prélève pratiquement toutes les MTD de l'eau du robinet, les filtres peuvent s'user plus rapidement.

Contactez ZeroWater aujourd'hui pour obtenir de plus amples informations sur les économies que vous pourriez réaliser sur des achats des filtres. Appelez le +1 (800) 503-2939 pour obtenir de plus amples informations sur le programme ZeroWater Continuity et commencez dès aujourd'hui à faire des économies!



La carte indique les divers niveaux de MTD par région

002-050 051-200 201-300 301-400 401+

Relevés des clients ZeroWater à compter du mois de mai 2010

PARTAGER ET COMPARER

Saisissez le relevé de vos MTD de l'eau du robinet sur le site www.zerowater.com et constatez les économies que vous pourriez réaliser sur les futurs achats des filtres.



GARANTIE POUR LE DISTRIBUTEUR ET LA CARAFE À FILTRE ET L'APPAREIL DE MESURE DES MDT DE ZEROWATER

Zero Technologies, LLC garantit au consommateur pour une période de quatre-vingt-dix (90) jours à partir de la date d'achat, le distributeur/la carafe ZeroWater (sauf la cartouche à filtre qui garantit 30 jours) pour tout défaut des matériaux ou de fabrication quand ils sont utilisés conformément au manuel d'utilisation. Durant cette période de 90 jours, si vous découvrez qu'une pièce du distributeur/de la carafe ZeroWater est endommagée ou cassée à cause d'un défaut de fabrication, nous remplacerons la pièce gratuitement si vous appelez le 1-800-503-2939 aux Etats-Unis. Le garant n'assume aucune responsabilité pour les dommages accidentels ou indirects; pour les dommages résultant d'une mauvaise utilisation du produit ou l'utilisation de tout accessoire non autorisé. Certains états ne permettent pas l'exclusion ou la limitation des dommages accidentels ou indirects, la limitation ou l'exclusion susmentionnée peut ne pas vous être appliquée. Dans la mesure où cela est permis par la loi locale, cette garantie tient lieu et place de toute autre garantie, formelle ou implicite, y compris toute garantie implicite de commercialisation ou de conformité et exclut toute autre obligation de la part du fabricant, du distributeur ou du revendeur, y compris toute responsabilité pour des dommages spéciaux, accidentels ou indirects. Cette garantie vous donne des droits légaux spécifiques et vous autorise également à avoir d'autres droits pouvant varier d'un état à l'autre aux Etats-Unis.

GARANTIE DE REMPLACEMENT ET POLITIQUE DE RETOUR DE LA CARTOUCHE À FILTRE

Bien que les cartouches à filtre de remplacement ont une garantie de 30 jours pour les défauts de fabrication, il n'existe pas d'autre garantie de remboursement. Pour déposer une plainte pour une réclamation en cas de cartouche défectueuse, vous devez d'abord contacter un représentant du service clientèle qui vous aidera à résoudre le problème quel qu'il soit. Si un problème est constaté pouvant être dû à un défaut de fabrication, il vous

sera alors donné des instructions sur la façon de renvoyer les cartouches défectueuses, elles seront remplacées ou vous seront renvoyées. Veuillez garder en mémoire que nous ne garantissons pas et ne pouvons pas garantir la durée de vie des cartouches à filtre car bon nombre de variables impactent la vie de chaque cartouche, comme : les conditions météorologiques, votre installation locale de traitement, le taux de consommation, etc... Nous pouvons seulement fournir des estimations basées sur l'expérience d'autres clients. Une durée de vie courte de la cartouche ne signifie pas nécessairement que vous ayez une cartouche défectueuse.

POLITIQUE DE RETOUR

Nous voulons que vous soyez pleinement satisfait de votre achat. Nous répondons de nos produits par une garantie de remboursement de 30 jours. Si pour une raison quelconque vous n'êtes pas complètement satisfait des systèmes de filtration d'eau que vous recevez, il vous suffit de nous renvoyer le produit dans les 30 jours suivant la réception de la marchandise pour le remboursement de votre produit au prix d'achat (moins les frais d'expédition et de traitement). Les retours doivent être acceptés ou peuvent être soumis à des frais de restockage / de remise à neuf. La politique de retour ne s'applique qu'aux ventes directes, non aux ventes au détail. Veuillez également noter que tous les composants d'un système de filtrage, y compris l'appareil numérique de mesure des MDT dans l'eau, doivent être retournés en bon état pour être acceptés comme marchandise retournée.

Si vous avez besoin d'un service ou si vous avez des questions concernant la façon d'utiliser votre produit ZeroWater, veuillez appeler le service clientèle gratuitement entre 8h00 et 20h00 CT, du lundi au vendredi au 1-800-503-2939, ou visitez notre site Web à: www.zerowater.com

Zero Technologies, LLC, 4510 Adams Circle, Suite G, Bensalem, PA 19020

DEUX FAÇONS D'ÉCONOMISER!

- 1 S'inscrire sur zerowater.com OU appeler le service clientèle au 1-800-503-2939
- 2 Renseigner le formulaire ci-dessous et l'envoyer à: **ZeroWater Savings**
4510 Adams Circle, Unit G
Bensalem, PA 19020



Inscrivez-moi pour recevoir les coupons pour des remplacements de filtre échangeur d'ions breveté ZeroWaterMD par courrier.

Nom: _____

Adresse: _____

Ville: _____ State/Province: _____ Zip/Postal Code: _____

Courriel: _____

APPENDIX C - RESIDENT LETTER

7/10/2019

Dear Denver Water Customer,

Denver Water wants your help with the Filter Lead Out of Water pilot study

We need your help and participation in a study on the use of water pitchers in the home. Why? Because the age of your home indicates that your service line may be made of lead.

At Denver Water, your safety is our most important responsibility. While the water we provide is safe and lead-free, lead can get into the water as it moves through household plumbing and customer-owned service lines — the pipes that bring water from Denver Water's pipe in the street to the plumbing in your home.

As we continue to help address this community issue, we're launching a Filter Lead Out of Water pilot study, in partnership with two local nonprofit organizations, Groundwork Denver and Mile High Youth Corps. Your help in this study will provide us with a better understanding of how customers may use these filters for everyday drinking and cooking activities.

We are providing you with a water pitcher filter and a three-month supply of replacement cartridges that are certified to significantly reduce lead concentrations, if present, in your household drinking water. In addition to the water pitcher filter, we are also sending set-up instructions and a few short survey questions.

Next Steps:

- Use your filter for drinking water, cooking and preparing infant formula.
- Complete the survey you received with your filter kit, as well as follow-up surveys mailed in the future.

If you are interested in an in-home meeting to talk more about lead or your filter experience, please contact us at flow@denverwater.org or 303-628-6655.

To learn more about lead in drinking water and what you can do to reduce your exposure to lead in drinking water, visit denverwater.org/Lead.

We appreciate your help in this important study. Please return the survey you received in your filter kit and follow-up surveys that will be mailed in the future.

Sincerely,

Denver Water

7/10/2019

Estimado(a) Cliente de Denver Water,

Denver Water quiere su ayuda con el estudio piloto Filtre el plomo del agua

Necesitamos su ayuda y participación en un estudio sobre el uso de jarras de agua en el hogar. ¿Por qué? Porque la fecha de construcción de su casa indica que su línea de servicio principal de agua puede ser hecha de plomo.

En Denver Water su seguridad es nuestra principal responsabilidad. A pesar de que el agua que suministramos es segura y sin plomo, este puede meterse al agua a medida que pasa por las tuberías de la casa y por las líneas de servicio principales particulares, que son las tuberías que llevan el agua desde la tubería de Denver Water en la calle, hasta las tuberías en su hogar.

Al tiempo que abordamos este problema de la comunidad, estamos lanzando el estudio piloto llamado Filtre el plomo del agua, en asociación con dos organizaciones locales sin fines de lucro, Groundwork Denver y Mile High Youth Corps. Su ayuda en este estudio nos permitirá entender mejor cómo los clientes pueden usar estos filtros para el agua de beber diaria y la de cocinar.

Le estamos suministrado una jarra con filtro para el agua y los cartuchos de repuesto para tres meses, que están certificados para reducir de manera considerable la concentración de plomo, si está presente en el agua potable de su hogar. Además de la jarra con filtro para el agua, le estaremos enviando instrucciones de uso y una encuesta corta.

Los siguientes pasos:

- Use su filtro para el agua que va a beber, con la que va a cocinar y preparar biberones.
- Complete la encuesta que recibió con el kit del filtro, así como las encuestas de seguimiento que recibirá por correo más adelante.

Si le interesa que alguien venga a su hogar para hablarle sobre el plomo o sobre su experiencia con el filtro, comuníquese con nosotros en flow@denverwater.org o al 303-628-6655.

Para obtener más información sobre el plomo en el agua potable y sobre lo que usted puede hacer para reducir su exposición al plomo en el agua potable, visite la página web denverwater.org/Lead.

Agradecemos su ayuda en este importante estudio. Por favor complete la encuesta que recibió con su kit del filtro, así como las encuestas de seguimiento que recibirá por correo más adelante.

Cordialmente,

Denver Water

APPENDIX D - SURVEY QUESTIONS

Filter Pilot Survey Question Matrix

Questions	Initial Survey (5116)	Use Survey (5122)	Alternative Filter Survey (5125)	Ongoing Surveys (5132)
1. Do you use your filter for drinking water? <ul style="list-style-type: none"> • Yes • No 		X	X	X
2. Do you use your filter for water used for cooking? <ul style="list-style-type: none"> • Yes • No 		X	X	X
3. Do you have a lead service line? <ul style="list-style-type: none"> • Yes • No • I do not know 	X			
4. What is your household's primary source of drinking water? (Check one) <ul style="list-style-type: none"> <input type="checkbox"/> Unfiltered faucet <input type="checkbox"/> Bottled water <input type="checkbox"/> Filtered - refrigerated water/ice dispenser <input type="checkbox"/> Filtered - pitcher filter <input type="checkbox"/> Filtered - under sink filter <input type="checkbox"/> Filtered - faucet mounted filter <input type="checkbox"/> Filtered - whole house filter <input type="checkbox"/> Other (specify) 	X			
5. What is your household's primary source of water used for cooking? (Check one) <ul style="list-style-type: none"> <input type="checkbox"/> Unfiltered faucet <input type="checkbox"/> Bottled water <input type="checkbox"/> Filtered - refrigerated water/ice dispenser <input type="checkbox"/> Filtered - pitcher filter <input type="checkbox"/> Filtered - under sink filter <input type="checkbox"/> Filtered - faucet mounted filter <input type="checkbox"/> Filtered - whole house filter <input type="checkbox"/> Other (specify) 	X			

Filter Pilot Survey Question Matrix

Questions	Initial Survey (5116)	Use Survey (5122)	Alternative Filter Survey (5125)	Ongoing Surveys (5132)
6. If you have an existing water filter system, what is the make and model number for your filter? (Fill in)	X			
7. Do you currently or do you plan in the future to use filtered or bottled water for infant formula? Yes/No/NA	X	X	X	X
8. If you do not primarily use the water filter provided, what issues are you experiencing? (Check all that apply) <input type="checkbox"/> Filter pitcher isn't large enough <input type="checkbox"/> Filter pitcher doesn't fit in refrigerator <input type="checkbox"/> The filter pitcher takes too much time to fill <input type="checkbox"/> It's too much effort to use the filter pitcher <input type="checkbox"/> I'm not interested in filtering my drinking water <input type="checkbox"/> Other, please specify: (fill in the blank) <input type="checkbox"/> Not Applicable (no issues)		X		X
9. If the water filter provided does not meet your needs, would you be more likely to use an alternative filter? (Check one) <input type="checkbox"/> Faucet-mounted filter <input type="checkbox"/> Refrigerator filter <input type="checkbox"/> Larger pitcher filter <input type="checkbox"/> Not Applicable (the water filter meets my needs)		X		X
10. Are you familiar with filter maintenance and cartridge replacement requirements? E.g. replacing the filter cartridge, cleaning the pitcher (if applicable)? Yes/No		X	X	X
11. What questions or comments do you have about the filter pilot?	X	X	X	X
12. How could we improve the filter pilot?	X	X	X	X
13. Want to stay informed about the FLOW pilot? Provide your email or phone number.	X	X	X	X



To be added to every survey: FILTER LEAD OUT OF WATER

Please provide your email address or mailing address to receive your Amazon gift card.

Email: _____ Mailing Address: _____

Survey Lead-Ins:

Initial Survey

Thank you for participating in Denver Water's FLOW Pilot. Your feedback will help us understand information about how water is used in your home for drinking and cooking activities. Please use the ZeroWater® pitcher provided and return your completed survey by mail or online within two weeks of receiving the filter kit. **As our way of thanking you for your feedback and using your filter, upon receipt of the completed survey, Denver Water will send you a \$15 Amazon gift card.** For an online survey, go to denverwater.org/Lead-survey or scan the QR code at the bottom of this survey.

Use Survey

Thank you for participating in Denver Water's FLOW Pilot. Your feedback will help us understand information about how water is used in your home for drinking and cooking activities and your preference for filters. Please use the ZeroWater® pitcher provided and return your completed survey by mail or online by July 31, 2019. **As our way of thanking you for your feedback and using your filter, upon receipt of the completed survey, Denver Water will send you a \$15 Amazon gift card.** For an online survey go to denverwater.org/FLOW-survey or scan the QR code at the bottom of this survey.

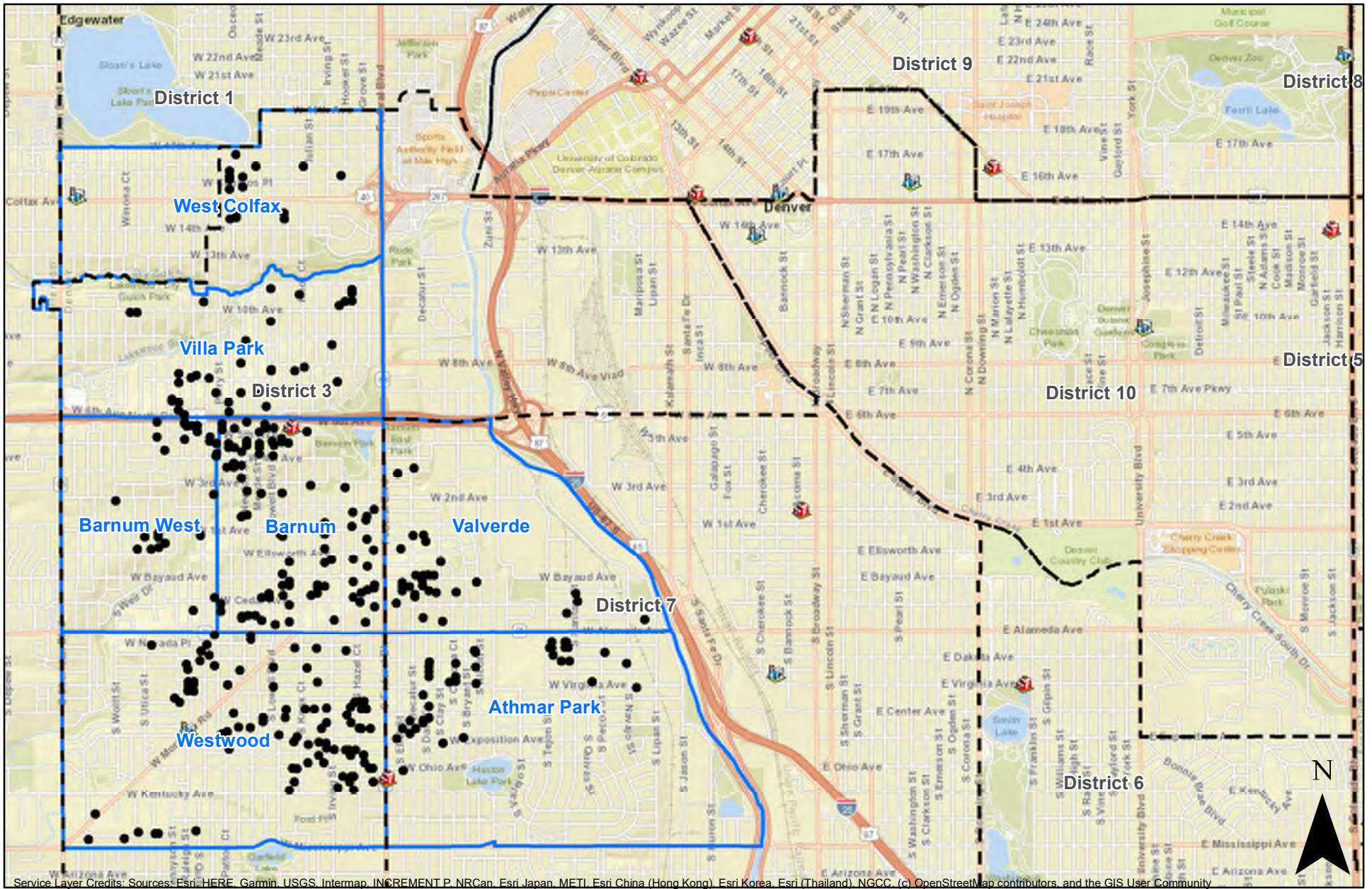
Alt Survey

Thank you for participating in Denver Water's FLOW Pilot. Your feedback will help us understand information about how water is used in your home for drinking and cooking activities. Please use the alternative filter provided and return your completed survey by mail or online by August 30, 2019. **As our way of thanking you for your feedback and using your filter, upon receipt of the completed survey, Denver Water will send you a \$15 Amazon gift card.** For an online survey go to <http://bit.do/LSL-AltFilter> or scan the QR code at the bottom of this survey.

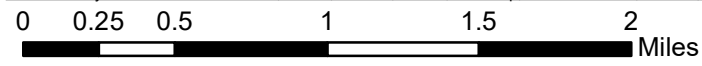
Ongoing Surveys


Thank you for participating in Denver Water's FLOW Pilot. Your feedback will help us understand information about how water is used in your home for drinking and cooking activities. Please use your provided filter and return your completed survey by mail or online by TBD. **As our way of thanking you for your feedback and using your filter, upon receipt of the completed survey, Denver Water will send you a \$15 Amazon gift card.** For an online survey go to <http://bit.do/LSL-Ongoing> or scan the QR code at the bottom of this survey.

APPENDIX E - MAPS



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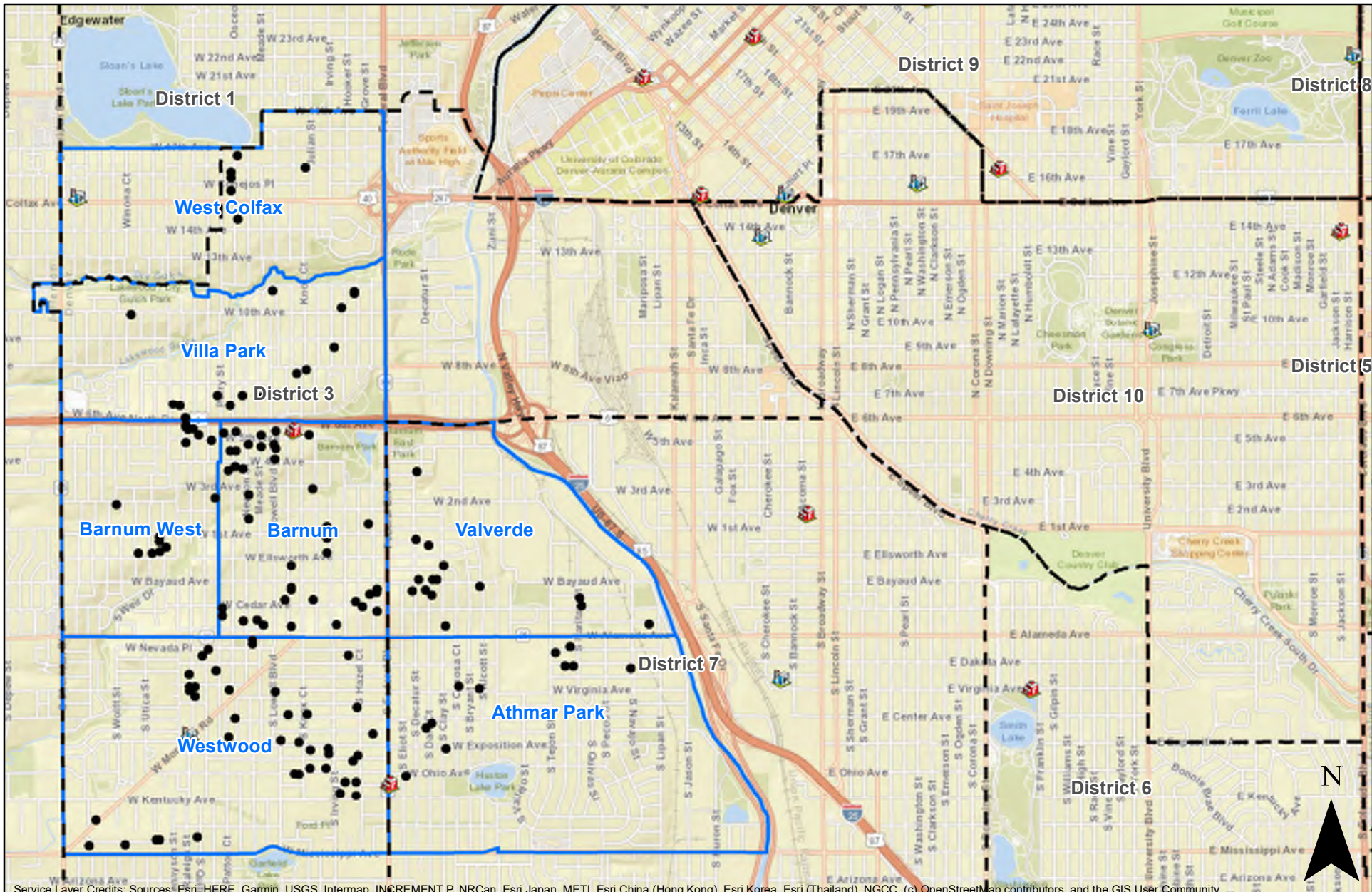
-  Fire Stations
-  Police Stations
-  Filter Pilot Locations (331)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

Filter Pilot Area

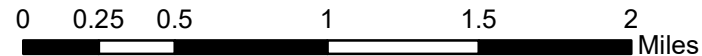


Author: R. Avery
Map Date: 2019-07-08






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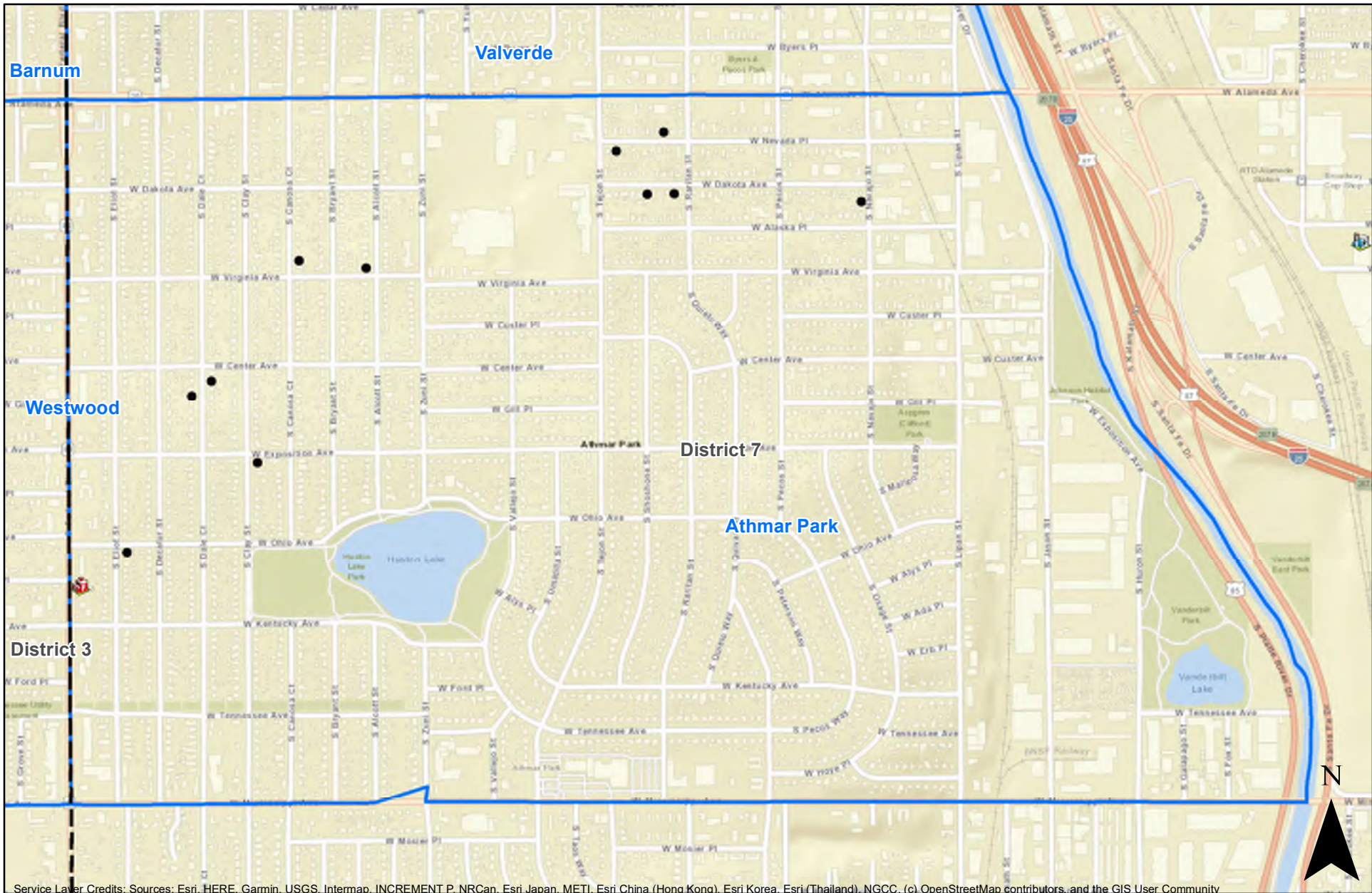
Filter Pilot Hand Delivery Locations

-  Fire Stations
-  Police Stations
-  Filter Pilot Hand Delivery Locations (142)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

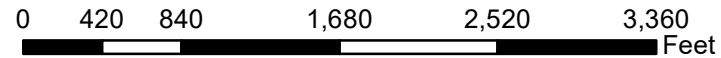


Author: R. Avery
Map Date: 2019-07-08







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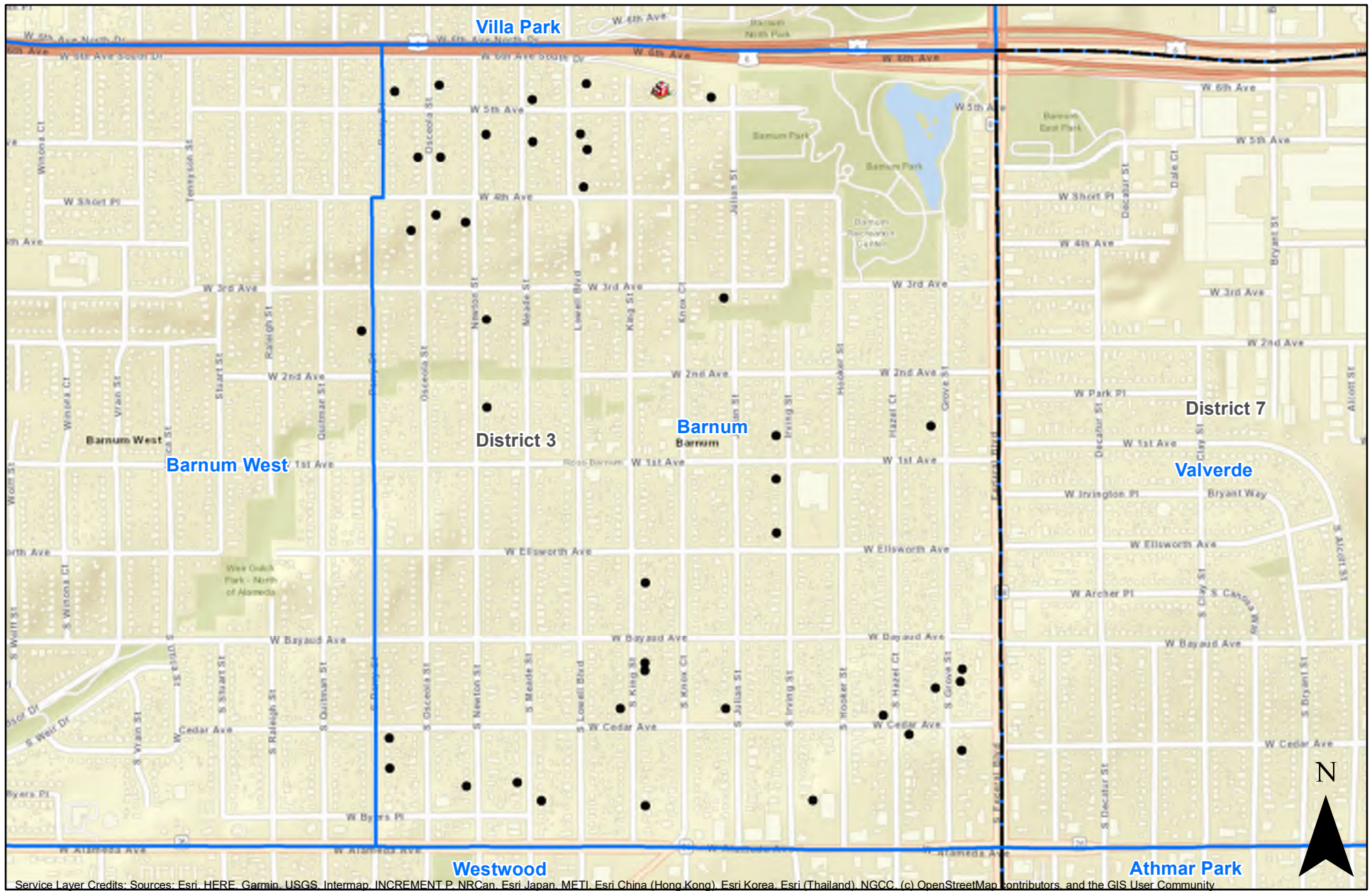
Filter Hand Delivery Locations: Athmar Park

-  Fire Stations
-  Police Stations
-  Filter Pilot Hand Delivery Locations (11)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

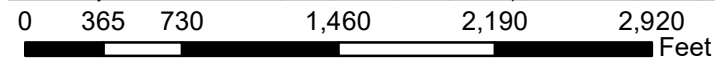


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Map Date: 2019-07-08







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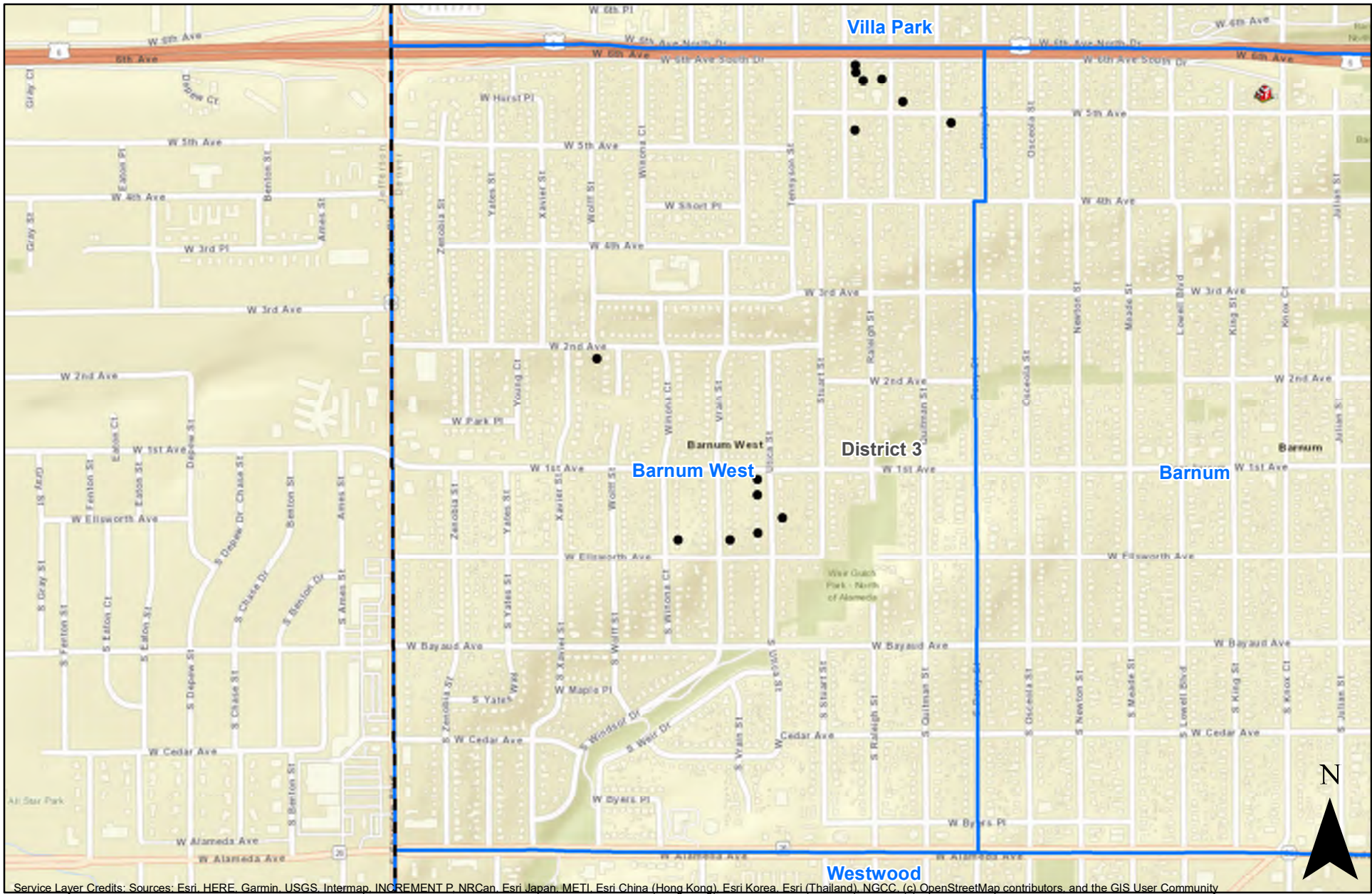
Filter Hand Delivery Locations: Barnum

-  Fire Stations
-  Police Stations
-  Filter Pilot Hand Delivery Locations (41)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

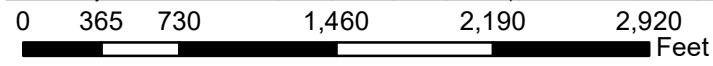


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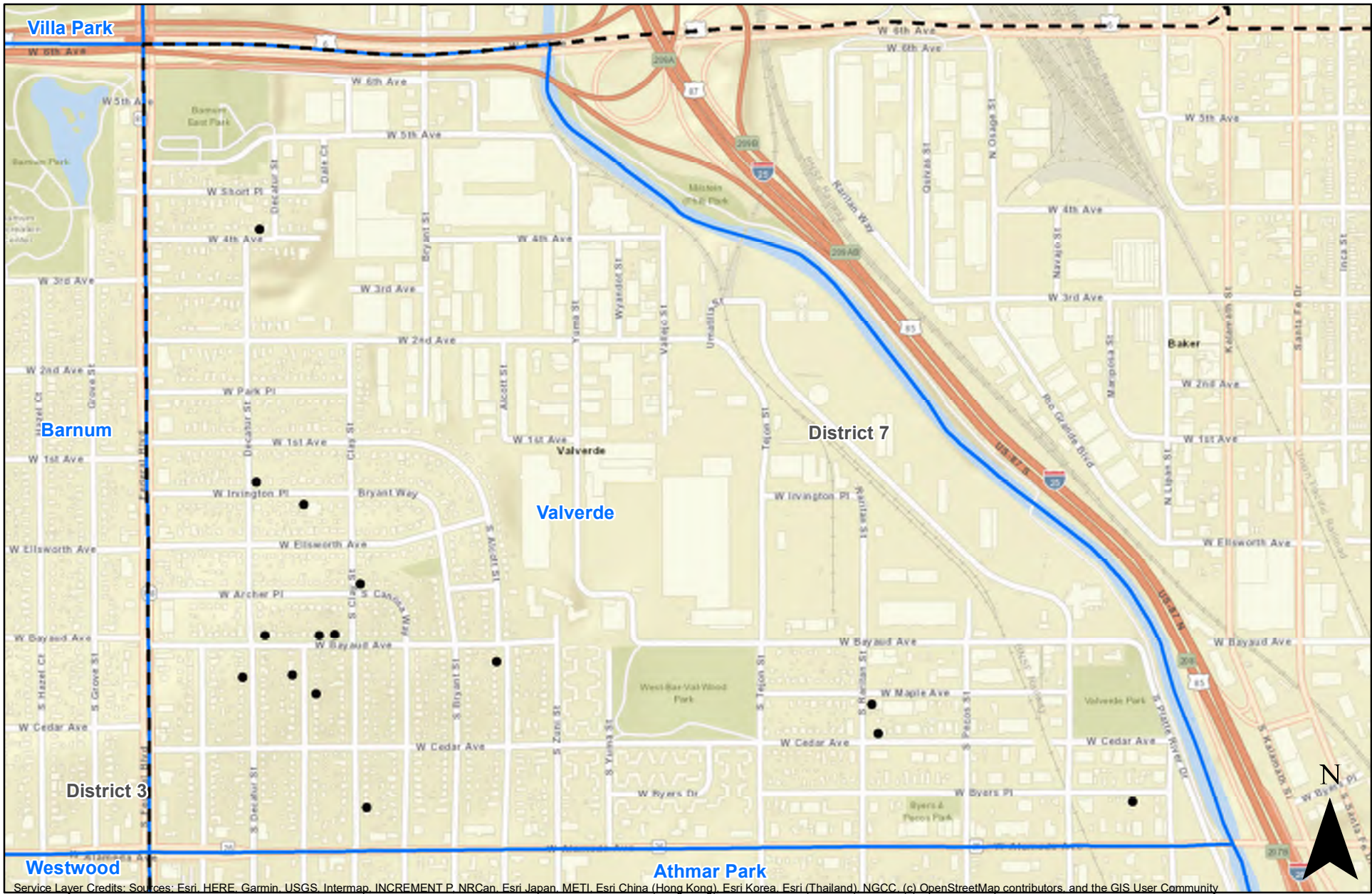
Filter Hand Delivery Locations: Barnum West

-  Fire Stations
-  Police Stations
-  Filter Pilot Hand Delivery Locations (14)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations









Author: R. Avery
Map Date: 2019-07-08

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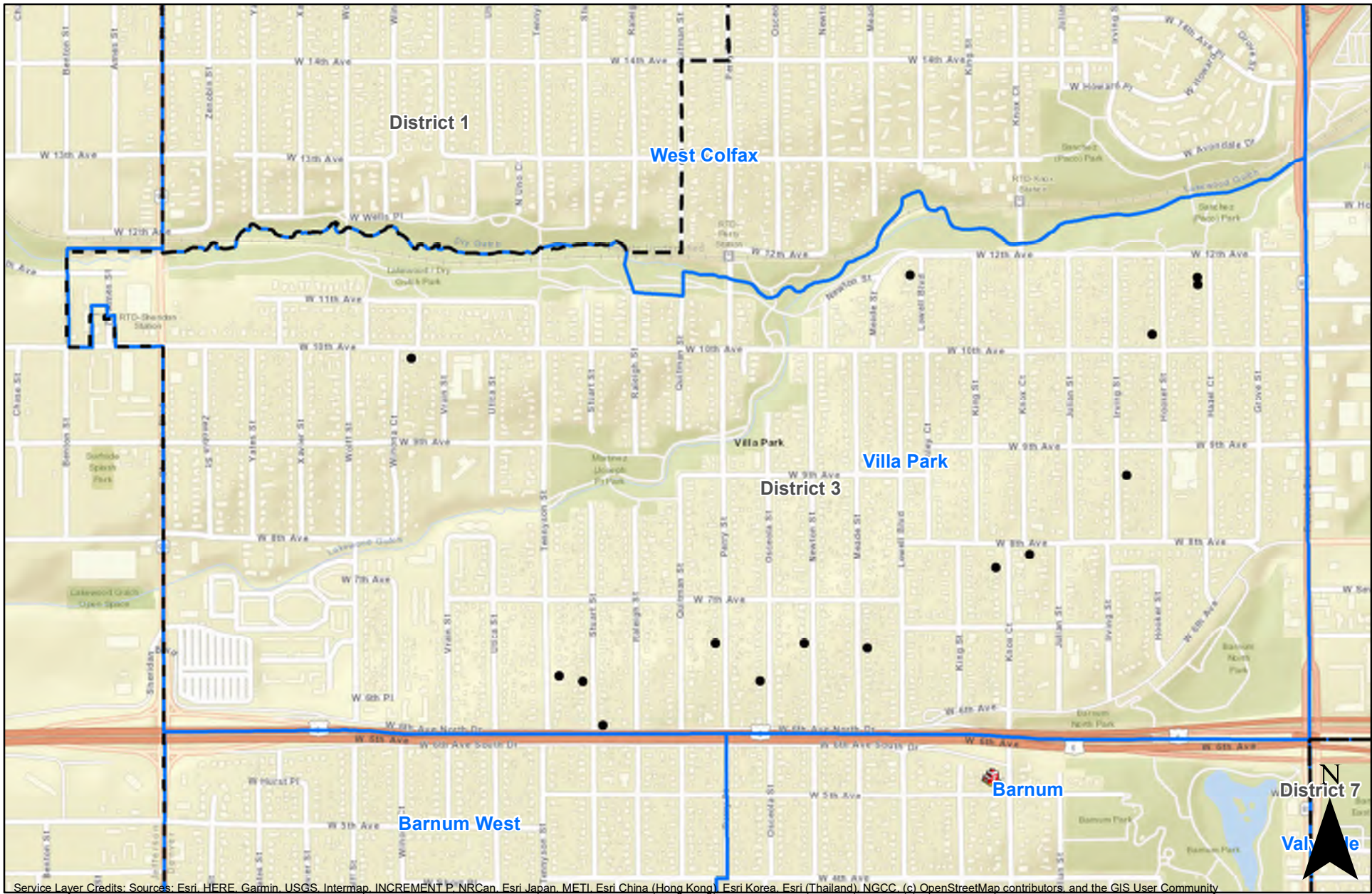
Filter Hand Delivery Locations: Valverde

-  Fire Stations
-  Police Stations
-  Filter Pilot Hand Delivery Locations (15)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

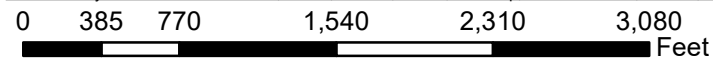


Author: R. Avery
Map Date: 2019-07-08






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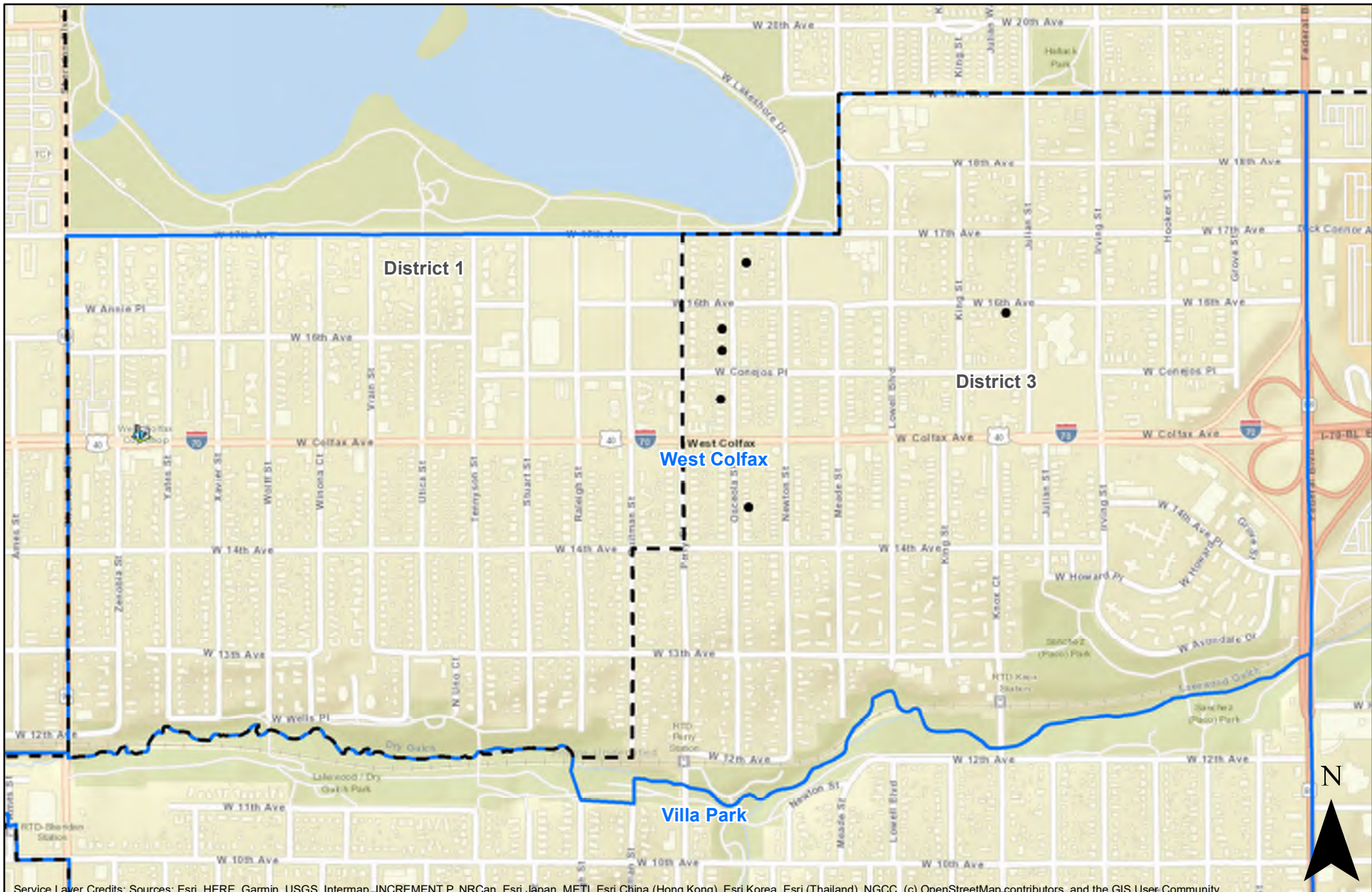
Filter Hand Delivery Locations: Villa Park

-  Fire Stations
-  Police Stations
-  Filter Pilot Hand Delivery Locations (15)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

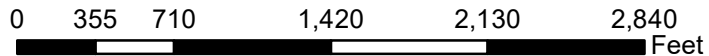


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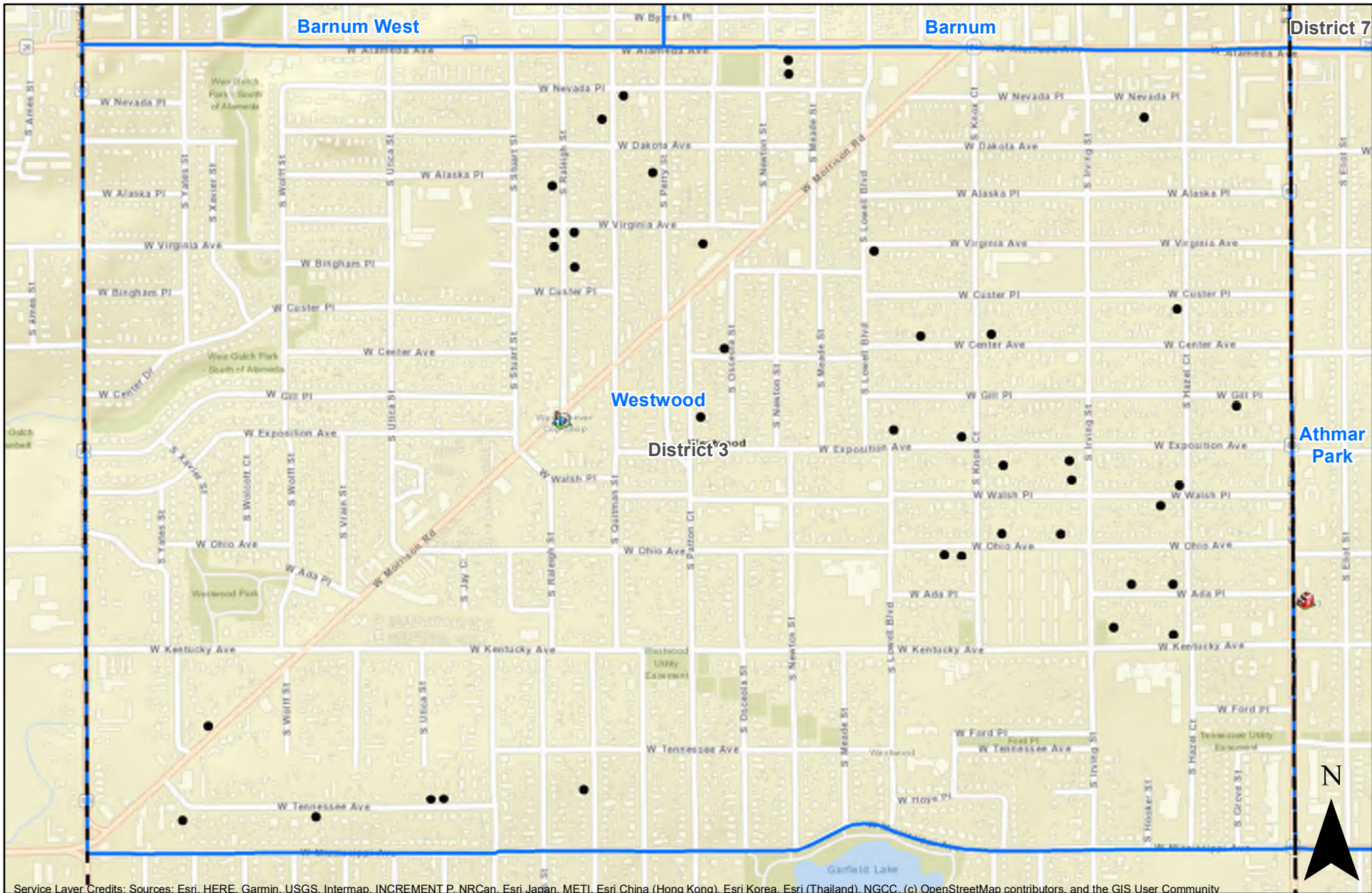
Filter Hand Delivery Locations: West Colfax

-  Fire Stations
-  Police Stations
-  Filter Pilot Hand Delivery Locations (6)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations



Author: R. Avery
Map Date: 2019-07-08



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0 370 740 1,480 2,220 2,960 Feet

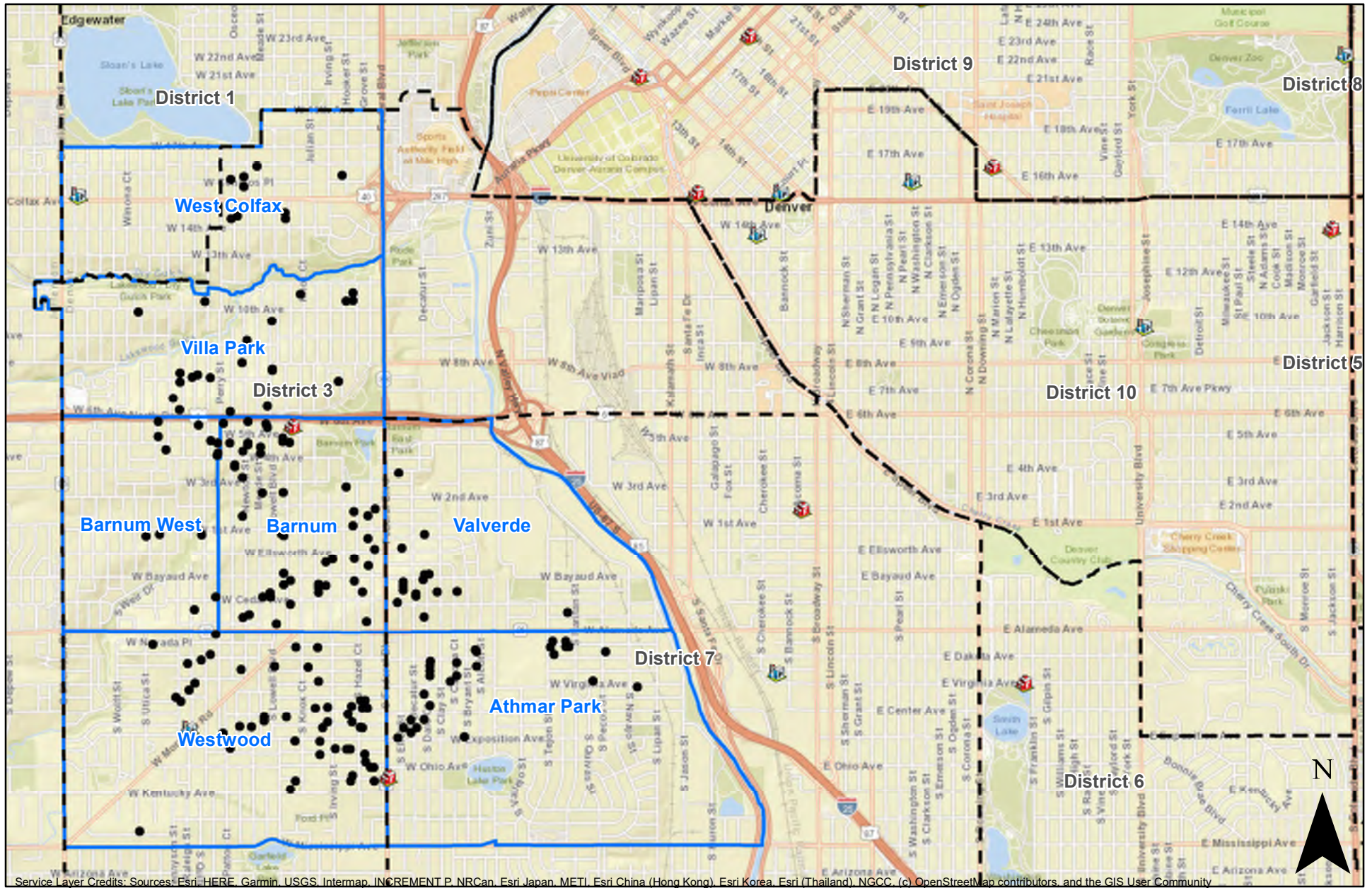
Filter Hand Delivery Locations: Westwood

-  Fire Stations
-  Police Stations
-  Filter Pilot Hand Delivery Locations (40)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

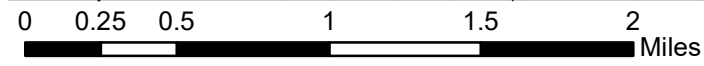


Author: R. Avery
Map Date: 2019-07-08

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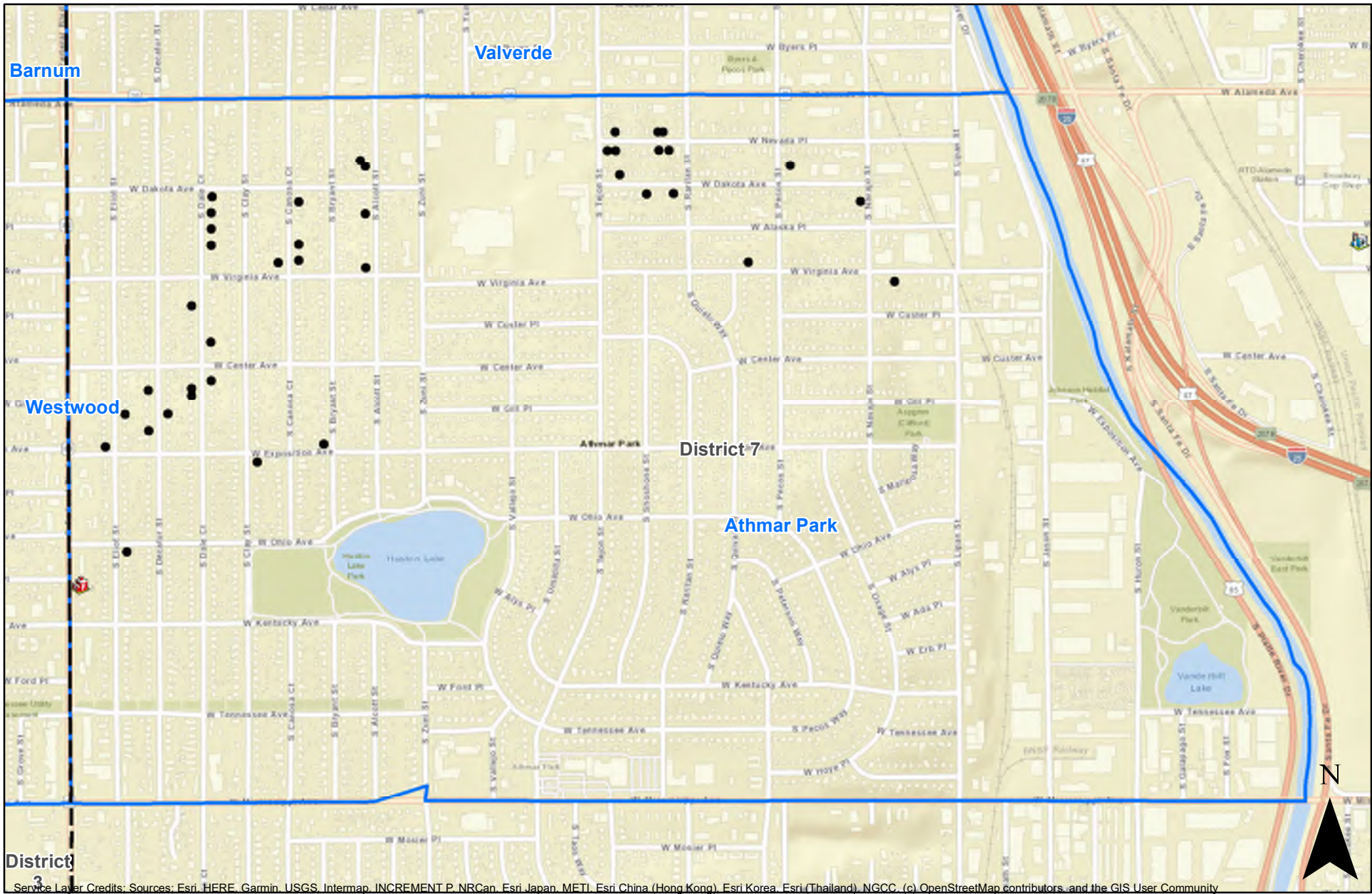
Filter Pilot Mail Delivery Locations

- Fire Stations
- Police Stations
- Filter Pilot Mail Delivery Locations (189)
- Council Districts
- Neighborhoods
- Registered Neighborhood Organizations

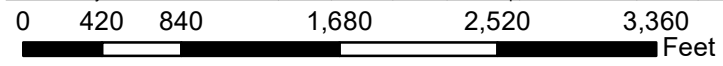


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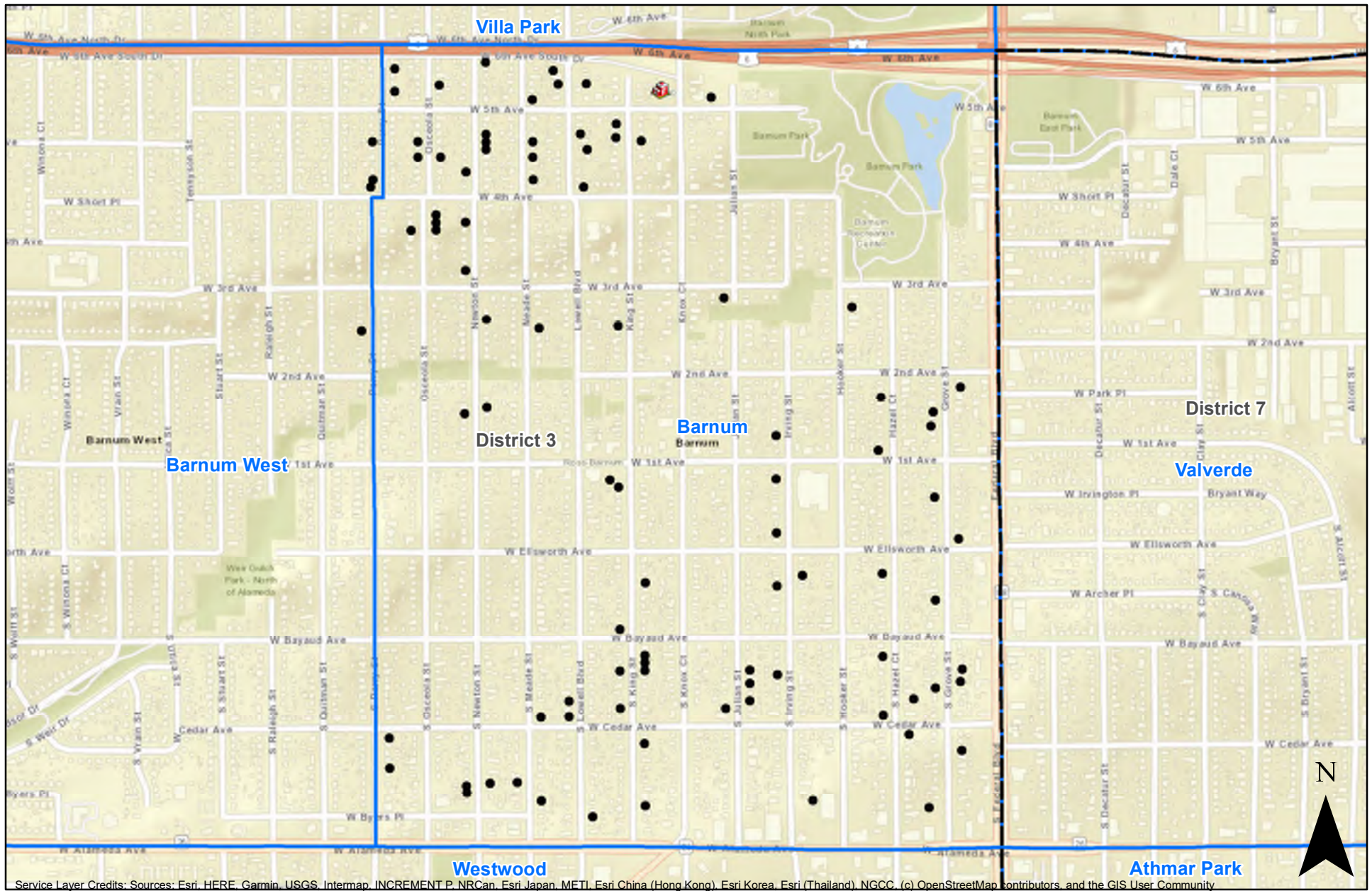
Filter Pilot Locations: Athmar Park

-  Fire Stations
-  Police Stations
-  Filter Pilot Locations (39)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

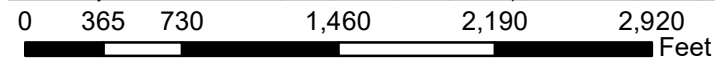


Author: R. Avery
Map Date: 2019-07-08




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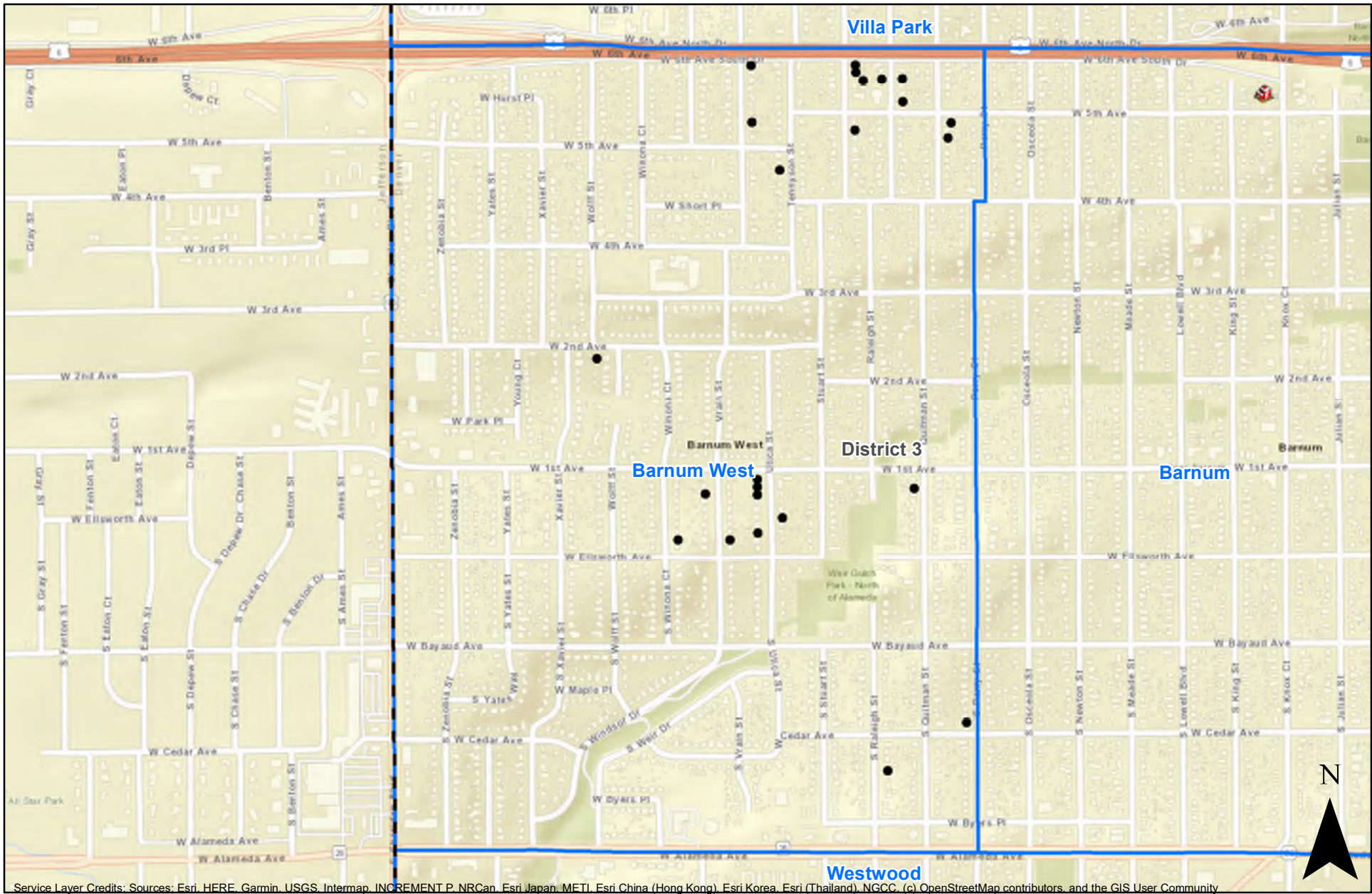
Filter Pilot Locations: Barnum

-  Fire Stations
-  Police Stations
-  Filter Pilot Locations (93)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

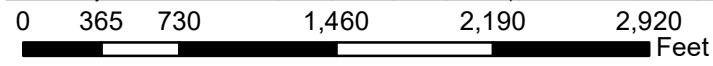


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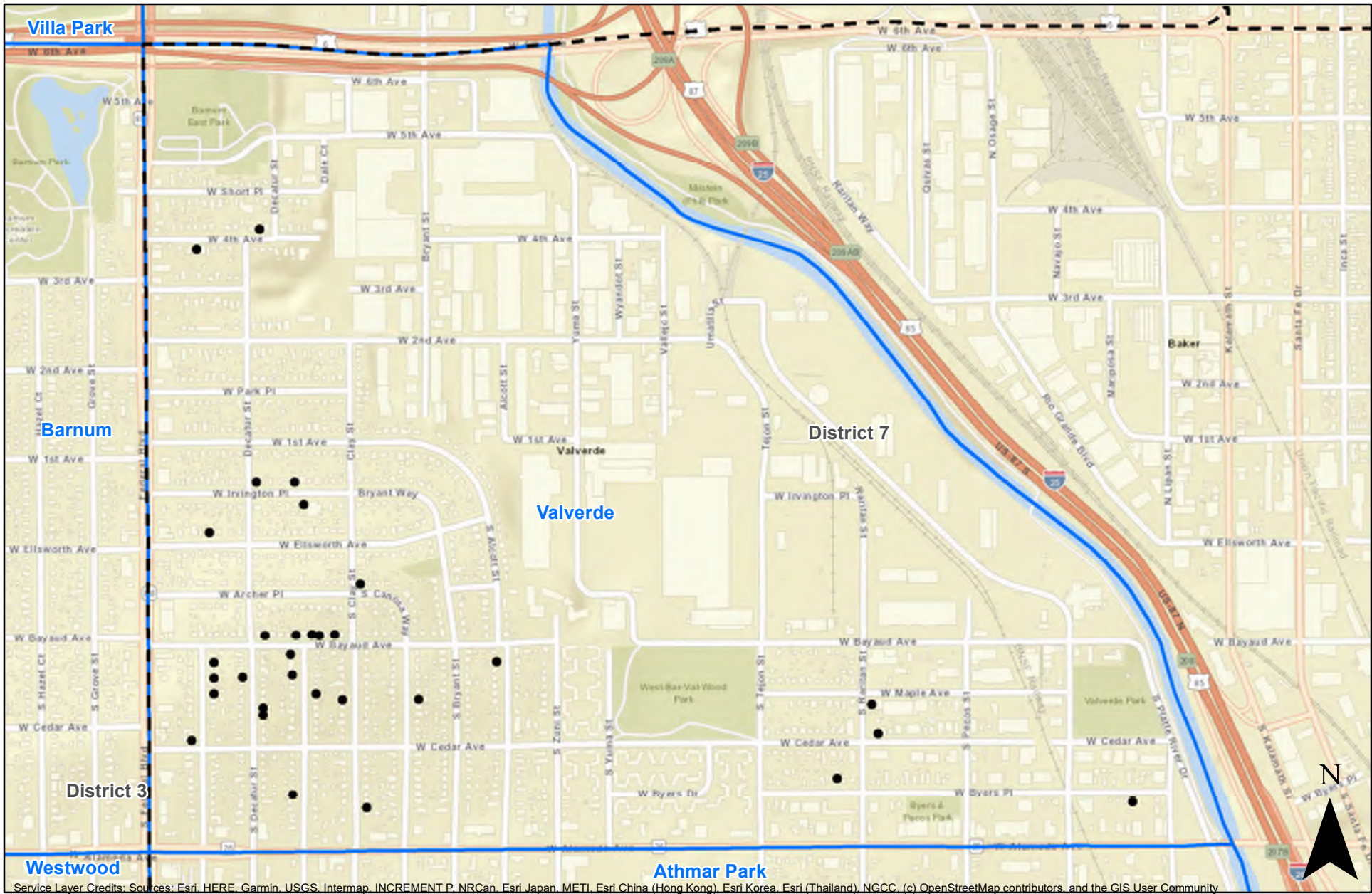
Filter Pilot Locations: Barnum West

-  Fire Stations
-  Police Stations
-  Filter Pilot Locations (24)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

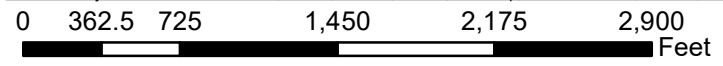


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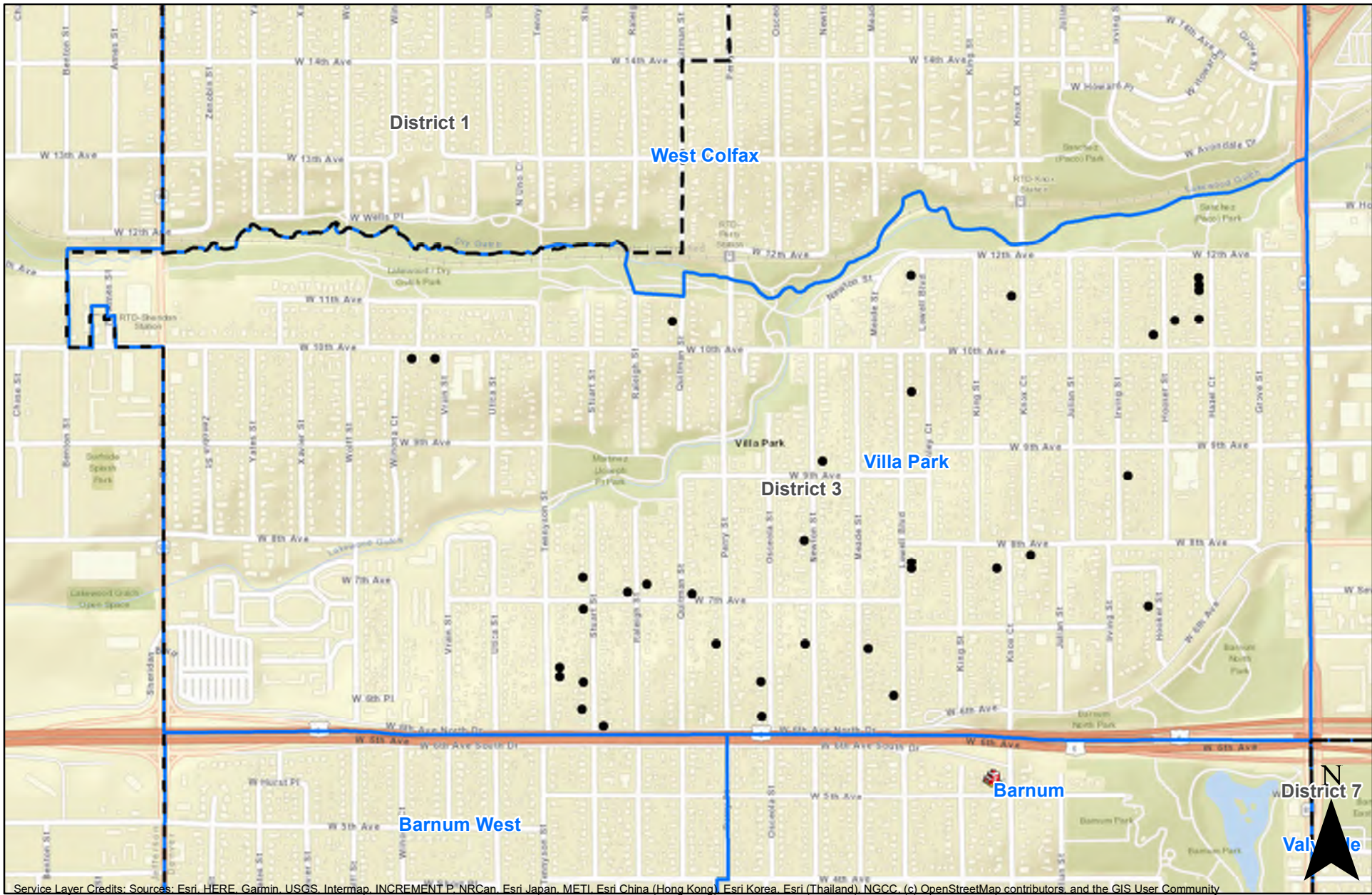
Filter Pilot Locations: Valverde

-  Fire Stations
-  Police Stations
-  Filter Pilot Locations (31)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

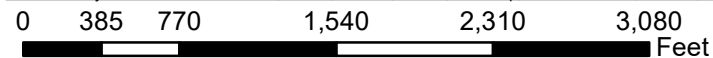


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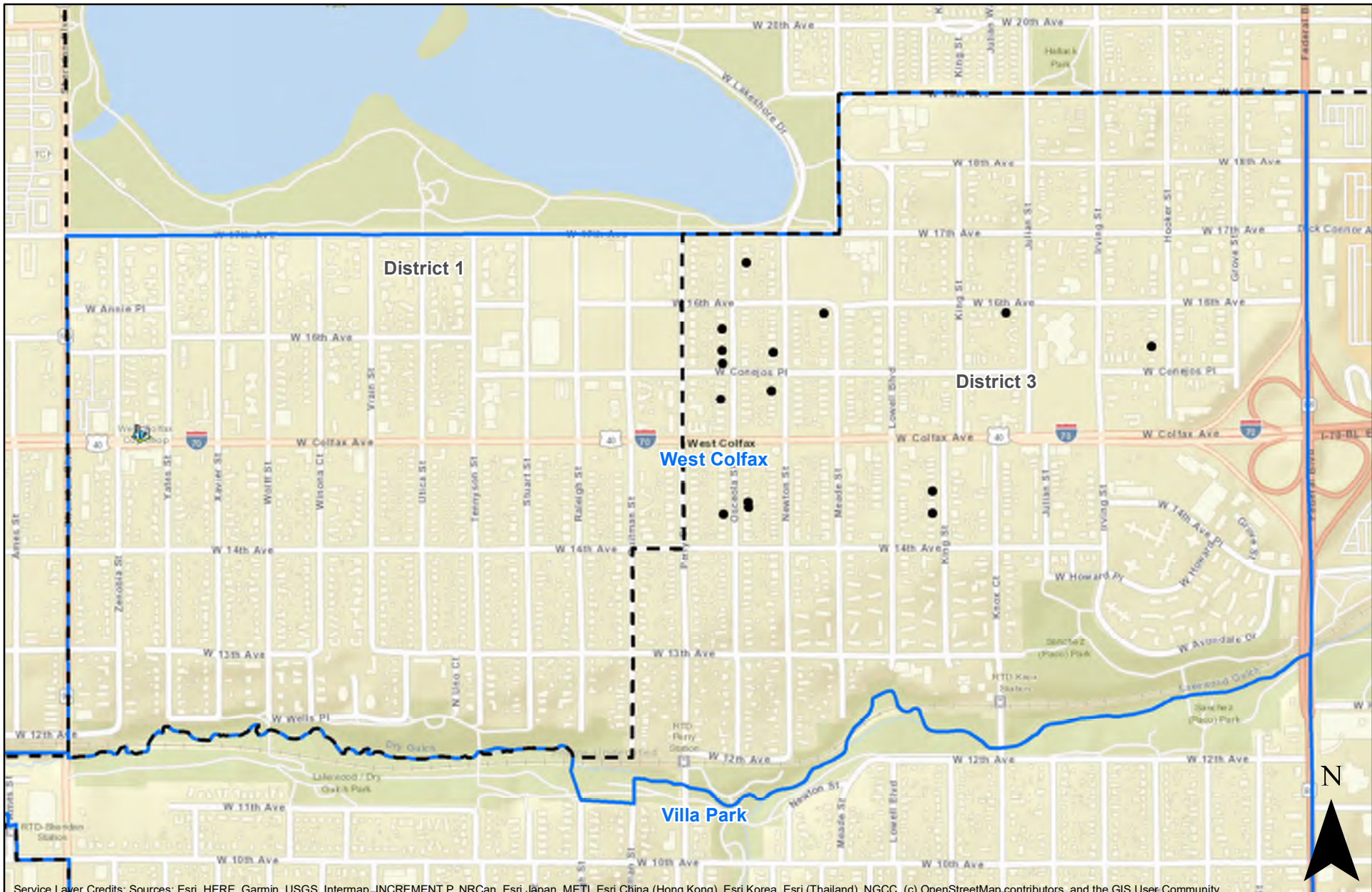
Filter Pilot Locations: Villa Park

-  Fire Stations
-  Police Stations
-  Filter Pilot Locations (36)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations



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Map Date: 2019-07-08






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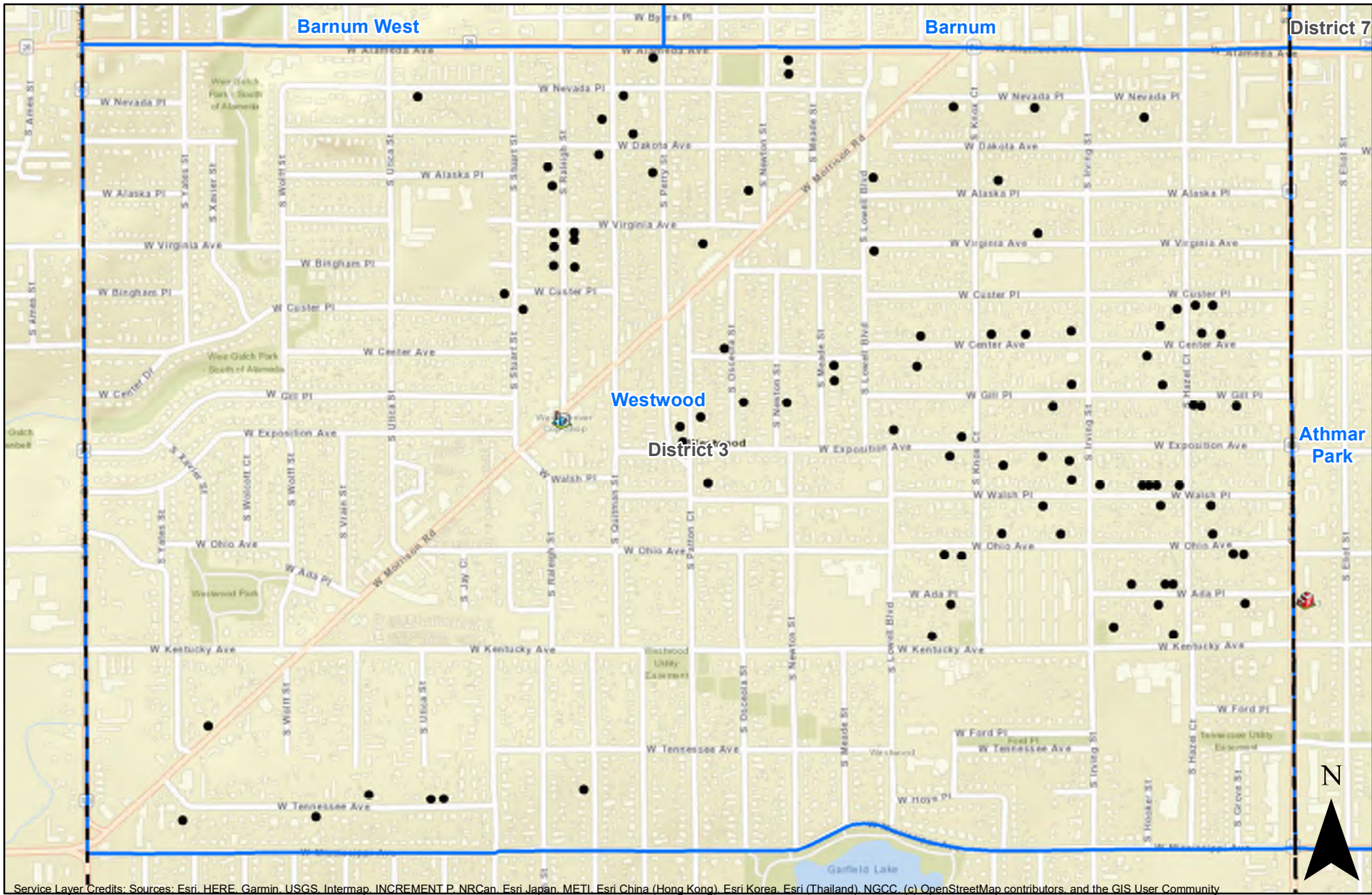
0 355 710 1,420 2,130 2,840 Feet

Filter Pilot Locations: West Colfax

-  Fire Stations
-  Police Stations
-  Filter Pilot Locations (15)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations









Author: R. Avery
Map Date: 2019-07-08



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0 370 740 1,480 2,220 2,960 Feet

Filter Pilot Locations: Westwood

-  Fire Stations
-  Police Stations
-  Filter Pilot Locations (93)
-  Council Districts
-  Neighborhoods
-  Registered Neighborhood Organizations

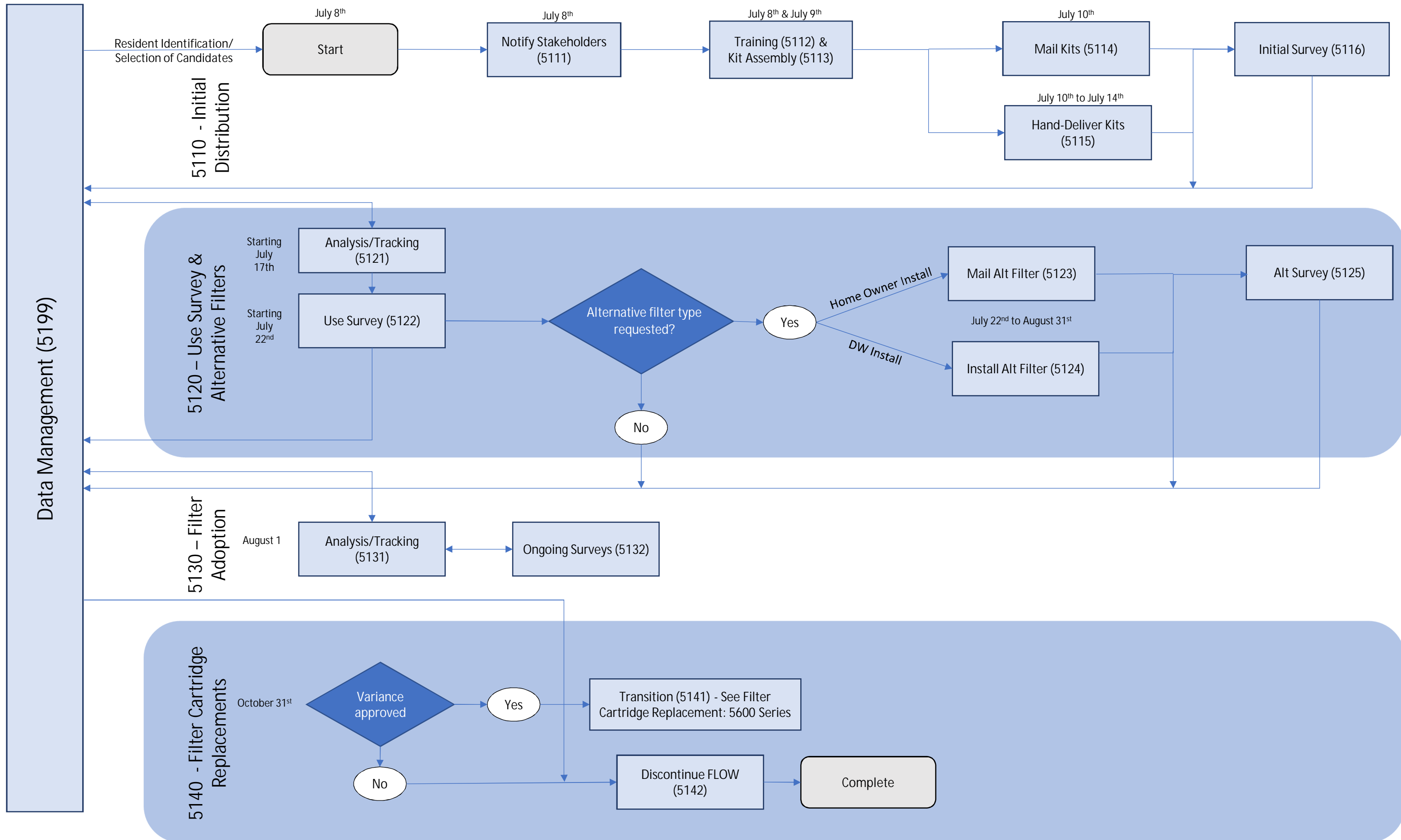


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APPENDIX F - FLOW PILOT FLOWCHART

FILTER PILOT – 5100 SERIES: WORKFLOW/FLOWCHART



APPENDIX G - COE



Community Outreach and Education (COE)

The overarching Lead Reduction Program Communication's Strategy, process, procedures, and guidelines will apply to the Filter Lead Out of Water (FLOW) Pilot. The success of the FLOW Pilot is paramount to provide Denver Water with the necessary data and information to support the variance request.

The collateral developed for the filter kit will be transitioned into the full-scale filter distribution effort. All COE materials will be bilingual for ease of use. The FLOW Pilot kit included the following COE materials:

Introduction Letter (Appendix C)

The introduction letter was our first touch point with Denver Water households who received the filter kit via USPS and door-to-door delivery. This letter provided the context as to why the Denver Water household received a filter kit, shared information about the FLOW Pilot, and provided contact information for additional support and questions.

Frequently Asked Questions (FAQ) (Appendix G1)

The FAQ document provided additional information beyond the introduction letter for recipients of the FLOW Pilot. The FAQ developed specifically for the FLOW Pilot has duplicative information from the full-scale FLOW Program initiative FAQ approved by the EPA and CDPHE, with additional context as to why participants are receiving the filter kit, the length of the FLOW Pilot, information about the surveys, and more.

Magnet Reminder Card (Appendix G2)

A refrigerator magnet was provided as a reminder to encourage filter pitcher use for infant formula, drinking, and cooking. The magnet provides a reminder to users to change their filter cartridge every 30-days. Program contact information is included on the magnet.

Door-hanger (Appendix G3)

100 of the 300 FLOW Pilot participants will have door-to-door delivery of the filter kits. For these 100 FLOW Pilot participants, a door-hanger was left on doors with the filter kit to notify Denver Water households of the FLOW Pilot, inform them of the contents of the filter kit, and provide contact information, should the Denver Water household residents not be home during the initial door to door delivery attempt.

Survey Card (Appendix G4)

An initial survey was included in the filter kit. FLOW Pilot participants were encouraged to complete the initial survey and return their comments to Denver Water within two weeks of receiving their filter kit. Future surveys will be mailed to the FLOW Pilot participants with incentives such as Amazon gift cards offered for the completion of each survey.

The designs of other materials used for the FLOW Pilot, including T-shirts, tote bags, and information cards are also included in this appendix.

LEAD REDUCTION PROGRAM

FREQUENTLY ASKED QUESTIONS

How does lead get into drinking water?

The water delivered to homes and businesses is lead-free, but lead can get into water as it moves through customers' lead-containing household plumbing and service lines (the pipes that bring water from Denver Water's main in the street to the plumbing in your home or building).

If Denver Water's water is lead-free, why is Denver Water focusing on lead reduction?

When it comes to lead in drinking water, no levels are safe. That is why Denver Water is working with the Colorado Department of Public Health and Environment and the Environmental Protection Agency to reduce the risks of lead exposure as drinking water moves through those homes and businesses.

In 2012, water quality sample results exceeded the level the EPA requires for taking action. The action level is an indicator that additional steps may need to be taken to optimize corrosion control treatment. While Denver Water has not exceeded the lead action level since 2012, it is committed to implementing the best method to permanently reduce lead in tap water.

In the meantime, Denver Water has already taken a number of measures to minimize the presence of lead in water, such as:

- Using a pH adjustment to reduce the risk of lead, copper and other metals from getting into drinking water from service lines or household plumbing.
- Replacing customer lead service lines free of charge when such piping is discovered during normal operations and maintenance activities.
- Partnering with Denver Public Schools, Douglas County Schools and Littleton Public Schools to develop and assist with their own lead-testing programs, testing over 15,000 samples.
- Offering free lead testing for customers.

What solutions are being considered?

Denver Water conducted a study on multiple treatment options to reduce the potential for lead entering drinking water from lead service lines and household plumbing. Based on the results, CDPHE, the state regulatory agency that oversees drinking water regulations, required Denver Water to begin adding orthophosphate in accordance with regulatory requirements. Orthophosphate, a food additive, would be added to all drinking water provided by Denver Water to provide additional coating for pipes to minimize corrosion and reduce the amount of lead released from lead-containing pipes and fixtures.

While orthophosphate has been safely and successfully used for decades across the country, concerns have been raised about the potential impacts of this additive to wastewater treatment plants and downstream reservoirs, streams and rivers. CDPHE, Denver Water and others are studying these potential impacts to determine ways to protect the environment if this approach moves forward.

Denver Water is proposing an alternative, holistic approach that directly tackles the biggest issue, customer-owned lead service lines, at its source by accelerating the removal of those lines through a Lead Reduction Program. The approach has multiple components:

- Increasing the pH level, which reduces the corrosivity of the water.
- Providing at-home water filters for all customers in Denver Water's service area with a suspected lead service line, free of charge.
- Replacing the estimated 50,000 to 90,000 lead service lines with copper lines in Denver Water's service area at no charge to the customer over the next 15 years.

LEAD REDUCTION PROGRAM

FREQUENTLY ASKED QUESTIONS

The EPA will begin accepting comments about this option this summer and is expected to decide whether Denver Water's proposed alternative meets Safe Drinking Water Act requirements by the end of the year. CDPHE will then make a decision whether to change the March 2018 orthophosphate designation, if appropriate. Regardless of whether the alternative option is selected, the implementation of optimal corrosion control will begin in March 2020.

How can I find out if I have a lead service line and what can I do about it?

In Denver Water's experience, homes and buildings most likely to have lead service lines are those built before 1951 in the Denver metro area (denverwater.org/neighborhood-age). Homes built before 1987 may have lead solder in their plumbing. Homes that do not fall within these two categories are less likely to be at risk for lead contamination in the water.

All Denver Water customers can get a free, at-home water quality test for lead by visiting denverwater.org/Lead or calling 303-893-2444. For those who are not Denver Water customers, we recommend you contact your local water utility or a certified lab in your area.

If your home has a lead service line, the best long-term action is to replace it with a copper service line. We recommend using a certified plumber. The cost of replacing a lead service line is approximately \$5,000-\$10,000, which can be a financial challenge. Denver Water has a partnership with the Denver Urban Renewal Authority to provide financing for homeowners to replace lead service lines. Under the program, DURA issues eligible property owners no- or low-interest loans based on income. DURA obtains bids and oversees the contractors retained. If you are interested, contact DURA at 303-534-3872 to learn the eligibility requirements for this limited-time program.

It is worth noting that Denver Water is currently working to develop a program that could replace property owners' lead service lines at no cost to them. Decisions on whether to implement this program may not occur until the end of 2019.

If you suspect your home has lead in the plumbing, there are a few immediate steps you can take to minimize exposure:



Use a filter certified by the National Safety Foundation to remove lead for drinking and cooking. Replace the filter cartridge according to the manufacturer's instructions.



Use only cold water for drinking, cooking and making baby formula. Remember, boiling water does not remove lead from water and hot water often contains higher levels of lead than cold water.



If water has not been used in the home for a few hours, such as first thing in the morning or when getting home from work, run the kitchen or any bathroom faucet for five minutes (remember to capture the water and reuse it!). You can also run the dishwasher, take a shower, or do a load of laundry to help flush water in your internal plumbing before drinking or cooking.



Regularly clean your faucet's screen (also known as an aerator). View step-by-step instructions at denverwater.org/lead-flushing.

Where can I go to ask questions and get more information?

You can call Denver Water at 303-893-2444, visit denverwater.org/Lead or email lead@denverwater.org.



FILTER LEAD OUT OF WATER

FREQUENTLY ASKED QUESTIONS

What is the purpose of the Filter Lead Out of Water (FLOW) pilot?

As part of the ongoing analysis this summer for Denver Water's proposed alternative to orthophosphate, Denver Water is conducting the FLOW pilot with a small number of customers with known lead service lines to better understand preferences and usage around water filters. This will help inform how the full-scale program would be implemented.

How were customers identified to participate in the FLOW pilot?

Customers were identified based on properties, with suspected lead service lines, in neighborhoods reflecting a diverse base of Denver Water customers, namely West Colfax, Villa Park, Barnum West, Barnum, Valverde, Westwood and Athmar Park. Identified properties are also owner-occupied.

Is the water in my home safe to use for drinking and cooking?

Based on Denver Water's ongoing inventory analysis, it is believed participants for the FLOW pilot likely have a customer-owned lead service line. This means that there is potential for lead to leach into your water as it moves through your service line. No levels of lead in drinking water are safe, which is why we are recommending the use of a filter for all of the water you use for drinking and cooking.

Should I use my water filter pitcher for all cooking and food preparation?

It is recommended to use filtered water for food preparation, such as preparing rice, beans, soup and other recipes where water is a base ingredient or absorbed into the dish. Keep in mind that boiling water does not remove lead. Filtered water should also be used to prepare infant formula.

Is my water safe for pets?

Changes in pet behavior as a result of drinking lead contaminated water are not likely to be noticeable. In general, pets are more likely to obtain lead as a result of eating an object containing much higher lead levels (lead paint chips). To be safe, check with your veterinarian and/or give your pet filtered water.

Is my water safe to use for a shower or bath?

Yes, bathing and showering is safe for you and your children, even if the water contains lead over EPA's action level. Human skin does not absorb lead in water at levels that cause a health concern.

Where can I go to ask questions and get more information on the filter pilot?

Call 303-628-6655 or email flow@denverwater.org for more information on the filter pilot. You can also go to denverwater.org/Lead to learn more about Denver Water's Lead Reduction Program.

PROGRAMA DE REDUCCIÓN DE PLOMO

PREGUNTAS FRECUENTES

¿Cómo llega el plomo al agua potable?

El agua que llega a las casas y negocios no contiene plomo, pero el plomo puede meterse en el agua a medida que pasa por las líneas de servicio y tuberías residenciales que contienen plomo (las tuberías que llevan el agua desde la tubería principal de Denver Water localizada en la calle, hasta su hogar o edificio).

Si el agua de Denver Water no contiene plomo, ¿por qué Denver Water se está enfocando en la reducción de plomo?

Cuando se trata de plomo en el agua, ningún nivel es seguro. Es por esto que Denver Water está trabajando con el Departamento de Salud Pública y del Medio Ambiente en Colorado y con la Agencia para la Protección del Medio Ambiente, para reducir los riesgos de exposición al plomo a medida que el agua potable pasa por esos hogares y negocios.

En 2012, los resultados de muestras de control de la calidad del agua sobrepasaron el nivel en el que EPA exige tomar medidas. Este nivel es un indicador de que puede ser necesario tomar medidas adicionales para mejorar el tratamiento para el control de la corrosión. A pesar de que desde 2012 Denver Water no ha sobrepasado el nivel en el que se deben tomar medidas, la entidad está comprometida a implementar el mejor método para reducir de manera permanente el plomo en el agua potable.

Mientras esto pasa, Denver Water ya ha tomado varias medidas para minimizar la presencia de plomo en el agua, como son:

- Hacer un ajuste al pH para reducir el riesgo de que el plomo, cobre u otros metales pasen al agua potable desde las líneas de servicio o la tubería del hogar.
- Reemplazar las líneas de servicio de plomo de manera gratuita para los clientes, cuando dichas tuberías sean descubiertas durante actividades normales de operación y mantenimiento.
- La asociación con las escuelas públicas de Denver, escuelas del condado de Douglas y escuelas públicas de Littleton para el desarrollo y ayuda con sus propios programas de hacer pruebas de plomo, examinando más de 15,000 muestras.
- Ofrecer a los clientes pruebas de plomo gratuitas.

¿Qué soluciones se están considerando?

Denver Water llevó a cabo un estudio sobre varias opciones de tratamiento para reducir la posibilidad de que el plomo llegue al agua potable debido a la existencia de líneas de servicio y tuberías de plomo en el hogar. Basado en los resultados, CDPHE, la agencia estatal reguladora que supervisa las regulaciones de agua potable, le exigió a Denver Water que agregara ortofosfato según los requerimientos reglamentarios. El ortofosfato, un aditivo alimentario, se agregaría a toda el agua potable provista por Denver Water, con el objetivo de brindar un recubrimiento adicional a las tuberías para reducir la corrosión y la cantidad de plomo liberado de las tuberías y griferías que contienen plomo.

A pesar de que el ortofosfato se ha usado por décadas de manera segura y con éxito en todo el país, ha surgido la preocupación del impacto que este aditivo pueda tener en las plantas de tratamiento de aguas residuales, arroyos, ríos y los depósitos a donde llega esa agua.

CDPHE, Denver Water y otros están estudiando estos posibles efectos para determinar maneras de proteger el medio ambiente si esta propuesta sigue adelante.

Denver Water propone una alternativa, con un enfoque holístico, que aborda directamente el asunto principal que son las líneas de servicio de plomo particulares, agilizando el remplazo de estas líneas a través del programa de reducción de plomo. Este enfoque tiene varios componentes:

- Aumentar el nivel de pH, lo cual reduce el factor corrosivo del agua.
- Proveer, sin costo alguno, filtros de agua para los hogares de todos los clientes en el área de servicio de Denver Water en donde se sospecha existen líneas de servicio de plomo.
- Reemplazar con cobre, sin costo alguno para los clientes y durante los siguientes 15 años, las estimadas 50,000 a 90,000 líneas de servicio de plomo, en el área de servicio de Denver Water.

PROGRAMA DE REDUCCIÓN DE PLOMO

PREGUNTAS FRECUENTES

La EPA empezará este verano a recibir comentarios sobre esta opción, y se espera que al final del año se decida si la alternativa propuesta por Denver Water cumple con las exigencias de la Ley de Agua Potable Segura. A continuación, y de ser apropiado, CDPHE decidirá si va a cambiar la designación de marzo de 2018 sobre el ortofosfato. Independientemente de si se selecciona la opción alternativa, la implementación del control óptimo de corrosión empezará en marzo de 2020.

¿Cómo averiguo si tengo líneas de servicio de plomo y qué puedo hacer al respecto?

Con base en la experiencia de Denver Water, los hogares y edificios con más probabilidad de tener líneas de servicio de plomo son aquellos construidos antes de 1951 en la zona metropolitana de Denver (denverwater.org/neighborhood-age). Los hogares construidos antes de 1987 pueden tener soldadura de plomo en sus tuberías. Los hogares que no estén en ninguna de estas dos categorías tienen menos probabilidad de estar en riesgo de contaminación de plomo en el agua.

Todos los clientes de Denver Water reciben de manera gratuita una prueba para revisar la presencia de plomo en el agua, visitando denverwater.org/Lead o llamando al 303-893-2444. A aquellas personas que no son clientes de Denver Water, les recomendamos se pongan en contacto con la compañía local de agua o con un laboratorio certificado local.

Si su hogar tiene una línea de servicio de plomo, la mejor solución a largo plazo es reemplazarla con una línea de servicio de cobre. Recomendamos que use un plomero certificado. El costo de reemplazar una línea de servicio de plomo es aproximadamente entre \$5,000 y \$10,000, lo que puede presentar una dificultad económica. Denver Water se ha asociado con Denver Urban Renewal Authority para ofrecer financiamiento a los propietarios para que reemplacen las líneas de servicio de plomo. Con este programa, DURA emite préstamos sin interés o de bajo interés, de bajo interés, basados en ingresos, para los propietarios elegibles. DURA hace las licitaciones y supervisa a los contratistas asignados. Si le interesa, comuníquese con DURA al 303-534-3872 para obtener más información sobre las condiciones de elegibilidad para este programa de tiempo limitado.

Vale la pena notar que Denver Water está trabajando en el desarrollo de un programa que podría reemplazar las líneas de servicio de plomo de los propietarios sin costo alguno para ellos. La decisión sobre la implementación de este programa puede que no se conozca hasta finales de 2019.

Si sospecha que su casa tiene plomo en las tuberías, hay unas medidas que puede tomar inmediatamente para reducir la exposición a este material:



Use un filtro certificado por la Fundación Nacional de Seguridad para eliminar el plomo del agua para beber y cocinar. Reemplace el cartucho del filtro siguiendo las instrucciones de fabricante.



Use solamente agua fría para tomar, cocinar y preparar biberones. Recuerde que hervir el agua no elimina el plomo del agua y el agua caliente generalmente contiene niveles más altos de plomo que el agua fría.



Si no se ha usado el agua en casa por unas horas, como a primera hora en la mañana o cuando llega a casa del trabajo, abra 5 minutos el grifo del fregadero o el de cualquier baño (¡recuerde recoger esta agua y reusarla!). También puede usar el lavavajillas, tomar una ducha o lavar una carga de ropa para ayudar a descargar el agua en su tubería interna, antes de beber o cocinar.



Limpie con frecuencia el filtro de su grifo (conocido también como el aireador). Vea las instrucciones paso a paso en denverwater.org/lead-flushing.

¿A dónde puedo ir a hacer preguntas y obtener más información?

Puede llamar a Denver Water al 303-893-2444, visitar denverwater.org/Lead o enviar un correo electrónico a lead@denverwater.org.

FILTRE EL PLOMO DEL AGUA

PREGUNTAS FRECUENTES

¿Cuál es el propósito del programa piloto Filtre el plomo del agua (FLOW)?

Como parte del análisis en marcha este verano para la propuesta de la alternativa al uso del ortofosfato, Denver Water está llevando a cabo el piloto del programa FLOW con un número pequeño de clientes de quienes se conoce tienen líneas de servicio para entender mejor las preferencias y uso de los filtros de agua. Esto nos ayudará a reunir más información para saber cómo se debería implementar el programa a gran escala.

¿Cómo se identificaron los clientes para participar en el programa piloto FLOW?

Los clientes se identificaron con base en las propiedades en las que se sospecha que hay líneas de servicio de plomo, en vecindarios con una composición cultural diversa de clientes de Denver Water, específicamente West Colfax, Villa Park, Barnum West, Barnum, Valverde, Westwood y Athmar Park. Las propiedades que se identificaron también estaban habitadas por los propietarios.

¿Es el agua de mi hogar segura para beber y cocinar?

Con base en el análisis en marcha del inventario de Denver Water, se cree que los participantes del programa piloto FLOW probablemente tienen una línea de servicio de plomo particular. Esto significa que existe la posibilidad de que el plomo entre al agua a medida que pase por su línea de servicio. No existe ningún nivel de plomo seguro en el agua potable, por lo cual estamos recomendando el uso de un filtro para toda el agua que usa para beber o cocinar.

¿Debería usar mi jarra para filtrar el agua para todo lo que cocine y prepare de comer?

Se recomienda usar agua filtrada para la preparación de alimentos como para preparar arroz, frijoles, sopas y otras recetas en donde el agua es el ingrediente base o se absorbe en los ingredientes. Tenga en cuenta que hervir el agua no elimina el plomo del agua. El agua filtrada también debe usarse para preparar biberones y lavarlos, así como para el agua de beber de los bebés.

¿Es el agua de mi hogar segura para las mascotas?

Es probable que no se note un cambio en el comportamiento de las mascotas como resultado de beber agua contaminada con plomo. En general, las mascotas tienen más probabilidad de ingerir plomo por haber comido un objeto que contiene niveles mucho más altos de plomo (pedazos de pintura con plomo). Para mayor seguridad, pregunte a su veterinario o de a su mascota agua filtrada.

¿Es el agua de mi hogar segura para ducharse o tomar un baño?"

Sí, bañarse o tomar una ducha es seguro para usted y sus niños, incluso si el agua contiene plomo a un nivel en el que la EPA exige tomar medidas. La piel humana no absorbe plomo en el agua en un nivel que pueda causar un problema de salud.

¿A dónde puedo ir a hacer preguntas y obtener más información sobre el programa piloto de filtros?

Llame al 303-628-6655 o escriba a flow@denverwater.org para obtener más información sobre el programa piloto de filtros. También puede visitar denverwater.org/Lead para obtener más información sobre el programa piloto de filtros.

FILTER LEAD OUT OF WATER

Denver Water delivers safe, lead-free water, but lead can get into water from plumbing and pipes in the home.

REMINDER

Use your filter for:



Drinking Water



Cooking



Infant Formula

Change your filter cartridges every 30 days on:

FILTRE EL PLOMO DEL AGUA

Denver Water provee agua segura y sin plomo, pero el plomo puede pasar al agua por medio de las tuberías de la casa.

RECORDATORIO

Use su filtro para:



Beber Agua



Cocinar



Preparar Biberones

Cambie los cartuchos del filtro cada 30 días el:

denverwater.org/Lead

flow@denverwater.org

303-628-6655



WE MISSED YOU!

Our crews stopped by today and left a water filter pitcher kit at your front door for your household's use.



The water filter pitcher kit is being provided as a precautionary measure. The age of your home indicates that you may have or had a lead service line. If so, there may also be lead particles present in your service line or plumbing. This water pitcher is certified to remove 99.6% of detectable dissolved solids, including lead, if present.

The kit includes:

- ◆ NSF certified 10-cup filter pitcher.
- ◆ A three-month supply of replacement cartridges.
- ◆ Filter Lead Out of Water program info.
- ◆ A reminder magnet.
- ◆ A reusable tote bag.

denverwater.org/Lead
flow@denverwater.org
303-628-6655



¡SENTIMOS NO HABERLE ENCONTRADO!

Hoy pasamos a visitarle y le dejamos un kit en la puerta de su casa de una jarra con filtro para el agua de uso en el hogar.



Le estamos dando este kit de jarra con filtro como una medida de precaución. La fecha de construcción de su casa indica que puede tener o haber tenido tuberías de plomo. De ser así, puede haber partículas de plomo en las tuberías o en la línea de suministro principal. La jarra para el agua está certificada para filtrar el 99.6% de sólidos disueltos detectables, incluso plomo, de estar presente.

El kit incluye:

- ◆ Jarra con filtro para 10 tazas, certificada por la NSF.
- ◆ Cartuchos de repuesto para tres meses.
- ◆ Información sobre un programa para filtrar el plomo del agua.
- ◆ Un imán de recordatorio.
- ◆ Una bolsa reusable.

denverwater.org/Lead
flow@denverwater.org
303-628-6655



FILTER LEAD OUT OF WATER

Thank you for participating in Denver Water's FLOW pilot. Your feedback will help us understand information about how water is used in your home for drinking and cooking activities. Please use the ZeroWater® pitcher provided and return your completed survey by mail or online within two weeks of receiving the filter kit. **As our way of thanking you for your feedback and using your filter, upon receipt of the completed survey, Denver Water will send you a \$15 Amazon gift card. For an online survey, go to denverwater.org/Lead-survey or scan the QR code at the bottom of this survey.**

Please provide your email address so that we can send you the Amazon gift card. _____

Without your email address we will not be able to send you the gift card.

1. Do you know if you have a lead service line?

- Yes No
 I do not know

2. What is your household's primary source of drinking water? (Check one)

- Unfiltered faucet Bottled water
 Filtered – refrigerated water/ice dispenser
 Filtered – pitcher filter
 Filtered – under sink filter
 Filtered – faucet mounted filter
 Filtered – whole house filter
 Other (specify) _____

3. What is your household's primary source of water used for cooking? (Check one)

- Unfiltered faucet Bottled water
 Filtered – refrigerated water/ice dispenser
 Filtered – pitcher filter
 Filtered – under sink filter
 Filtered – faucet mounted filter
 Filtered – whole house filter
 Other (specify) _____

4. If you have an existing water filter system, what is the make and model number for your filter? (Fill in)

5. Do you currently or do you plan in the future to use filtered or bottled water for infant formula?

- Yes No NA

6. What questions or comments do you have about the filter pilot?

7. How could we improve the filter pilot?

8. Want to stay informed about the FLOW pilot? Provide your email or phone number.

Email: _____

Phone: _____





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POSTAGE WILL BE PAID BY ADDRESSEE

DENVER WATER
LEAD REDUCTION PROGRAM
1600 W 12TH AVE
DENVER CO 80204-9963



FILTRE EL PLOMO DEL AGUA

Gracias por participar en el programa piloto FLOW de Denver Water. Sus comentarios nos van a ayudar a entender cómo se usa el agua para beber y cocinar en su hogar. Por favor use la jarra para agua de ZeroWater® que le hemos dejado y envíe por correo o en línea su encuesta completa, en las primeras dos semanas después de haber recibido el kit. **Una vez recibamos su encuesta completa, como agradecimiento por sus comentarios y por usar el filtro, Denver Water le enviará una tarjeta de regalo de Amazon por un valor de \$15. Para completar la encuesta en línea, visite denverwater.org/Lead-survey o escanee el código QR al final de la encuesta.**

Incluya su correo electrónico de modo que podamos enviarle la tarjeta de regalo de Amazon. _____

Sin su correo electrónico no podremos enviarle la tarjeta de regalo.

1. ¿Sabe si tiene una líneas de servicio principal de agua hecha de plomo?

- Sí No sé No

2. ¿Cuál es la principal fuente de agua potable en su hogar? (Marque una)

- Agua sin filtrar del grifo Embotellada
 Filtrada – Del refrigerador o dispensador de hielo.
 Filtrada – Jarra con filtro
 Filtrada – Filtro debajo del fregadero
 Filtrada – Filtro instalado en el grifo
 Filtrada – Filtro para toda la casa
 Otra (Especifique) _____

3. ¿Cuál es la fuente principal de agua para cocinar en su hogar?

- Agua sin filtrar del grifo Embotellada
 Filtrada – Del refrigerador o dispensador de hielo.
 Filtrada – Jarra con filtro
 Filtrada – Filtro debajo del fregadero
 Filtrada – Filtro instalado en el grifo
 Filtrada – Filtro para toda la casa
 Otra (Especifique) _____

4. Si tiene un sistema de filtro para el agua, ¿cuál es la marca y el número del modelo del filtro? (Escríbalos)

5. ¿Usa o piensa usar agua filtrada o embotellada para preparar biberones?

- Sí No No aplica

6. ¿Qué preguntas o comentarios tiene sobre el programa piloto de filtros?

7. ¿Cómo podemos mejorar el programa piloto de filtros?

8. ¿Quiere mantenerse informado(a) sobre el programa piloto FLOW? Incluya su correo electrónico o número telefónico.

Correo electrónico: _____

Teléfono: _____





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DENVER WATER
PROGRAMA DE REDUCCIÓN DE PLOMO
1600 W 12TH AVE
DENVER CO 80204-9963



FILTER LEAD OUT OF WATER

Thank you for participating in Denver Water's FLOW Pilot. Your feedback will help us understand information about how water is used in your home for drinking and cooking activities and your preference for filters. Please use the filter pitcher provided and return your completed survey by mail or online by July 31, 2019. **As our way of thanking you for your feedback and using your filter, upon receipt of the completed survey, Denver Water will send you a \$15 Amazon gift card. For an online survey go to denverwater.org/FLOW-survey or scan the QR code at the bottom of this survey.**

Please provide your email address or mailing address to receive your Amazon gift card. Email: _____

Mailing Address: _____

1. Do you use your filter for drinking water?

- Yes No

2. Do you use your filter for water used for cooking?

- Yes No

3. Do you currently or do you plan in the future to use filtered or bottled water for infant formula?

- Yes No NA

4. If you do not primarily use the water filter provided, what issues are you experiencing? (Check all that apply)

- Filter pitcher isn't large enough
 Filter pitcher doesn't fit in refrigerator
 The filter pitcher takes too much time to fill
 It's too much effort to use the filter pitcher
 I'm not interested in filtering my drinking water
 Other (specify) _____
 Not applicable (no issues)

5. If the water filter provided does not meet your needs, would you be more likely to use an alternative filter? (Check one)

- Faucet-mounted filter Refrigerator filter
 Larger pitcher filter Not applicable (the water filter meets my needs)

6. Are you familiar with filter maintenance and cartridge replacement requirements? E.g., replacing the filter cartridge, cleaning the pitcher (if applicable)?

- Yes No

7. What questions or comments do you have about the filter pilot?

8. How could we improve the filter pilot?

9. Want to stay informed about the FLOW pilot? Provide your email or phone number.

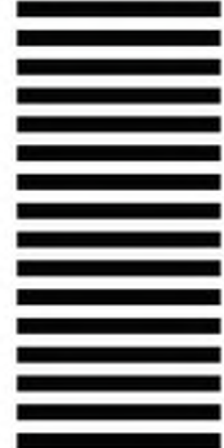
Email: _____

Phone: _____





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DENVER WATER
LEAD REDUCTION PROGRAM
1600 W 12TH AVE
DENVER CO 80204-9963



FILTRE EL PLOMO DEL AGUA

Gracias por participar en el programa piloto FLOW de Denver Water. Sus comentarios nos ayudarán a entender cómo usted usa el agua para beber y cocinar en su hogar, así como su preferencia en filtros. Por favor use la jarra para agua de que le hemos dejado y complete su encuesta por correo o por internet a más tardar el 31 de julio de 2019. **Una vez que recibamos su encuesta completa, como agradecimiento por sus comentarios y por usar el filtro, Denver Water le enviará una tarjeta de regalo de Amazon con un valor de \$15. Para completar la encuesta en línea, visite denverwater.org/FLOW-survey o escaneé el código QR al final de la encuesta.**

Por favor escriba su correo electrónico o dirección de residencia para recibir una tarjeta de regalo de Amazon.

Correo electrónico: _____ Dirección de residencia: _____

1. ¿Usted filtra el agua que toma?

Sí No

2. ¿Usted filtra el agua que usa para cocinar?

Sí No

3. ¿Usa agua filtrada o embotellada para preparar biberones de sus niños (o piensa usarla en el futuro)?

Sí No No aplica

4. Si usted generalmente no usa agua filtrada, ¿qué problemas está experimentando? (Seleccione todos los que apliquen)

- La jarra con filtro no es lo suficientemente grande.
- La jarra con filtro no cabe en el refrigerador.
- La jarra con filtro se demora mucho en llenarse.
- Es mucho trabajo usar la jarra con filtro.
- No me interesa filtrar el agua que voy a tomar.
- Otra razón. Por favor especifique: _____
- No aplica (no tengo problemas)

5. ¿Si la jarra con filtro que le dimos no satisface sus necesidades, ¿sería más probable que usara otro tipo de filtro como alternativa? (Marque una)

- Filtro instalado en el grifo Filtro en el refrigerador
- Una jarra con filtro más grande
- No aplica (el filtro de agua cubre mis necesidades)

6. ¿Conoce los pasos necesarios para hacerle mantenimiento al filtro y para reemplazar el cartucho del filtro? Por ejemplo, ¿sabe cómo reemplazar el cartucho del filtro o limpiar la jarra (si aplica)?

Sí No

7. ¿Qué preguntas o comentarios tiene sobre el programa piloto de filtros?

8. ¿Cómo podemos mejorar el programa piloto de filtros?

9. ¿Quiere seguir recibiendo información sobre el programa piloto FLOW? Escriba su correo electrónico o número de teléfono.

Correo electrónico: _____

Teléfono: _____





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The logo and text are displayed on a solid green rectangular background. The logo is a stylized white 'D' with a smaller 'D' inside, and the words 'DENVER' and 'WATER' are in a bold, white, sans-serif font stacked below it.

Lime Green Shirt
Bright White Ink

2.5" Wide per email

v2



Imprint dimensions: 5" w x 5.04" H

Ink Color = White



For more information about our Lead Reduction Program, please visit denverwater.org/Lead.

Para obtener más información sobre nuestro programa de reducción de plomo, visite la página web denverwater.org/Lead.

lead@denverwater.org

303-893-2444



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APPENDIX H - FILTER DATA SUMMARY

FILTER LEAD OUT OF WATER INITIAL SURVEY

Online or Paper Survey	Date	Language	* Do you know if you have a lead service line?	* What is your household's primary source of drinking water?	If other, please specify	* What is your household's primary source of water used for cooking?	If other, please specify	If you have an existing water filter system, what is the make and model number for your filter?	* Do you currently or do you plan in the future to use filtered or bottled water for infant formula?	What questions or comments do you have about the filter pilot?	How could we improve the pilot?
Online	7/11/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		no I do not	Not applicable	I really like the option of either being able to pour it in my glass or I can use the spigot.	
Online	7/11/2019	English	I do not know	Filtered- refrigerated water/ice dispenser		Unfiltered faucet		I don't know how to find this information	Not applicable		
Online	7/14/2019	English	Yes	Unfiltered faucet		Unfiltered faucet			Yes	I would like to know the steps being taking to fix the lead problem in our tap water so we do not need to use a filter.	It would be nice for low income Families to be able to get free filters considering these do not last very long and also giving free mineral drops since this filter takes all the necessary minerals out of our water for our health.
Online	7/17/2019	Español	I do not know	Unfiltered faucet		Unfiltered faucet			Yes		
Online	7/17/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Not applicable	Will replacement filters be provided, or offered on a subscription basis?	
Online	7/18/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		Refrigerator - Whirlpool WRS571CIDM01	Not applicable	Should I be concerned?	I think this is very impressive!
Online	7/22/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Yes	I appreciate the filter and will use it	Info on how to test home water for lead
Online	7/23/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	Not applicable		
Online	7/23/2019	English	I do not know	Filtered- pitcher filter		Unfiltered faucet			Not applicable	How expensive are the replacement filters? Where do I get the replacement filters? What exactly does the zero water filter out? Is a 148 test really bad?	More information about all of it would be nice.
Online	7/24/2019	Español	I do not know	Unfiltered faucet		Unfiltered faucet			Yes	This is a good program and thank you for caring for the citizens.	An announcement on the tv or radio would be helpful to let the citizens know about issues of lead in water.
Online	7/24/2019	Español	I do not know	Bottled water		Filtered - whole house filter			Not applicable	Very good program, will help the economy of this family, since weekly bottled water is bought.	
Online	7/25/2019	English	I do not know	Bottled water		Unfiltered faucet			Yes		
Online	7/25/2019	English	I do not know	Filtered- refrigerated water/ice dispenser		Unfiltered faucet			Not applicable		
Online	7/25/2019	English	Yes	Filtered- refrigerated water/ice dispenser		Filtered- refrigerated water/ice dispenser		GE refrigerator	Not applicable		
Online	7/25/2019	English	I do not know	Bottled water		Filtered- refrigerated water/ice dispenser		Samsung	Not applicable	no	
Online	7/29/2019	English	No	Unfiltered faucet		Unfiltered faucet		None	No		
Online	8/4/2019	Español	Yes	Filtered- pitcher filter		Filtered- pitcher filter		n/a	Not applicable	me gusta	no se
Paper	7/12/2019	English	I do not know	Bottled water		Unfiltered faucet			Yes		
Paper	7/12/2019	English	I do not know	Bottled water		Unfiltered faucet		N/A We have none	Not applicable	How long is this pilot for? And will we be notified if the proposed alternative to orthophosphate is used?	
Paper	7/13/2019	English	I do not know	Filtered - refrigerated water/ice dispenser		Unfiltered faucet		N/A	Not applicable	N/A	N/A
Paper	7/17/2019	English	Yes	Unfiltered faucet		Unfiltered faucet		None	Yes	Good idea	Maybe a filter for sink in kitchen
Paper	7/25/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Not applicable	How could I figure out if I have lead service line?	
Paper	7/25/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	Yes	How long will you provide filters?	
Paper	7/25/2019	English	I do not know	Filtered - pitcher filter		Filtered - pitcher filter			Not applicable	Does my home have lead pipes?	
Paper	7/19/2019	English	I do not know	Filtered - refrigerated water/ice dispenser		Unfiltered faucet		Amana fridge	Not applicable	The water tastes great!	The lid is hard to remove and replace
Paper	7/17/2019	English	Yes	Filtered - under sink filter		Filtered - under sink filter		Culligan RC E2-4	Not applicable	I'm glad this is happening, but let's replace the service lines!	This is a good first step, but you should be specifically notifying everyone who has lead.
Paper	7/15/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Not applicable		Provide refill filters
Paper	7/15/2019	English	I do not know	Filtered - pitcher filter		Unfiltered faucet		Brita filter	No	If there is lead in my water, when will my pipes be replaced?	
Paper	7/15/2019	English	I do not know	Filtered - under sink filter		Filtered - under sink filter		General Electric water filtration system GXSL55F	Not applicable	None	Need to know how to get my water tested for lead. What about blood tests for residents of home?
Paper	7/15/2019	English	Yes	Filtered - pitcher filter		Unfiltered faucet		Pur	No	Where to get more when they run out?	Excellent already
Paper	7/15/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	No	Do I need to send the filters back in?	
Paper	7/15/2019	Spanish	I do not know	Filtered - refrigerated water/ice dispenser		Unfiltered faucet			Yes	Cada cuando hay que cambiar el filtro de la jarra? (When do you have to change the filter?)	Avernos quisado si quisieramos a ver aseptado participado en el programa? (Do you want to see if we participate in the program?)
Paper	7/16/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	Not applicable	Good idea to see if I do have lead in my drinking/cooking water	Not sure at this time - just received in mail. Began using it on 7/15/2019

FILTER LEAD OUT OF WATER INITIAL SURVEY

Online or Paper Survey	Date	Language	* Do you know if you have a lead service line?	* What is your household's primary source of drinking water?	If other, please specify	* What is your household's primary source of water used for cooking?	If other, please specify	If you have an existing water filter system, what is the make and model number for your filter?	* Do you currently or do you plan in the future to use filtered or bottled water for infant formula?	What questions or comments do you have about the filter pilot?	How could we improve the pilot?
Paper	7/23/2019	English	I do not know	Filtered - pitcher filter		Unfiltered faucet		Brita/Generic Target filter	Not applicable	Thank you! Water definitely tastes better.	
Paper	7/23/2019	English	Yes	Filtered - pitcher filter		Unfiltered faucet			Not applicable		
Paper	7/26/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Not applicable	Water tastes better/just started using. Plan on using for cooking also.	Smaller filter
Paper	7/22/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	No	Do we continue to receive filters after the first 3 months?	
Paper	7/22/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	No	How bad is the water I have been drinking for the past 3 years?	Provide more filters
Paper	7/22/2019	English	I do not know	Bottled water		Unfiltered faucet			Not applicable	None	
Paper	7/23/2019	English	I do not know	Bottled water		Unfiltered faucet		Fridge filter	Not applicable		
Paper	7/23/2019	English	I do not know	Bottled water		Unfiltered faucet		None	Yes		
Paper	7/23/2019	English	No	Bottled water		Bottled water			No		
Paper	7/23/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	Not applicable	Is my water safe to drink?	
Paper	7/24/2019	English	I do not know	Filtered - pitcher filter		Unfiltered faucet		Brita pitcher	Not applicable		
Paper	7/23/2019	English	Yes	Unfiltered faucet		Unfiltered faucet			No	How long can we expect help from Denver Water?	Home faucet filtration system
Paper	7/23/2019	English	I do not know	Bottled water		Unfiltered faucet			Not applicable		
Paper	7/23/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Not applicable		
Paper	7/27/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Yes	None	Not sure if it could get any better
Paper	7/26/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	Not applicable	None - product is great. I need to buy a bigger one.	Not sure. Mine was reading 188 before filter. After filter, it reads 000.
Paper	7/26/2019	English	Yes	Unfiltered faucet		Unfiltered faucet		N/A	Not applicable	None	
Paper	7/26/2019	English	I do not know	Bottled water		Filtered - faucet mounted filter		Don't have one	Not applicable		At this time I don't have one, only a water heater, thank you.
Paper	7/26/2019	English	I do not know	Filtered - faucet mounted filter		Filtered - faucet mounted filter		Pur Maxion	Not applicable	None. It's a good idea.	
Paper	7/26/2019	English	Yes	Bottled water		Unfiltered faucet			No	Don't know yet.	?
Paper	7/29/2019	English	Yes	Other	5 gallon jugs refilled at grocery store	Other	5 gallon jugs refilled at grocery store		Not applicable	How long will filters be provided?	We're excited about it! Would love to learn if/when service line replacement is part of pilot program.
Paper	7/29/2019	English	Yes	Bottled water		Unfiltered faucet		Clear2H2O	No		
Paper	7/29/2019	English	No	Bottled water		Unfiltered faucet		No	Yes	How often do we need to change cartridges/filters?	It is a small container/jar. Can I buy or get bigger size?
Paper	7/29/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		NA			
Paper	7/30/2019	English	I do not know	Filtered - faucet mounted filter		Filtered - faucet mounted filter		RF-9999	Yes	Only contact via email...DO NOT KNOCK ON MY DOOR!	
Paper	7/30/2019	English	Yes	Bottled water		Unfiltered faucet		None	No		
Paper	7/31/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		NA	Not applicable	Why is there standing water in the upper (feed) reservoir?	A faster flow from the push button would be nice.
Paper	8/1/2019	English	I do not know	Filtered - refrigerated water/ice dispenser		Filtered - whole house filter			Not applicable		
Paper	8/1/2019	English	I do not know	Filtered - pitcher filter		Unfiltered faucet		Brita pitcher	Not applicable	Are lead pipes required to be replaced?	
Paper	7/22/2019	English	I do not know	Bottled water		Unfiltered faucet		NA	Yes	In the event water is tested and lead is found, but the resident is unable to replace due to finances, what will Denver Water's action be?	
Paper	8/3/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			No		
Paper	8/3/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Yes	Will it continue on past what filters were provided?	Nothing. I'm very thankful!
Paper	8/6/2019	English	I do not know	Filtered - pitcher filter		Unfiltered faucet		Brita - less than 1 yr old	Not applicable	Why? Am I living in Flint, MI?! Feels sketch!	Educate us on why we need this. *sorry - read enclosed info after
Paper	8/6/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet		N/A	Not applicable	How much will it cost?	More than 3 months - 6 months at least
Paper	8/6/2019	English	No	Unfiltered faucet		Unfiltered faucet		N/A	Not applicable	Just starting out, but water tastes much better and looks cleaner	Right now, I don't know
Paper	8/12/2019	English	I do not know	Unfiltered faucet		Unfiltered faucet			Not applicable		

FILTER LEAD OUT OF WATER USE SURVEY

Online or Paper Survey	Date	Language	*Do you use your filter for drinking water?	*Do you use your filter for water used for cooking?	Do you currently or do you plan in the future to use filtered or bottled water for infant formula?	If you do not primarily use the water filter provided, what issues are you experiencing?	If other, please specify	If the water filter provided does not meet your needs, would you be more likely to use an alternative filter?	Are you familiar with filter maintenance and cartridge replacement requirements? e.g., replacing the filter cartridge, cleaning the pitcher?	What questions or comments do you have about the filter pilot?	How could we improve the filter pilot?
Online	7/24/2019	English	Yes	Yes	Not applicable	Not applicable (no issues)			Yes	Great idea!	Would be nice if more people could be in the program. Would be nice if the water department had a system to replace the piping.
Online	7/24/2019	English	Yes	Yes	Not applicable			Not applicable (the water filter meets my needs)	No		
Online	7/24/2019	English	Yes	Yes	Not applicable	Filter pitcher isn't large enough		Faucet-mounted filter	No		
Online	7/24/2019	English	Yes	No	Yes	Not applicable (no issues)		Not applicable (the water filter meets my needs)	No		
Online	7/25/2019	English	Yes	Yes	Yes	The filter pitcher takes too much time to fill		Faucet-mounted filter	Yes		A faucet filter would be great to have!
Online	7/25/2019	English	Yes	No	Not applicable	Other	Doesn't pour smoothly, too bulky, and takes a while to fill up. It's great! But the tester is reading 000 also for my tap water so not sure if that tester is working right.	Not applicable (the water filter meets my needs)	Yes		
Online	7/26/2019	English	Yes	No	Yes	The filter pitcher takes too much time to fill		Faucet-mounted filter	Yes	Please fix water line. What can we do to make program go thru?	Water delivery service
Online	7/26/2019	English	Yes	No	Not applicable	Not applicable (no issues)		Faucet-mounted filter	Yes	No	Everything has been great!
Online	7/26/2019	English	Yes	Yes	Not applicable	Filter pitcher isn't large enough		Faucet-mounted filter	No	Looking at installing his own filter	
Online	7/26/2019	English	Yes	Yes	Not applicable	Filter pitcher isn't large enough		Faucet-mounted filter	Yes		
Online	7/26/2019	English	Yes	No	No	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	My water tastes better. Having a hard time working the reader, it isn't showing all 0's	
Online	7/27/2019	English	Yes	No	Not applicable	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	Thanks for the pitcher, it's bigger than the one we had purchased ourselves	
Online	7/27/2019	English	Yes	No	Yes	The filter pitcher takes too much time to fill		Faucet-mounted filter	Yes	Having this filter pitcher you provided has made me more conscious of my water at home	A faucet mounted one would be more useful for cooking purposes. But I like the pitcher for cold fridge water
Online	7/27/2019	English	Yes	No	Not applicable	Other	Too much effort to refill and use for cooking water	Faucet-mounted filter	Yes	A smaller pitcher for fridge would be helpful faucet filter might be preferable if it works with our current faucet	
Online	7/28/2019	English	Yes	Yes	No			Larger pitcher filter		Thank you for the filter I like it it really work and it help me out a lot	
Online	7/30/2019	English	Yes	Yes	Not applicable	Not applicable (no issues)		Faucet-mounted filter	No		Keep people informed on when our service line will be replaced. How can low-income households qualify to get these replaced sooner?
Online	7/30/2019	English	Yes	Yes	Not applicable	The filter pitcher takes too much time to fill		Faucet-mounted filter	Yes		It is unsettling to get this water filter and not to know what the quality of the water is. I work for a similar program with Aurora. I wish the initial materials had told us that our water is good but that our pipes may not be. Was left wondering how much at risk I am.
Online	7/30/2019	English	No	No	Not applicable	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes		
Online	7/31/2019	Español	No	No	Not applicable	Other	Didn't know what it was for, do buy bottled water for drinking	Refrigerator filter	No	Not sure, need to give it a try // Where do we get the filters?	For it to have a sign on it making it clear it was not sent in error - thought it was a mistake and meant for the neighbors or something
Online	7/31/2019	English	Yes	Yes	No	Not applicable (no issues)		Faucet-mounted filter	Yes		Water taste
Online	7/31/2019	English	Yes	Yes	Yes	Filter pitcher doesn't fit in refrigerator		Faucet-mounted filter	Yes		
Online	8/1/2019	English	Yes	Yes	Not applicable	The filter pitcher takes too much time to fill		Faucet-mounted filter	Yes		Sometimes the top lid falls off of the filter
Online	8/7/2019	English	Yes	Yes	No	Not applicable (no issues)		Faucet-mounted filter	Yes		
Online	8/7/2019	English	Yes	No	Not applicable	The filter pitcher takes too much time to fill		Faucet-mounted filter	Yes	Is the filter taking out any helpful minerals from our water?	
Online	8/12/2019	English	Yes	No	Yes	Other	Having a hard time pouring it out	Faucet-mounted filter	Yes	Pretty good size pitcher, and its helping us buy less bottled water	
Paper	7/23/2019	English	Yes	Yes	Yes	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	Thankful, awesome program. Do it to other houses.	N/A
Paper	7/27/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	N/A	N/A
Paper	7/27/2019	English	Yes	No	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	No	N/A
Paper	7/27/2019	English	Yes	Yes	NA	Not applicable (no issues)		Faucet-mounted filter	Yes		
Paper	7/27/2019	English	Yes	Yes	Yes	Not applicable (no issues)		Larger pitcher filter	Yes		
Paper	7/27/2019	English	Yes	No	Yes	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes		
Paper	7/27/2019	English	Yes	Yes	Yes	Filter Pitcher isn't large enough. The filter pitcher takes too much time to fill		Larger pitcher filter	No		Bigger pitcher/faster fill up
Paper	7/27/2019	English	Yes	Yes	NA	Filter Pitcher isn't large enough		Faucet-mounted filter	Yes	Nothing, thank you	Provide faucet filters for everyday use
Paper	7/27/2019	English	Yes	No	No	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	Water tastes better	N/A
Paper	7/27/2019	English	Yes	Yes	Yes	The filter pitcher takes too much time to fill		Faucet-mounted filter	Yes	Want more info on lead	N/A
Paper	7/28/2019	English	Yes	No	No	The filter pitcher isn't large enough. The filter pitcher takes too much time to fill.		Faucet-mounted filter	Yes	Difficult for cooking	Faucet-mounted
Paper	7/28/2019	English	Yes	No	Yes	Filter pitcher doesn't fit in refrigerator			Yes	Use bottled water	Don't know
Paper	7/28/2019	English	No	No	Yes	Other	Taste is flat	Faucet-mounted filter	Yes	I'd like to know how much lead is in my pipes	
Paper	7/28/2019	English	Yes	Yes	No	Not applicable (no issues)		Refrigerator filter	Yes		
Paper	7/28/2019	English	Yes	No	Yes	Filter pitcher isn't large enough. Other	A lot of grandkids	Larger pitcher filter	Yes	Connect to faucet. Love the taste	
Paper	7/25/2019	English	Yes	Yes	NA	The filter pitcher takes too much time to fill		Faucet-mounted filter. Larger pitcher filter	Yes	The filters are expensive	
Paper	7/25/2019	Spanish	No	No	Yes	Filter pitcher doesn't fit in refrigerator. It's too much effort to use the filter pitcher. Other	I am 68 years old and with arthritis in my hands. It is very difficult to pour the water from the pitcher, but I really like filtered water.	Faucet-mounted filter	Yes	I think it is very good	I might like other types of filters, such as an under-sink filter
Paper	7/28/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	None	N/A
Paper	7/29/2019	English	Yes	No	NA	Filter Pitcher isn't large enough. The filter pitcher takes too much time to fill		Faucet-mounted. Not applicable (the water filter meets my needs)	Yes	I use it. Nice gift	
Paper	7/29/2019	English	Yes	No	NA	Not applicable (no issues)		Faucet-mounted filter. Larger pitcher filter	No	Thank you!	Send more than one pitcher
Paper	7/30/2019	English	Yes	No	NA	Not applicable (no issues)		Faucet-mounted filter	Yes	Faucet-mounted filter would be great!	
Paper	7/30/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	No. Thanks.	N/A
Paper	7/30/2019	English	Yes	Yes	Yes	Not applicable (no issues)		Faucet-mounted filter	Yes		
Paper	7/30/2019	English	No	No	NA	Not applicable (no issues)		Faucet-mounted filter	Yes		
Paper	7/27/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes		
Paper	7/27/2019	English	No	Yes	No	Filter pitcher isn't large enough. Not applicable (no issues)		Faucet-mounted filter	No	N/A	N/A
Paper	7/31/2019	English	Yes	Yes	NA	Not applicable (no issues)		Faucet-mounted filter	Yes	None so far	I'm unsure
Paper	7/26/2019	English	Yes	Yes	Yes	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	None	None
Paper	7/26/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	None	None
Paper	7/26/2019	English	Yes	No	NA	Filter pitcher isn't large enough		Faucet-mounted filter	Yes	More info on how to change the lead pipes would help	I do think more people in the house would use a faucet filter
Paper	7/26/2019	Spanish	Yes	Yes	Yes	Not applicable (no issues)		Refrigerator filter	Yes	No questions or comments	By keeping clean
Paper	7/26/2019	Spanish	Yes	Yes	NA						
Paper	7/25/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	Will Denver Water continue to provide filters?	Provide the filters
Paper	7/27/2019	Spanish	Yes	Yes	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	It's good	With a faucet-mount filter
Paper	7/29/2019	English	Yes	Yes	No	Not applicable (no issues)		Larger pitcher filter	Yes	I think it works great! I have used others, and this is great!	
Paper	7/29/2019	English	Yes	Yes	NA	Filter pitcher isn't large enough		Larger pitcher filter. Refrigerator filter	Yes	Happy to learn about it/enroll, as we've been filtering on our own for years.	Offer options for financial assistance to replace service line.

FILTER LEAD OUT OF WATER USE SURVEY

Online or Paper Survey	Date	Language	*Do you use your filter for drinking water?	*Do you use your filter for water used for cooking?	Do you currently or do you plan in the future to use filtered or bottled water for infant formula?	If you do not primarily use the water filter provided, what issues are you experiencing?	If other, please specify	If the water filter provided does not meet your needs, would you be more likely to use an alternative filter?	Are you familiar with filter maintenance and cartridge replacement requirements? e.g., replacing the filter cartridge, cleaning the pitcher?	What questions or comments do you have about the filter pilot?	How could we improve the filter pilot?
Paper	7/29/2019	English	Yes	Yes	No	Filter pitcher isn't large enough		Larger pitcher filter. Faucet-mounted filter	Yes		
Paper	7/29/2019	Spanish	Yes	Yes	NA	Filter pitcher isn't large enough		Not applicable (the water filter meets my needs)	Yes	I can store containers with filtered water in my refrigerator	Mandar stickers y pegarlos con nombramientos de agua segura.
Paper	7/29/2019	English	Yes	Yes	NA	Filter pitcher doesn't fit in refrigerator. The filter pitcher takes too much time to fill		Faucet-mounted filter	Yes	The ZeroWater filter is good quality, but doesn't make enough water at a time.	An easier to use/more efficient filter or just helping us fix our pipes.
Paper	7/29/2019	English	Yes	Yes	NA	Filter Pitcher isn't large enough. The filter pitcher takes too much time to fill. It's too much effort to use the filter pitcher		Refrigerator filter	Yes	My water doesn't get to the "below 6" reading with the filter	Unsure of process. Will we get more filters?
Paper	7/29/2019	Spanish	No	No	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	No	It's good for the health	Let the program continue.
Paper	7/29/2019	English	Yes	No	NA	The filter pitcher takes too much time to fill. It's too much effort to use the filter pitcher.		Refrigerator filter	Yes	None	It fine
Paper	7/31/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	No	I am very happy with this item
Paper	8/1/2019	Spanish	Yes	Yes	NA	Filter pitcher isn't large enough. Filter pitcher doesn't fit in refrigerator		Larger pitcher filter	No	How often do I change the filter?	
Paper	7/30/2019	Spanish	Yes	Yes	No	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes		
Paper	7/30/2019	Spanish	Yes	No	Yes	Filter pitcher isn't large enough. Filter pitcher doesn't fit in refrigerator. The filter pitcher takes too much time to fill		Faucet-mounted filter. Refrigerator filter. Larger pitcher filter	Yes	We have always felt Denver had good water - why now we need filter?	Shape is odd and have to refill too often, lid hard to grab.
Paper	8/2/2019	English	Yes	Yes	NA	Filter pitcher isn't large enough. Other	Freezes	Faucet-mounted filter	Yes		
Paper	8/2/2019	English	Yes	No	NA	Not applicable (no issues)		Faucet-mounted filter	yes	N/A	N/A
Paper	8/6/2019	English	Yes	No	NA	Not applicable (no issues)		Not applicable (the water filter meets my needs)	Yes	N/A	N/A
Paper	8/8/2019	English	Yes	No	NA				Yes	None - just trying out	N/A
Paper	8/12/2019	English	Yes	Yes	NA	Filter pitcher isn't large enough. The filter pitcher takes too much time to fill. Other.	Spigot dispensing H2O is very slow	Larger pitcher filter	No	Do I have to buy filters? Do I foot the bill for replacement filters? How do I get them? How often should I test filtered H2O?	Include info about filters. I don't like the solid waste component of the filters. Recyclable?
Paper	8/12/2019	English	Yes	Yes	NA	Not applicable (no issues). Other.	Would be easier to use tap	Faucet-mounted filter	Yes		It's good. Thank you.
Paper	8/12/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (no issues)	Yes		
Paper	8/12/2019	English	Yes	Yes	NA	Not applicable (no issues)		Not applicable (no issues)	Yes	I like it better than a Brita brand I had used prior.	Curious what happens in three months? Filters available?

APPENDIX III.C.3 - FILTER PROGRAM PLAN

September 2019



TECHNICAL MEMORANDUM

To Denver Water
From Mott MacDonald
Date August 13, 2019
Project No. 507100139
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Subject Denver Water Lead Reduction Program (LRP)
Appendix III.C.3 Filter Program Plan

I. PURPOSE

The purpose of this Technical Memorandum (TM) is to summarize the framework for Denver Water's full-scale Filter Lead Out of Water (FLOW) Program, which targets properties with known, suspected, and possible lead service lines. The FLOW Program includes the distribution of filters to the target Denver Water households, on-going outreach / education to engage Denver Water households to filter their water for infant formula, drinking, and cooking and filter / filter cartridge replacement management. The basis for this TM is threefold:

1. Summarize the series for full-scale FLOW Program implementation.
2. Describe the methodology used to obtain confirmation of filter adoption by targeted Denver Water households for infant formula, drinking, and cooking:
 - **Adoption** = Additional reduction of lead through the use of a certified filter or use of an alternative source of lead-free water (i.e. bottled water).
 - **Non-Adoption** = Customer uses tap water.
3. Document how Denver Water will strive for 100% Filter Adoption over 15-years through use of the communications, outreach and education (COE) plan.

Denver Water's service line inventory dated August 8, 2019 includes:

- 319,700 service lines used for drinking water in the Denver Water service area.
- 84,546 service lines identified as known, suspected and possible lead service lines – these premises are candidates for FLOW.

Multi-family properties are included in the 84,546 service lines that are part of the filter program. A multi-family property has multiple household units. A household unit is an individual residence that receives a filter. Using available data, it is estimated that Filter Program participants consist of 119,250 Denver Water household units, with each household unit receiving a filter.

Presented herein is the background, filter distribution methods, customer notifications, filter kit materials, follow-up/survey information, filter use adoption validation basis, schedule, and reporting metrics.

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II. BACKGROUND

General

Denver Water serves high-quality drinking water to approximately 1.4 million people and continuously monitors water quality. Drinking water entering the distribution system prior to the connection to the customer's service line is free of lead. However, lead may leach into the drinking water as it stagnates in the customer-owned lead service line and/or premise plumbing.

Denver Water is committed to taking steps to optimize its water system for control of lead by implementing a Lead Reduction Program (LRP). One element of Denver Water's LRP is the FLOW Program, which includes the distribution of filters certified to remove lead by NSF to approximately 119,250 Denver Water household units (84,546 service lines) with known, suspected, and possible lead service lines. Filters are used as the interim treatment barrier to remove lead from Denver Water households' drinking water until the lead service line is replaced. The filter provides a reliable barrier for dissolved and particulate lead. A Denver Water household will be removed from FLOW Program either six months after replacement of the lead service line or if a non-lead service line is confirmed at the property.

Denver Water is considering providing filters over 15 years as Denver Water progresses through the inventory of lead service line properties and replaces lead service lines. Denver Water will strive for 100% filter adoption to reduce lead exposure for all customers with a known, suspected, or possible lead service. Denver Water households not using a filter certified to remove lead by NSF will receive the benefit of a 40% to 65% reduction in lead levels from improved pH/alkalinity adjustment only. In addition to the pH/alkalinity adjustment, Denver Water households using a filter certified to remove lead by NSF will experience a >97% reduction in lead levels.

Upon LRP approval, it is expected that implementation of FLOW Program will commence immediately, following the multi-media public information campaign and customer notification model in accordance with the COE Plan. The success of the COE and FLOW Program is paramount to provide Denver Water with information and also to share information with Denver Water households that does as much as possible to encourage filter use and education. If the variance is not granted, filters will be distributed per Denver Water's current practices.

FLOW Program Participants

As presented earlier, FLOW participants consist of 119,250 Denver Water household units. The LSI map will be divided into 12 areas (approximately 10,000 filters per area) for use with distribution of the filters and communications within geographic areas.

The FLOW Program includes the distribution of filters to approximately 119,250 Denver Water household units by March 20, 2020 and the collection of follow-up surveys regarding adoption from a minimum of 1,059 randomly selected Denver Water households on an annual basis.

Filter Type

As part of Denver Water's current practice, a water pitcher filter is distributed to a Denver Water household:

- after the replacement of their lead service line, with five (5) months of replacement cartridges; or
- after potholing reveals a lead service line, with five (5) months of replacement cartridges.

Currently, Denver Water distributes a ZeroWater pitcher filter with the following features:

1. 10-cup capacity
2. NSF certified to remove lead
3. 5-stage filter with ion exchange that removes 99.6% of detectable dissolved solids, including lead and fluoride
4. filter cartridges replaced based upon average use (approximately 30-days for a Denver Water household household)

In addition to pitcher filters, other filters certified to remove lead by NSF include: filters attached to the kitchen faucet and refrigerators filters. Denver Water will purchase filters from multiple vendors that are NSF certified to remove lead and do not remove fluoride. A summary of available pitcher filters and available alternative filter types and replacement cartridges is included in Appendix A.

ZeroWater pitchers remove fluoride through ion exchange. Other filter types do not remove fluoride. Denver Water will distribute pitcher filters for FLOW that will remove nearly all the lead, but leave other important minerals, like fluoride.

Filter Kit

Each participant of the FLOW Program will receive a kit with the pitcher filter, a 6 month supply of filter cartridges, and education/outreach material. Details on the filter kit (education / outreach documents, pitcher filter and cartridge manufacturer instructions, packaging, and other contents) are included in Appendix B.

Filter Distribution

Denver Water households will be automatically enrolled and provided with a filter and replacement cartridges, based on the following three factors:

1. A known, suspected, or possible lead service line and included in the LSI.
2. Demographics for occupants at the property
3. Until the service line is confirmed to be non-lead or 6 months after a lead service line is replaced.

Denver Water will work closely with Distributors to determine if the notification/enrollment letter, filters, replacement cartridges, and COE will be provided directly by Denver Water or in collaboration with the appropriate Distributor.

The distribution of filters and replacement cartridges in the FLOW Program will be documented and tracked during the life of the LRP using an electronic database and GIS. The filters will be distributed to customers prior to implementation of the pH and alkalinity adjustment using various methods as follows:

PRIMARY (90%)

- Direct mail by Denver Water and/or distributor with delivery confirmation

SECONDARY (10%)

- Hand delivery by Denver Water or contractor via door-to-door canvassing
 - In-person transaction
 - Drop-off

EXCEPTIONS - DENVER WATER HOUSEHOLD PREFERENCE ONLY

- Pickup
 - Denver Water facility
 - Mobile unit
 - Community meetings / events
 - Other

Filter Cartridge Replacements

Replacement filter cartridges will be distributed to Denver Water households using the various methods identified for distribution of pitcher filters. It is estimated that approximately 690,000 pitcher and alternative filters and 2.8 million replacement cartridges will be distributed over the life of the FLOW Program (15-years), if only pitcher filters are implemented. As the LRP progresses, Denver Water will investigate the use of other filter types to promote filter adoption.

Filter Cartridge Waste Reduction

Some manufacturers provide solutions to mitigate waste created by lifetime filter cartridge replacements as follows:

1. The typical Brita pitcher filter life is 6 months. Brita recycles filter cartridges using Terracycle (<https://www.terracycle.com/en-US/>) using the following process:
 - a. Brita cartridges are dried for a minimum of 3 days.
 - b. Approximately 5 pounds of Brita cartridges are packaged for return to Terracycle.
 - c. Shipping labels are printed from Brita's website with postage paid by Brita.
 - d. The Brita cartridges are mailed to Terracycle for recycling.

Brita's recycling system may be utilized by an individual Denver Water household or by Denver Water using cartridge drop-off locations placed throughout the city.

2. The typical DuPont pitcher filter life is 3 months. DuPont uses reusable cartridge housings:

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- a. The initial pitcher filter cartridge is a plastic housing for the media (carbon block).
- b. Carbon blocks are provided separate from the plastic housing by DuPont.
- c. Carbon blocks are placed into the plastic cartridge housing.
- d. Used carbon blocks are removed from the cartridge housing, by the Denver Water household, following manufacturer's recommended safety precautions.
- e. Plastic cartridge housings are replaced periodically when the housing has reached its service life (approximately 8 years).

Sustainable solutions will be investigated further during implementation and over the life of the FLOW Program.

Alternative Filters

Alternative filters (filters attached to the kitchen faucet and refrigerators filters) will be utilized throughout the FLOW Program, as the cartridges have a longer filter life, generally three to 10 months, providing a more sustainable approach for the 15-year lead service line replacement and filter plan. Alternative filters may require less maintenance, less involvement from FLOW Program staff, and may increase ease of use by Denver Water households, which may encourage filter adoption. They will be distributed to Denver Water households who have requested an alternative filter. Although typically a higher capital cost than a pitcher filter, alternative filters often have longer filter life and ease of use for infant formula, drinking, and cooking. Lessons learned from the FLOW Pilot regarding alternative filters will be implemented into the full-scale FLOW Program, as applicable. Alternative filters options are shown in Appendix A.

Alternative filters will be distributed to Denver Water households using the various methods identified for distribution of pitcher filters. It is anticipated that a portion of the alternative filters will require inspection and/or installation by Denver Water staff and/or contractors to assure correct installation.

It is anticipated that up to approximately 20% of the customers may request an alternative filter.

Customers will be provided with options for filter use and replacements as shown in Table III.C.3-1.

Table III.C.3-1 Alternative Filter Use and Replacement Options

Option	Replacements Provided
<ul style="list-style-type: none"> One Pitcher Filter 	Replacement pitchers after 8 years and cartridges
<ul style="list-style-type: none"> Two Pitcher Filters 	Replacement pitchers and cartridges
<ul style="list-style-type: none"> Kitchen Faucet Filter 	Replacement faucet filter and cartridges
<ul style="list-style-type: none"> Refrigerator Filter 	Replacement cartridges
<ul style="list-style-type: none"> Refrigerator Filter and One Pitcher Filter 	Replacement pitchers and cartridges

Replacement Filter Housing

It is anticipated that a typical pitcher filter will be usable for approximately eight years. Denver Water households will receive a replacement and/or additional pitcher filter and replacement cartridges as shown in Table III.C.3-2.

Table III.C.3-2 Replacement Pitcher Filter and Cartridge Distribution

Request Type	Identifier
Additional pitcher to supplement the initial pitcher to reinforce filter use	Denver Water household
Damaged and/or lost pitcher filters	Denver Water household
New homeowners and long-term rental property turnover	Denver Water billing changes, rental property owners, and management companies
Short term rental property (Air BnB, VRBO, etc.)	Rental property owners and management companies
Participant in the FLOW Program for eight years (replacement of filter pitcher in 8 th year)	FLOW Program database

Notification Methods

Notification methods for the FLOW Program include:

- Direct mail and door-to-door delivery of filter kits (Appendix B) with a letter to the customer, detailed instructions regarding the FLOW Program, water filter cartridge use and replacement, survey/response form (multi language), a quick

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response (QR) code for access to Denver Water's digital registration page (in lieu of mail in survey/response), and other related details. The material will be available on Denver Water's website (www.denverwater.org/lead).

- Door-to-door canvassing of neighborhoods campaigns
- Neighborhood meetings and additional strategic community outreach opportunities.
- Robocalls to impacted Denver Water households.
- Follow-up communication using mail, email, phone, and door to door survey.

Denver Water households that are confirmed as non-lead service lines that request a pitcher filter will receive educational materials regarding the FLOW Program and a water quality sample kit for assuring the Denver Water household that they are not required to filter their water, but may do so at their own expense.

In addition, water quality sampling and community outreach and education materials will be provided to customers not in the FLOW Program, as requested.

Survey

There are five categories of surveys to help gather information from FLOW Program participants about how filters are used for infant formula, drinking, and cooking activities. The surveys will be similar to the surveys used during the FLOW Pilot but will be revised as necessary during implementation of the FLOW Program to incorporate lessons learned.

- **Initial Survey:** The intent of this survey is to obtain initial feedback from the Denver Water household. This survey is included in the hand-delivered and mailed filter kits.
- **Use Survey:** The use survey will be sent to FLOW Program participants a few weeks after they have received their filter kit. The intent of this survey is to confirm if a Denver Water household is using the filter for infant formula, drinking, and cooking. This survey also includes an option for participants to elect for an alternative filter.
- **Adoption Survey:** Once a year, the adoption survey will be sent to approximately 1,250 random customers to generate the minimum 1,059 responses. Denver Water will use internal resources and community outreach services to enhance survey response rates. This survey will have the following three questions:
 - Do you use your filter or bottled water for drinking water? Yes/No
 - Do you use your filter or bottled water for water used in cooking? Yes/No
 - Do you use your filter or bottled water for infant formula preparation? Yes/No/Not Applicable (no infants)

This survey question will be used for metrics to determine filter adoption. From June until December each year, follow-up calls and emails may be used in order

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to achieve the 1,059 responses. In January, the adoption survey results will be submitted to CDPHE and EPA.

- **Alternative Survey:** Once a Denver Water household has an alternative filter installed, the alternative survey is sent to provide feedback on whether the FLOW Program participant is using their alternative filter for infant formula, drinking, and cooking.
- **Ongoing Surveys:** Twice a year, during the 15-year FLOW Program, ongoing surveys will be used to confirm if the Denver Water household is continuing to use the filter for infant formula, drinking, and cooking. This survey will also provide options for Denver Water households to opt for alternative filters and will obtain feedback of the COE and the FLOW Program.

The intent of the survey is to obtain confirmation of the primary water source used by FLOW Program participants for infant formula, drinking, and cooking:

- **Adoption** = Additional reduction of lead through the use of a certified filter or use of an alternative source of lead-free water (i.e. bottled water).
- **Non-Adoption** = Customer uses tap water.

Filter use data will be gathered using questions such as these and as included in Appendix C:

What is your household's primary source of drinking water? (Check one)

- Unfiltered Faucet
- Bottled water
- Filtered - refrigerated water/ice dispenser
- Filtered - pitcher filter
- Filtered - under sink filter
- Filtered - faucet-mounted filter
- Filtered - whole house filter
- Other (specify)

What is your household's primary source of water for cooking? (Check one)

- Unfiltered Faucet
- Bottled water
- Filtered - refrigerated water/ice dispenser
- Filtered - pitcher filter
- Filtered - under sink filter
- Filtered - faucet-mounted filter
- Filtered - whole house filter
- Other (specify)

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What is your household's primary source of water for infant formula preparation? (Check one)

- Not Applicable (no infants)
- Unfiltered Faucet
- Bottled water
- Filtered - refrigerated water/ice dispenser
- Filtered - pitcher filter
- Filtered - under sink filter
- Filtered - faucet-mounted filter
- Filtered - whole house filter
- Other (specify)

Once a year in May, for return by July, a survey (the adoption survey) of a minimum of 1,059 randomly selected participants (Appendix C.III.1) will be undertaken to measure adoption rates (with at least a 95% confidence and no more than 5% error) and to determine reasons for non-adoption. Denver Water will use program resources, internal resources, and community outreach services to enhance survey response rates. From June until December each year, follow-up calls and emails will be used in order to achieve the 1,059 responses. In January, the adoption survey results will be submitted to CDPHE and EPA. More than 1,059 surveys may be sent out in order to achieve the minimum responses. Additional surveys of random customers may be issued between June and December to obtain the necessary minimum responses to support the adoption rate. The survey will evolve over time, as more is learned throughout the process of the FLOW Program.

The adoption survey will be random and proportional to the population of the total service area, in order to achieve a statistically sufficient number of responses for the area. Additional random surveys will be conducted of sub-areas to determine demographics but will not be considered as part of the annual adoption survey metrics.

For all surveys, Denver Water will provide an online survey option that is mobile friendly (Snap Survey).

For customers that either do not respond to the adoption survey or communicate that the filter was not used, Denver Water may follow-up with a phone-call, an email, or an in-person visit to provide additional education on methods to reduce lead exposure; determine whether or not an alternative lead reduction strategy is used; and to ultimately encourage the use of the filter.

Additionally, a survey of each customer will be provided during the Accelerated Lead Service Line Replacement (ALSLR) Program (approximately 4,267 surveyed based on the number of completed lead service line replacements each year). The results of the ongoing surveys will be evaluated and used to confirm adoption rates and make improvements to the Filter and COE Programs (learn-by-doing).

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The FLOW Program will be adjusted based upon survey results and additional feedback acquired during public outreach and education. Specifically, “Adaptive Management” techniques will be implemented to adjust the COE to target and follow-up with specific sub-groups. The ALSLR Program may be advanced for a specific subgroup if it is determined that they are not participating in FLOW.

Vulnerable Populations

Vulnerable populations; such as pregnant women, children, and those of low socioeconomic standing; will be identified, contacted, and tracked using the following methods:

- Lead Service Inventory (LSI) - The lead service inventory will incorporate factors, such as proximity to schools, daycares, preschools, independent data sources, etc. to assist with the identification of vulnerable populations
- COE – Outreach to specific groups will be completed using focused community outreach, meetings, and individual interaction with Denver Water households using the tactics noted in Appendix III.A Communications, Outreach and Education Plan.
- Survey Questions - The survey questions will help identify expecting families, families with infants, and families of low socioeconomic standing.

The data above will be incorporated into the LSI for use with the predictive modelling effort (see LRP Plan Appendix III.B.3 Prediction Model and Prioritization), which will be used to prioritize and target filter distribution and annual ALSLR locations.

Filter Adoption

Filter adoption is defined as the following action by the customer to reduce lead in their infant formula, drinking, and cooking water by:

- Using and maintaining filters properly, as well as clean and/or replace the filter and cartridges at the appropriate time.
- or
- Using an alternative source of lead-free water (i.e. bottled water).

Filter adoption is assumed based on FLOW Program participant’s responses to the adoption survey questions.

Based on a 2017 customer survey (1,432 responses) by Denver Water, the majority of customers reported that their household typically drink unfiltered tap water as shown by the survey results:

- 37% of customers use filters (type of filter and standard unknown)
- Less than one in ten customers reported that their household drinks bottled water regularly
- 54% of customers reported drinking unfiltered tap water

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At a minimum, Denver Water must achieve filter adoption rates for customers with known, suspected, or possible lead service lines to at least 65% to provide equivalent protection to orthophosphate treatment.

Adoption Calculations

In order to achieve a minimum 65% filter adoption rate; 688 responses of 1,059 adoption surveys participants must indicate that the filters are being used for infant formula, drinking, and cooking. A failure of either of the adoption survey questions is considered a failure.

Minimum Survey Responses and Adoption:

- *Minimum 65% Adoption: 1,059 FLOW Survey Responses x 65% = 688 yes responses (for both drinking and cooking)*

Filter adoption rates will be tracked and data collected will be included in the annual adoption submittal to support filter adoption metrics. Filter adoption assumes customers are using and maintaining the filter properly, as well as replacing the filter cartridges at the appropriate time.

Denver Water will work with the LRP Leadership Committee to identify and implement additional outreach efforts directed at improving the adoption rate before the annual reporting date if the overall filter adoption rate is less than 65% by the end of year one. Failure to correct the non-adoption rate will trigger actions in accordance with the multi-tiered response plan.

Multi-Tiered Response Plan

If a customer chooses not to enroll in the FLOW Program and it cannot be determined if an alternative filter or drinking water supply is used, or does not employ a filter, the protocol that Denver Water may follow includes the following steps:

- Confirm materials of construction, pothole the property (if the service line material is suspected or unknown) and attempt to understand the materials used in premise plumbing (via visual inspection if allowed by the customer).
- Offer water quality sampling to quantify the magnitude of lead release, if not previously sampled.
- Interview the Denver Water households to determine whether or not an alternative means to reduce lead exposure is employed such as an existing filter system (confirmed NSF certified to remove lead) or if the Denver Water households rely on bottled water for infant formula, drinking, and cooking.
- Make two additional attempts to encourage the customer to use a filter, based on site specific information for materials of construction and the water quality sampling results.
- If the customer continues to choose to not filter (or opts out of the FLOW Program), the property will be placed on a Filter Non-Adoption List.

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- Revisit on an annual basis to deliver additional education material and deliver a pitcher filter, replacement cartridges, and a water quality sampling kit.
- Regularly provide lead education with billing to encourage filter use until the lead service line is replaced or confirmed non-lead.
- Notify local health department at a frequency of every 6 months and request assistance by the local health department.
- Denver Water household contacted by the local health department and Denver Water coordination of next steps with the local health department.

Lessons Learned

Other entities have distributed filters to customers for lead and non-lead programs. The lessons learned from distribution of filters for other entities are shown in Table III.C.3-3.

Table III.C.3-3 Lessons Learned in Other Jurisdictions

Item No.	Description
1	Directions for filter use must be clear to ensure proper use of filters.
2	Reach out to Denver Water households through various methods: phone calls, emails, door-to-door, website videos, tables at community events, local TV stations, etc.
3	Impersonators may be an issue. Make sure all staff have ID badges and outreach material spells out what Denver Water households can expect from Denver Water staff.
4	Many man hours are needed for door-to-door delivery of pitchers.
5	Be prepared to field questions of why certain citizens are included in the filter program, and others are not. Make sure the criteria are clear and there is consensus on who is in the filter program and who may be added, as more information is gathered.

Lessons learned from the FLOW Pilot that will be implemented into the full-scale FLOW Program are shown in Table III.C.3-4.

Table III.C.3-4 Lessons Learned From the Filter Pilot Program

Item No.	Description
1	Provide advance targeted communications, outreach and education prior to filter distribution to introduce the program and explain the importance of filter use.
2	Reinforce the importance of using the filter for cooking and infant formula preparation (in addition to drinking water).
3	Inform participants the filters and replacement cartridges are provided at no cost to the customer for the duration of the program.
4	Provide alternative filters such as refrigerator, larger pitchers, and faucet mount.

Item No.	Description
5	Provide additional Spanish-speaking staff for field crews for initial distribution and follow-up visits.
6	Have one adoption survey after the participants have been contacted, are aware of the program, and have been using the filter for period of time.
7	Send filters addressed to tenants, not owners of the homes, if renters reside in the household.
8	Print individual participant's survey access codes directly on their survey in order to easily track the participant's responses.
9	Make survey questions clear, so that each answer doesn't have more than one meaning.
10	Have more outreach materials educating customers about how the service line is owned by the homeowner and how they can request a lead test kit.
11	Simplify outreach materials.
12	Update phone numbers in the database as project progresses.
13	Provide alternative filters and additional filters as filling the pitcher is cumbersome and slow.
14	Younger generation prefer online survey responses and electronic communications.
15	Not all residents have email addresses and internet access and hard copy surveys should continue to be provided.
16	Follow-up calls should be made from a Denver Water phone number.
17	Outreach staff should fill out and request a water quality sampling kit for concerned residents.
18	Include lead service line replacement information and talking points with filter program.
19	Follow-up visits and door-to-door outreach is not preferred for all participants. Some have requested communication via email only.
20	Simplify survey questions to prevent confusion.

General Water Quality - Flushing

To reduce your exposure to lead in drinking water, we recommend flushing your faucet before using the water, unless a faucet filter that removes lead is installed and cannot be

bypassed during flushing, following the steps highlighted on www.denverwater.org.
(<https://www.denverwater.org/your-water/water-quality/lead/reduce-your-risk>)

When using water for drinking, cooking and making ice, beverages and infant formula:

- *Use cold water. Hot water dissolves lead faster and is likely to contain higher levels of lead.*
- *If water has not been used for a few hours, run the kitchen or any bathroom faucet for a few minutes. You also can run the dishwasher or take a shower.*

Flushing the faucet is not required if a faucet filter that removes lead is installed and cannot be bypassed. Flushing water through a faucet filter that cannot be bypassed will shorten the life of the filter.

III. FLOW PROGRAM

The framework for the FLOW Program consists of the following series:

- 5200 – Data Management
- 5300 – Distribution
- 5400 – Alternative Filters
- 5500 – Twice a Year Follow-Up
- 5600 – Transition off FLOW

Below is a general summary of each series. Separate from this TM, Denver Water will further develop each series by identifying the key steps, processes and workflows prior to implementation. For each series, office and field staff supporting the FLOW Program will be trained. Efforts outlined herein do not include COE tasks.

A. Data Management – 5200 Series:

A geodatabase will be developed and used to track & manage the FLOW Program:

- Initial FLOW Program Participants - Premise / Denver Water household data for 84,546 properties / 119,250 Denver Water household units.
- Change of Denver Water household (Move In/Move Out) – Denver Water billing changes, new account rental property owner registration, rental property management companies, others. Denver Water will provide monthly updates.
- Add/Delete Premise – Based upon field data, including service line material type, replacement of lead service, others.
- Field Data Collection - The Mott MacDonald Field Inspection Tools (MMFIT) application will be available during the ALSLR Program and the FLOW Program to field collect Denver Water household data regarding both lead service lines and filter use.
- Integration with Denver Water CIS/CC&B
- FLOW Program Surveys - Filter recipients will be asked to respond to several online surveys related to filter use. The surveys will be administered using the

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survey tool, Snap Survey, to seamlessly collect data directly from FLOW participants.

A dashboard for tracking metrics and adoption rates for the FLOW Program will be developed.

B. Distribution – 5300 Series

• Initial Distribution

- **Procure Filter Kits:** Coordinate with the suppliers to procure pitcher filters, cartridges, boxes, bags and other contents for 119,250 filter kits. Coordinate delivery to pick and pack warehouse in the Denver Area. It is expected that deliveries will be divided into 12 batches (10,000 filters) for use with distribution of the filters and communications within geographic areas.
- **Training:** Office and field staff supporting FLOW will be trained.
 - Finalize filter kit education/outreach material, surveys, phone / in-person scripts, FAQs, and other key references, as included in Appendix D.
 - Conduct in-person training.
- **Kit Assembly:** The filter kit contents (Appendix B) will be assembled for hand delivery and mailing.
- **Mail Kits:** Boxed filter kits will be mailed directly to 90% of Denver Water households. Those Denver Water households that are enrolled in the Denver Water email subscription will also be emailed the letter highlighting that the filter kit package has been mailed, encourage participation, and request for the Denver Water household to contact Denver Water if the Denver Water household does not receive the kit within 5 days. The intent is to split into 12 batches (approximately 9,100 kits in a batch) to allow targeted distribution to specific areas within the Denver Water service area and provide staggered follow-up as required. The plan includes the goal of mailing one batch per week. The first batch will include the initial Denver Water households identified for lead service line replacement in 2020 to allow for adequate distribution and use prior to the start of the ALSLR Program in January 2020.
- **Hand-Deliver Kits:** Bagged filter kits will be hand delivered (drop off) to 10% of Denver Water households. Those Denver Water households that are enrolled in the Denver Water email subscription will also be emailed the letter, highlighting that the filter kit package will be delivered and encourage participation in the FLOW Program. The intent is to split into 12 batches (approximately 1,000 kits in a batch) in coordination with the mailed kits to allow targeted distribution to specific areas within the Denver Water service area and provide staggered follow-up as required. Field staff will carry a Denver Water photo identification and for ease of identification.

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- **Initial Survey**

- **Second Distribution** – It is estimated that pitcher filters should be replaced every 8 years. As technology advances, the 8-year replacement time period will be reviewed and adjusted, as needed. The Second Distribution will follow the same framework as the Initial Distribution.
- **Individual Distributions** – Throughout the FLOW Program, it is expected that new Denver Water households will be added due to move in / move outs, services added to LSI, and other reasons. Also, previously delivered kits may have been missing, lost or damaged. Individual distribution of filter kits, filters or filter cartridges will be mailed within two weeks to the Denver Water household.

C. Alternative Filters - 5400 Series

- **Analysis/Tracking:** Data gathered from the filter kit distribution, door-to-door visits, surveys, and other feedback received will be captured in a centralized database. Data will be further analyzed related to the participant's filter use and requests for alternative filters.
- **Use Survey**
- **Mail Alternative Filter:** If an alternative filter has been requested by the Denver Water household and they have opted for a home-owner-installed alternative filter, the alternative filters will be directly mailed to the Denver Water household. This option is predicted to be used for alternative filters that are easily installed.
- **Install Alternative Filter:** If an alternative filter has been requested by the Denver Water household and they have opted for Denver Water to install, an appointment will be made and the alternative filter will be installed, at no cost to the Denver Water household. Before installing the filter, Denver Water will conduct a visual inspection of the service line as it enters the house. With the aid of the homeowner, the entry point for the service line will be identified. Field staff will carry a Denver Water photo identification for ease of identification.
- **Alternative Survey**

D. Twice a Year Follow-Up – 5500 Series

Upon LRP approval, a twice a year follow-up will commence 6 months after the initial distribution and continue through the end of the FLOW Program in 15 years. The intent is to distribute the next 6 month supply of filter replacement cartridges, further outreach / education material, and survey.

- **Replacement Cartridges:** The next 6 month supply of filter replacement cartridges and outreach / education material will be distributed.

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- **Mail:** Pitcher filter replacement cartridges will be directly mailed to the Denver Water household. Also, alternative filter cartridges that are easily installed will be mailed to the Denver Water household.
- **Install:** If an alternative filter is used and they have opted for Denver Water to install, an appointment will be made and the filter replacement cartridge will be installed. Field staff will carry a Denver Water photo identification for ease of identification.
- **Adoption Survey** - once per year
- **On-going Surveys**

E. Transition Off the FLOW Program – 5600 Series

- **Individual:** A Denver Water household will be removed from the FLOW Program, either six months after replacement of the lead service line, or if a non-lead service line is confirmed at the property.
 - Replacement cartridges will be provided for the 6 month period following the lead service line replacement. The Denver Water household will be notified via letter.
 - A Denver Water household will be transitioned off the FLOW Program if a non-lead service line is confirmed at the property in accordance with Appendix III.D.1 Accelerated Lead Service Line Replacement Plan. No additional replacement cartridges will be provided. The Denver Water household will be notified via letter at the end of a 6 month period.
- **FLOW Program Discontinued:** If Denver Water transitions off the FLOW Program, no additional replacement cartridges will be provided. The Denver Water households will be notified via letter.

IV. FILTER USE METRICS

Metrics were developed for use in the FLOW Program and a table of metrics is provided in the Lead Reduction Program Plan (LRP Plan).

V. DEMOGRAPHICS EVALUATION

As part of the use survey, it is important to determine the adoption rate amongst the diverse populations in the Denver Water service area. The American Community Survey (ACS) is part of the U.S. Census Bureau's Decennial Census Program and is designed to provide current social, economic, housing, and demographic estimates throughout the decade. Combining American Census Survey (ACS) data with FLOW data allowed for the estimation of trends between levels of diversity in a neighborhood and filter adoption rates within the FLOW neighborhoods. ACS information at the Block Group Level will be taken from the 2013 to 2017 American Community Survey estimates. The information was adjusted for the Hispanic representation included as a category to reflect additional available diversity information. The information was linked to the Survey Census Block

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Groups to develop a geographic component to the data. The survey data was then evaluated by Diversity Categories By Block Group (ACS Data for B02001) as follows:

- Hispanic alone
- White (Non-Hispanic) alone
- Black or African American alone
- American Indian and Alaska Native alone
- Asian alone
- Native Hawaiian and Other Pacific Islander alone
- Some other race alone

As an example, the FLOW Pilot survey results were geolocated based on the address, tap number, or other available spatial information. The geolocation allows the data collected from the FLOW Pilot to be associated to a location and a block group for further analysis of the adoption rates and other survey results compared to the available diverse population statistics for each area. The following evaluations were completed for the Filter Pilot premises:

1. The comparison of the adoption rate noted on completed surveys to the diverse population for each surveyed area.
2. The comparison of areas where surveys were sent but not returned or the adoption rate is low.
3. The identification of specific diverse populations where surveys were sent but not returned or the adoption rate is low.
4. The comparison of the survey results between different areas and diverse groups to establish trends by ethnic population.
5. The populations where filters were sent but surveys not returned.
6. The comparison of adoption rate to the baseline approved adoption metric.

The survey results were then compared to the neighborhood demographics. The COE program can be adjusted if there is a lack of survey results or negative feedback from a certain area are identified. If an area is systemically not participating in FLOW, then the areas' criticality (and thus risk) will be ranked as higher priority in the ALSLR Program.

A summary of the FLOW Pilot demographics evaluation, for three of the seven neighborhoods, is shown in Table III.C.3-5.

Table III.C.3-5 Survey Results by Diversity Analysis (sample results)*

Neighborhood	1	2	3
White Hispanic (%)	62	64	61
White Non-Hispanic (%)	29	16	18.6
Black or African American (%)	3	1	0.1
American Indian and Alaska Native (%)	2	1	0
Asian (%)	0	9	19
Native Hawaiian and Other Pacific Islander (%)	0	0	1
Other (%)	4	9	0.3
Number Using Filter for Drinking	8	4	2
Number Using Filter for Cooking	6	4	2
Initial Survey Completed	7	8	0
Filter Use Survey Completed	9	6	2
Using for Drinking (%)	89	67	100
Using for Cooking (%)	67	67	100
Initial Survey Completed (%)	64	73	0
Filter Use Survey Completed (%)	82	55	9

**The demographic data was developed using limited survey data from August 2, 2019 and available census data. The demographic data is provided as an example and will be further developed with the full-scale filter plan.*

The data indicate that at least 67% of the population surveyed use the filter for drinking and cooking in three (3) of the seven neighborhoods where White Hispanics make up the majority of the population. Other considerations may be affecting neighborhood 3, which shows a markedly lower adoption rate. A geographic strategy analysis will be conducted to determine how the COE plan should be adjusted in neighborhood 3 as opposed to modifying the overall COE efforts specified for the White Hispanic population. Neighborhood 3 has a larger Asian population and this information will be used to provide guidance for increased COE for filter adoption in this neighborhood.

VI. FILTER PLAN 2019/2020 TIMELINE EXAMPLE

Date	Activity	Comments
Based on an October 20, 2019 Variance Approval		
July – October 2019	Develop FLOW Plan	
September 30, 2019	Denver Water contract with <ul style="list-style-type: none"> • pitcher filter kit content suppliers • pick and pack warehouse • distribution team • program management 	
October 21, 2019	Variance Approval Expected	Go / No-Go from Denver Water on FLOW Program
October 23, 2019	Order pitcher filter kit supplies	Confirm pitcher filter supplies and coordinate with suppliers
October 23, 2019	COE	Launch Denver Water internal COE plan
November 11, 2019	Training/Kit Assembly	Training materials and filter kits are ready for distribution
November 13, 2019	Commence Distribution of Batch 1	Coordinate outreach and delivery
November 20, 2019	Commence Distribution of Batch 2	Coordinate outreach and delivery
December 2, 2019	Commence Distribution of Batch 3	Coordinate outreach and delivery
December 9, 2019	Commence Distribution of Batch 4	Coordinate outreach and delivery
December 16, 2019	Commence Distribution of Batch 5	Coordinate outreach and delivery
January 6, 2020	Commence Distribution of Batch 6	Coordinate outreach and delivery
January 13, 2020	Commence Distribution of Batch 7	Coordinate outreach and delivery
January 20, 2020	Commence Distribution of Batch 8	Coordinate outreach and delivery
January 27, 2020	Commence Distribution of Batch 9	Coordinate outreach and delivery
February 3, 2020	Commence Distribution of Batch 10	Coordinate outreach and delivery
February 10, 2020	Commence Distribution of Batch 11	Coordinate outreach and delivery
February 17, 2020	Commence Distribution of Batch 12	Coordinate outreach and delivery

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Date	Activity	Comments
March 20, 2020	Confirm pitcher filter distribution to all Denver Water households with known, suspected, and possible lead service lines	
Starting May 2020 & every 6 months	Twice a Year Follow-up following the same batch sequence <ul style="list-style-type: none"> • Analysis/Tracking • Use Survey • Distribute filter cartridge replacements 	<ul style="list-style-type: none"> • Feedback and collection of data • Determine alternative filter type requested • Follow-up phone calls
Starting May 2020 & every year	<ul style="list-style-type: none"> • Adoption Survey 	<ul style="list-style-type: none"> • Track Filter Adoption
Starting July 2020	<ul style="list-style-type: none"> • Mail Alternative Filters • Install Alternative Filters • Alternative Survey 	<ul style="list-style-type: none"> • Order, delivery, and installation of alternative filter equipment • Feedback and collection of data
Starting October 1, 2020.	Analyze surveys on filter usage submitted from approximately 4,267 Denver Water households as part of the ALSLR Program, 1,059 FLOW Program Participants, and others	
December 2020	Progress Meeting	<ul style="list-style-type: none"> • Feedback and collection of data
June through December every year	Follow-up on Adoption Survey	<ul style="list-style-type: none"> • COE
Every January	Report Adoption Survey results to CDPHE and EPA	

APPENDIX A – FILTER TYPES

Filter Types

Federal regulations do not exist for residential water treatment filters. Voluntary national standards and National Sanitation Foundation (NSF) / American National Standards Institute (ANSI) protocols have been developed to establish minimum requirements for the safety and performance of residential water treatment filters. NSF/ANSI Standards 42 and 53 are applicable for water quality and lead removal, as described, below.

- **NSF/ANSI 42**

Filters are certified to reduce aesthetic impurities such as chlorine, taste, and odor. Filters can be point-of-use (POU) (faucet filter, water pitcher, etc.) or point-of-entry (POE) (whole house) treatment systems.

- **NSF/ANSI 53**

Filters are certified to reduce a contaminant with a health effect, such as lead. The standard establishes health effects as regulated by the U.S. Environmental Protection Agency (EPA). Both standards 42 and 53 include adsorption and filtration treatment.

NSF established laboratories that may test and certify filters that meet the NSF protocols for lead removal. The certified laboratories include: NSF International, CSA International, Water Quality Association (WQA), International Association of Plumbing and Mechanical Officials, Underwriters Laboratory, Truesdail, and Intertek.

A summary of filter pitchers, cost estimates, and features is shown in Table A1. A summary of different types of filters, certification laboratory to NSF/ANSI Standards 42 and 53, and associated filter life is shown in Table A2. The general range of filter life for pitcher filters is 1-6 months and the general range of filter life for alternative filters is 1-10 months. Product detail sheets are attached.

Table A1: Pitcher Filters

Brand/Model	Certification Laboratory	Filter Life	Percent Lead Reduction at pH 8.5	Removes Fluoride	Unit Cost - Retail	Wholesale Cost	Size of Packaging (L X W X H)	Weight	Inventory and Lead Time
Brita Monterey (#OB50) 10-cup pitcher with Longlast filter (#OB06) ¹	WQA	6 months	99.6%	No	\$34.99 ²	TBD	TBD	TBD	TBD
DuPont 8-cup pitcher (WFPT100) with WFPTC100N filter ³	WQA	3 months	97.4%	No	\$18.71 ⁴	TBD	7 X 9 ¼ X 9 ½"	1.8 lbs	TBD
DuPont WFTP200 10-cup pitcher with WFPTC100N filter ⁵	WQA	3 months	97.4%	No	\$24.96 ⁶	TBD	5 3/8 X 11 ½ X 11 ¼"	2.4 lbs	TBD
ZeroWater 10-cup filter pitcher (ZP-010) ⁷	NSF	1 month	99.0%	Yes	\$34.99 ⁷	TBD	12 ¼ X 6 X 11 5/8"	3.75 lbs	TBD

Table A1: Pitcher Filters

Brand/Model	Certification Laboratory	Filter Life	Percent Lead Reduction at pH 8.5	Removes Fluoride	Unit Cost - Retail	Wholesale Cost	Size of Packaging (L X W X H)	Weight	Inventory and Lead Time
Pur Classic 11-cup pitcher (PPT111WV1) with lead reduction filter (PPF951K) ⁸	WQA	2 months	97.9%	No	\$34.99 ⁸	TBD	TBD	TBD	TBD

Notes:

- https://www.brita.com/water-pitchers/monterey-longlast/?ds_rl=1238837&gclid=Cj0KCCQjw9JzoBRDjARIsAGcdIDU8xyyMENARguLCz_NAqDULgUppLOhn01Pd3XbXRcXZGGWDHWOyLgaAslGEALw_wcB&gclid=aw.dshttp://www.protectplus.com/PD-Water-Filtration-82/DuPont-Traditional-Water-Filter-Pitcher-WFPT100-653
- <https://www.homedepot.com/p/Brita-Monterey-10-Cup-Water-Filter-Pitcher-in-Blue-with-Longlast-Filter-BPA-Free-6025836304/308802800>
- <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Mirage-Water-Filter-Pitcher-WFPT200-652>
- https://www.amazon.com/DuPont-WFPT100X-Traditional-Filter-Pitcher/dp/B007VZ2OTM/ref=sr_1_1?keywords=dupont+8-cup+pitcher&qid=1561675034&s=hi&sr=1-1
- <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Mirage-Water-Filter-Pitcher-WFPT200-652>
- <https://www.amazon.com/DuPont-WFPT200X-Mirage-Filter-Pitcher/dp/B007VZ2OTC>
- https://www.zerowater.com/products-10-Cup-Pitcher?gclid=Cj0KCCQjw9JzoBRDjARIsAGcdIDWhrdUxnskz0UuAp4CluOcDKJ27qwbOVoqxdOPq9XYFa3OJIVwIK2YaAhvzEALw_wcB
- <https://www.pur.com/water-filter-pitchers-and-dispensers/pur-ultimate-pitcher-filtration-system-with-lead-reduction>

Table A2: Point-of-Use Filter Types

Filter Type	Brand/Model	Certification Laboratory	Filter Life	Percent Lead Reduction at pH 8.5
Water Dispenser	ZeroWater 20-cup water filter jug (ZD-20RP) ¹	NSF	1 month	99.0%
	ZeroWater 30-cup water filter jug (ZD-30RP) ²	NSF	1 month	99.0%
	ZeroWater 40-cup water filter jug (ZBD-040) ³	NSF	1 month	99.0%
Water Dispenser	Brita Ultramax 18-cup Dispenser (#OB24) with Brita Longlast filter (#OB06) ⁴	WQA	6 months	99.6%
Faucet-Mount	DuPont WFFM100 Faucet Mount Filter with WFFMC100 or WFFMC300 filter ⁵	WQA	5 months	99%
	DuPont WFFM350 with Ultra Protection Filter (WFFMC300) ⁶	WQA	10 months	99%
	Brita Faucet Filtration System FF-100 with FR-200 filter ⁷	NSF & WQA	5 months	99.3%
	Brita Basic Faucet Filtration System SAFF-100 with FR-200 filter ⁸	NSF & WQA	5 months	99.3%
Faucet-Mount	Pur PFM400H Faucet with MineralClear Filter (RF9999) ⁹	WQA	3 months	99.9%

Table A2: Point-of-Use Filter Types

Filter Type	Brand/Model	Certification Laboratory	Filter Life	Percent Lead Reduction at pH 8.5
Refrigerator Filters	Frigidaire PureSource 3 (WF3CB) ¹¹	NSF	6 months	99.1%
	Maytag Refrigerator Water Filter (UKF8001) ¹²	NSF	6 months	99.3%

Notes:

1. https://www.brita.com/water-pitchers/monterey-longlast/?ds_rl=1238837&gclid=Cj0KCOjw9JzoBRDjARIsAGcdIDUj8xyvMENARguLCz_NAqDULgUppLOhm01Pd3XbXRcXZGGWDHWOyLgaAslGEALw_wcB&gclid=aw.dshttp://www.protectplus.com/PD-Water-Filtration-82/DuPont-Traditional-Water-Filter-Pitcher-WFPT100-653
2. <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Mirage-Water-Filter-Pitcher-WFPT200-652>
3. <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Mirage-Water-Filter-Pitcher-WFPT200-652>
4. https://www.zerowater.com/products-10-Cup-Pitcher?gclid=Cj0KCOjw9JzoBRDjARIsAGcdIDWhrdUxnskz0UuAp4CluOcDKJ27qwbOVqxdOPq9XYFa3OJIVwIK2YaAhvzEALw_wcB
5. <https://www.pur.com/water-filter-pitchers-and-dispensers/pur-ultimate-pitcher-filtration-system-with-lead-reduction>
6. <https://www.zerowater.com/products-20-Cup-Ready-Pour>
7. <https://www.zerowater.com/products-30-Cup-Ready-Pour>
8. <https://www.zerowater.com/products-40-Cup-Ready-Pour>
9. <https://www.brita.com/water-dispensers/ultramax-longlast/>
10. <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Premier-Faucet-Mount-Drinking-Water-Filter-WFFM100-647>
11. <http://www.protectplus.com/PD-Water-Filtration-82/DuPont-Deluxe-Faucet-Mount-WFFM350-646>
12. <https://www.brita.com/faucet-systems/complete/>
13. <https://www.brita.com/faucet-systems/basic/>
14. <https://www.pur.com/faucet-filtration-systems/pur-advanced-faucet-filtration-system-with-mineralclear-filter>
15. https://www.frigidaire.com/Filter-Accesories/Filter/water-filters/WF3CB/?gclid=CjwKCAjwuqfoBRAEEiwAZErCsqOkiflHCX2HhuFjxt_hL213qbrqvzOJ96upk87nk6SIa4b2_4hT2BoCuXYQAvD_BwE&gclid=aw.ds
16. <https://www.homedepot.com/p/Maytag-UKF8001-Refrigerator-Water-Filter-UKF8001/100671093>

APPENDIX B – FILTER KIT CONTENTS

Filter Kit Contents

Each participant of the Filter Lead Out of Water (FLOW) Program will receive a filter kit via direct mail or door-to-door hand delivery. Each filter kit includes the following:

Kit Items:

- Frequently Asked Question (FAQ) summary for Lead Service Lines (LSL) and FLOW Program questions
- One (1) water filter pitcher - NSF certified to remove lead
- 6-month supply of replacement filter cartridges
- Pitcher filter instructions and maintenance guidelines in multiple languages
- Initial Survey
- Reusable bag
- Magnet with reminders to use filtered water for infant formula, drinking, and cooking, cartridge date change information, program contact information, website, and telephone number
- Door hanger

The filter pitcher should be used for all infant formula, drinking water, and cooking. The manufacturer's instructions for use and maintenance should be followed and the filter should be replaced in accordance with the manufacturer's guidelines.

APPENDIX C - SURVEY QUESTIONS

FLOW Program Survey Question Matrix

Questions	Initial Survey	Use Survey	Adoption Survey	Alternative Filter Survey	Ongoing Surveys
1. Do you use your filter or bottled water for drinking water? <ul style="list-style-type: none"> • Yes • No 		X	X	X	X
2. Do you use your filter or bottled water for water used for cooking? <ul style="list-style-type: none"> • Yes • No 		X	X	X	X
3. Do you use your filter or bottled water for water used for infant formula preparation? <ul style="list-style-type: none"> • Yes • No • Not Applicable (no infants) 		X	X	X	X
4. Do you have a lead service line? <ul style="list-style-type: none"> • Yes • No • I do not know 	X				
5. What is your household's primary source of drinking water? (Check one) <ul style="list-style-type: none"> <input type="checkbox"/> Unfiltered faucet <input type="checkbox"/> Bottled water <input type="checkbox"/> Filtered - refrigerated water/ice dispenser <input type="checkbox"/> Filtered - pitcher filter <input type="checkbox"/> Filtered - under sink filter <input type="checkbox"/> Filtered - faucet mounted filter <input type="checkbox"/> Filtered - whole house filter <input type="checkbox"/> Other (specify) 	X				

FLOW Program Survey Question Matrix

Questions	Initial Survey	Use Survey	Adoption Survey	Alternative Filter Survey	Ongoing Surveys
6. What is your household's primary source of water used for cooking? (Check one) <input type="checkbox"/> Unfiltered faucet <input type="checkbox"/> Bottled water <input type="checkbox"/> Filtered - refrigerated water/ice dispenser <input type="checkbox"/> Filtered - pitcher filter <input type="checkbox"/> Filtered - under sink filter <input type="checkbox"/> Filtered - faucet mounted filter <input type="checkbox"/> Filtered - whole house filter <input type="checkbox"/> Other (specify)	X				
7. What is your household's primary source of water used for infant formula preparation? (Check one) <input type="checkbox"/> Unfiltered faucet <input type="checkbox"/> Bottled water <input type="checkbox"/> Filtered - refrigerated water/ice dispenser <input type="checkbox"/> Filtered - pitcher filter <input type="checkbox"/> Filtered - under sink filter <input type="checkbox"/> Filtered - faucet mounted filter <input type="checkbox"/> Filtered - whole house filter <input type="checkbox"/> Not Applicable <input type="checkbox"/> Other (specify)	X				
8. If you have an existing water filter system, what is the make and model number for your filter? (Fill in)	X				
9. Do you currently or do you plan in the future to use filtered or bottled water for infant formula? Yes/No/NA	X	X		X	X
10. If you do not primarily use the water filter provided, what issues are you experiencing? (Check all that apply) <input type="checkbox"/> Filter pitcher isn't large enough <input type="checkbox"/> Filter pitcher doesn't fit in refrigerator <input type="checkbox"/> The filter pitcher takes too much time to fill <input type="checkbox"/> It's too much effort to use the filter pitcher <input type="checkbox"/> I'm not interested in filtering my drinking water		X			

FLOW Program Survey Question Matrix

Questions	Initial Survey	Use Survey	Adoption Survey	Alternative Filter Survey	Ongoing Surveys
<input type="checkbox"/> Other, please specify: (fill in the blank) <input type="checkbox"/> Not Applicable (no issues)					
11. If the water filter provided does not meet your needs, would you be more likely to use an alternative filter? (Check one) <input type="checkbox"/> Faucet-mounted filter <input type="checkbox"/> Refrigerator filter <input type="checkbox"/> Larger pitcher filter <input type="checkbox"/> Not Applicable (the water filter meets my needs)		X			X
12. Are you familiar with filter maintenance and cartridge replacement requirements? E.g. replacing the filter cartridge, cleaning the pitcher (if applicable)? Yes/No		X		X	X
13. What questions or comments do you have about the FLOW Program?	X	X		X	X
14. How could we improve the FLOW Program?	X	X		X	X
15. Want to stay informed about the FLOW Program? Provide your email or phone number.	X	X		X	X
16. What is your age? <input type="checkbox"/> Under 18 <input type="checkbox"/> 18-24 years old <input type="checkbox"/> 25-34 years old <input type="checkbox"/> 35-44 years old <input type="checkbox"/> 45-54 years old <input type="checkbox"/> Over 55 <input type="checkbox"/> Prefer not to say	X	X		X	X
17. What is your gender? <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Other (specify) <input type="checkbox"/> Prefer not to say	X	X		X	X
18. Are you Hispanic or Latino? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I do not know					

FLOW Program Survey Question Matrix

Questions	Initial Survey	Use Survey	Adoption Survey	Alternative Filter Survey	Ongoing Surveys
<input type="checkbox"/> Prefer not to say					
19. What is your ethnicity? (Check all that apply) <input type="checkbox"/> White (Non-Hispanic) <input type="checkbox"/> Black or African American <input type="checkbox"/> Native American or Alaska Native <input type="checkbox"/> Asian <input type="checkbox"/> Native Hawaiian and Other Pacific Islander <input type="checkbox"/> Multiple ethnicities <input type="checkbox"/> Other (specify) <input type="checkbox"/> I do not know <input type="checkbox"/> Prefer not to say	X	X		X	X
20. Are you married, widowed, divorced, separated, or never married? <input type="checkbox"/> Married <input type="checkbox"/> Widowed <input type="checkbox"/> Divorced <input type="checkbox"/> Separated <input type="checkbox"/> Never married <input type="checkbox"/> Prefer not to say	X	X		X	X
21. Are you pregnant, nursing, or an expecting family? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Prefer not to say	X	X		X	X
22. What is the primary language you speak? (Check all that apply) <input type="checkbox"/> English <input type="checkbox"/> Spanish <input type="checkbox"/> Other (specify)	X	X		X	X

FLOW Program Survey Question Matrix

Questions	Initial Survey	Use Survey	Adoption Survey	Alternative Filter Survey	Ongoing Surveys
23. What is the highest level of school you have completed, or the highest degree you have received? <input type="checkbox"/> Less than high school degree <input type="checkbox"/> High school degree or equivalent (e.g., GED) <input type="checkbox"/> Some college but no degree <input type="checkbox"/> Associate degree <input type="checkbox"/> Bachelor’s degree <input type="checkbox"/> Graduate degree <input type="checkbox"/> Prefer not to say	X	X		X	X
24. Which of the following categories best describes your employment status? <input type="checkbox"/> Employed, working 1-39 hours per week <input type="checkbox"/> Employed, working 40 or more hours per week <input type="checkbox"/> Not employed, looking for work <input type="checkbox"/> Not employed, NOT looking for work <input type="checkbox"/> Retired <input type="checkbox"/> Disabled, not able to work <input type="checkbox"/> Prefer not to say	X	X		X	X
25. How much total combined money did all members of your household earn in 2018? <input type="checkbox"/> \$0 - \$9,999 <input type="checkbox"/> \$10,000 - \$19,999 <input type="checkbox"/> \$20,000 - 29,999 <input type="checkbox"/> \$30,000 - 39,999 <input type="checkbox"/> \$40,000 - 49,999 <input type="checkbox"/> \$50,000 - 59,999 <input type="checkbox"/> \$60,000 - 69,999 <input type="checkbox"/> \$70,000 - 79,999 <input type="checkbox"/> \$80,000 - 89,999 <input type="checkbox"/> \$90,000 - 99,999 <input type="checkbox"/> \$100,000 or more <input type="checkbox"/> Prefer not to say	X	X		X	X

APPENDIX D - COE



Community Outreach and Education (COE)

The overarching Lead Reduction Program Communication's Strategy, process, procedures, and guidelines will apply to the FLOW Program. The success of the COE will be paramount to provide Denver Water with the necessary data and information to support the variance submittal.

All COE materials will be bilingual for ease of use. The filter kit will include the following COE materials:

Frequently Asked Questions (FAQ)

The FAQ document will provide additional information beyond the press release of the filter program. The FAQ developed specifically for the filter program will have duplicative information from the larger FLOW Program initiative FAQ approved by the EPA and CDPHE, with additional context as to why participants are receiving the filter kit, the length of the program, information about the surveys, and more.

Magnet Reminder Card

A refrigerator magnet will provide a reminder to encourage filter pitcher use for infant formula, drinking, and cooking. The magnet will also remind users to change their filter cartridge regularly. Program contact information will be included on the magnet.

Door-hanger

10% of FLOW Program participants will have door-to-door delivery of their filter kits. A door-hanger will be left on doors with the filter kit to notify Denver Water households of the FLOW Program, inform them of the contents of the filter kit, and provide contact information should the Denver Water household residents not be home during the initial door to door delivery attempt.

Survey Card

An initial survey will be included in the filter kit. FLOW Program participants will be encouraged to complete the initial survey and return their comments to Denver Water within two weeks of receiving their filter kit. Future surveys will be mailed to the FLOW Program participants with incentives such as Amazon gift cards or the chance to be entered into a drawing for a reward offered for the completion of each survey.

APPENDIX III.D.1 - ACCELERATED LEAD SERVICE LINE REPLACEMENT PLAN

September 2019



1600 S Quebec Street
Greenwood Village, CO 80111
aecom.com

**Project name: Accelerated
Lead Service Line
Replacement Plan**

**Project ref: Denver Water
Lead Reduction Plan**

To: Denver Water

From: AECOM

CC:

Date:
August 16, 2019

Appendix III.D.1 Accelerated Lead Service Line Replacement Plan

Introduction

Background and Purpose

The Denver Water Lead Reduction Program (LRP) provides a path forward for Denver Water to replace all lead service lines (including galvanized downstream of lead) within its service area (including distributors) over the next 15-years. To support this effort, the enclosed Accelerated Lead Service Line Replacement (ALSLR) Plan describes the general steps and the estimated resources needed to replace approximately 63,955 lead service lines (LSLs) with a 7.0% cumulative program year average replacement rate (or approximately 4,477 lead service lines per program year).

The goal of the ALSLR Plan is to develop an approach that allows for the consistent and reliable replacement of services over the next 15-years. The ALSLR Plan was prepared to develop a contracting and procurement strategy for Denver Water based on lessons learned from other Lead Reduction Programs (LRPs) that have successfully replaced a comparable number of lead services, on the order of a few 1000s per year. The contracting and procurement strategy for the ALSLR Plan is presented in the three construction phases: Pre-Construction Phase, Construction Phase, and Post Construction Phase. The ALSLR Plan describes the close collaboration necessary with the other LRP elements including the Filter Program Plan, Communications, Outreach and Education (COE) Plan, and Lead Service Line Inventory (LSLI – Predicative Model). The reader is directed to Table III.D-1 below, for a list of pertinent Definitions and Acronyms used in this Technical Memorandum as a reference guide.

Table III.D-1. List of Definitions and Acronyms

Definition or Acronym	Descriptions
ALSLR	Accelerated Lead Service Line Replacement
AL	Action Level
CDPHE	Colorado Department of Public Health and Environment
CI	Construction Inspector
CM	Construction Manager
COE	Communications, Outreach, and Education
EJCDC	Engineers Joint Contract Documents Committee
EPA	Environmental Protection Agency
KPI	Key Performance Indicator
LSLI	Lead Service Line Inventory
LRP	Lead Reduction Program
LRP Plan	document submitted to EPA/CDPHE as the technical document that supports Denver Water's variance request.
LSL	Lead Service Line
LSLR	Lead Service Line Replacement
Non-copper	Refers to materials such as lead, galvanized, and polyethylene
Program	Refers to program staff from Denver Water and/or program management firm as appropriate for the task at hand.
POU	Point of Use (as in POU filter)
RFP	Request for Proposal
ROM	Rough Order of Magnitude
TBD	To Be Determined
TM	Technical Memorandum
YoY	Year-Over-Year

References

1. Denver Water Standards / Specifications
2. AWWA/ANSI Standard C810-17
3. Denver Water Procurement Process
4. Predictive Model and Prioritization (Appendix III.B.3)
5. LRP Plan Submissions
6. Filter Adoption (Appendix III.C.1)
7. Filter Pilot (Appendix III.C.2)
8. Filter Program Plan (Appendix III.C.3)
9. Communications, Outreach, and Education Plan (Appendix III.A)

LRP Variance Criteria

Overview

The ALSLR Plan has been developed to meet certain Key Performance Indicators (KPIs) established in the LRP. The success of the ALSLR Plan depends on the success of other LRP elements, namely

the COE Plan and Filter Program Plan, and will undergo continuous improvement through the Learning-by-Doing element. The ALSLR Plan will address the following key LRP variance criteria elements;

- Denver Water will replace all lead services, from the main to the first fitting inside the dwelling. Lead services include galvanized pipe downstream of lead.
- The target of 7.0% cumulative program year replacements is based on a total estimated number of known and suspected lead services of 63,955.
- A LSL replacement for compliance is counted as partially¹ or fully replacing the lead or lead/galvanized service line from the water main to the premise.
- The overall LRP objective of replacing the lead service is to remove the major source of lead from customer’s drinking water supply. This implies that all portions of the lead or lead/galvanized service line will be replaced in full – no known lead service line remains. Where a portion was previously replaced - confirmed through LSL investigation activities, the remaining lead or lead/galvanized service line will be replaced. Conditions under which the lead would not be replaced are limited to earning consent from the property owner to replace the service line. If consent is not provided, additional actions are triggered, as discussed in this Plan.

The evaluation criteria and reporting needs are defined in the Terms and Conditions².

Annual LSLR Criteria and Resource Requirements

Based on the lessons learned from other LRPs as well as Denver Water’s history of LSLRs, a LSLR Resource Summary table was prepared and presents the anticipated range of level of effort (expressed as number of crews) that will be required to meet the 7.0% target for annual replacements based on various assumptions (see Table III.D-2). Denver Water’s water main replacement program as well as other similar programs has found that their LSLR crews have consistently replaced from two to four LSLs per day depending upon various circumstances. Based on the LSL inventory of 63,955, Denver Water will need approximately 6 to 11 LSLR external crews, (see Table III.D-2) to achieve an 7.0% cumulative average replacement rate (or approximately 22 LSLRs daily).

Denver Water planned a conservative approach to the Accelerated Lead Service Line Replacement Program by setting the target replacement quantity at 5,250 lead service lines per year. Targeting a higher replacement quantity is more of a safety factor than a number adjustment to achieve compliance of 7.0% cumulative program year average replacement rate. For the LRP and ALSLR Program to be successful, confirming the number of lead service lines and where the lead services are located is paramount. Starting the Program with a 15% safety factor (4,477 vs 5,250 LSLs) for the targeted program year LSLR will provide a compliance buffer of 773 LSLs. This buffer gives the ALSLR Program the ability to manage unforeseen situations that may occur in the first few years without missing the regulatory compliance goal. Additionally, the higher targeted replacement volume will help the Program not rely on other programs to provide support on LSLR and reduce potential effects of other elements (such as inclement weather and foreseen planning issues) to influence the annual replacement totals.

Table III.D-2. 15-Year LSL Replacement Resource Summary

			No. of Crews*
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¹ Reference Figure III.D-D. Non-Copper Service Line Replacement Scenarios for examples of acceptable partial LSL replacements.
² Reference Appendix IV.A.

Estimated LSL Inventory	Annual Replacement	Total Daily LSLR	LSLR/day per Crew	LSLR/day per Crew	LSLR/day per Crew	LSLR/day per Crew
	7.0%	200 work days	2	2.5	3	4
80,000	5,600	28	14	11	9	7
75,000	5,250	26	13	11	9	7
65,000	4,550	23	11	9	8	6
63,955	4,477	22	11	9	7	6
55,000	3,850	19	10	8	6	5

*Based on experience from Denver Water as well as other jurisdictions, a single crew can replace between 2 and 4 LSLs per day.

In the following sections, the ALSLR Plan will use the annual replacement target of 5,250 as the basis of calculations and resources required to meet the 7.0% cumulative program year average.

Overview of Other LRPs from Other Jurisdictions

Introduction

Denver Water reviewed the experience of other jurisdictions who replaced lead services in their water systems and the associated lessons learned helped guide the development of the proposed ALSLR Plan’s contracting and procurement strategy, including the anticipated LSLR rates, delivery delays, and risks.

The previous LRP’s experience was gathered from the City of Flint, Pittsburgh Water and Sewerage Authority, and Detroit Water and Sewerage Department based on AECOM’s experience working with these water systems as well as information that is publicly available. The City of Flint, under an Emergency Order, replaced approximately 18,000 LSLs from December 2017 to January 2019. The Pittsburgh Water and Sewerage Authority, under an Administrative Order due to multiple Action Level (AL) exceedances, is mandated to replace 7.0% of approximately 14,000 LSLs per year from June 2017 to December 2019. Per the July 2018 Michigan Department of Environment and Quality Lead and Copper Rule, the Detroit Water and Sewerage Department needs to replace more than 125,000 LSLs at a replacement rate of 5.0% per year. Key lessons learned in terms of procurement, describing the scope and responsibilities of all parties to the LRP, and defining the process and steps involved with replacing the LSLs (see Table III.D-3). A preliminary list of potential risks to delivery are summarized in Table III.D-4, based on experience gained from other jurisdictions when replacing lead services on the order of 1000s per year.

Table III.D-3: Lessons Learned from Other Jurisdictions – Procurement, Contracting, and Scoping the Work

Item No.	Description
1	Provide a standard process and expectation related to invoicing when working with multiple contractors (one form for all contracts, offset invoice submittal schedule, enough back up provided with invoice). <i>Why? This will expedite accurate budget status reporting</i>

2	<p>Delineate the roles and responsibilities regarding the Contractor and Client Representative communicating any aspect of LSLR work to Residents and ultimately to the regulatory agencies, consistent with the COE Plan.</p> <p><i>Why? This will improve the effectiveness of the COE Plan and the overall LRP.</i></p>
3	<p>Determine who will perform restoration efforts and describe scope in the Contract Documents accordingly. Consider hiring a separate contractor to be responsible for the restoration work, such that the LSLR crew is not responsible for any external restoration activities such as curb and gutter, landscaping (including turf), hardscaping, or sidewalk modifications, including:</p> <ul style="list-style-type: none"> (1) filling any excavations on private property with removed soils (2) placing sod, concrete sidewalks and any concrete hardscaping in the public right of way (ROW) (i.e., in small sections of driveway) (3) completing final street paving, sidewalk replacement, and sod after the work order is completed. <p><i>Why? This promotes more efficient restoration work process and delegates the task a Contractor more specialized in this type of work. Note that Denver Water's current policy is to provide external restoration only.</i></p>
4	<p>Determine the timelines and means and methods to communicate with the Property Owner (and Residents, if not the same) all aspects of the LSLR process. For example, the Client Representative should mail agreement packages to the Property Owners at least 45-days ahead of replacement. Details to be finalized in coordination with the COE Plan.</p> <p><i>Why? This will inform the Property Owner of work to come and how they can prepare the property for the work. This will also allow the work to be performed efficiently, avoiding delays to obtain consent on the day of work.</i></p>
5	<p>Describe expectations of the Contractor and Client Representative with respect to conducting Property Owner coordination meetings. The purpose of this meeting is to review the work process and potential restoration needs. Details to be finalized in coordination with the COE Plan,</p> <p><i>Why? Supports maintaining the customer's trust in Denver Water while allowing the work to proceed efficiently.</i></p>
6	<p>Allow one construction inspector (CI) per crew to keep up with reviewing the scope of work being performed, collecting the data necessary, and completing the daily paperwork. Communicate this expectation to the contractors bidding the work.</p> <p><i>Why? Having adequate CIs will ensure work is accurately documented and uploaded to the lead service inventory in a timely fashion.</i></p>
7	<p>Delineate roles and responsibilities for the Contractor and Construction Manager (CM) in the Contract Documents for who does what with respect to obtaining consent, flushing the service line post LSLR, and distributing filters etc.</p> <p><i>Why? This will provide more transparency of expectations and accuracy during the procurement process, while reducing costs, protecting public health, avoiding duplication of effort and improving efficiency and quality of the LRP during execution</i></p>
8	<p>Make mandatory the pre-bid conference to prevent excess time spent on RFP questions and unrealistic bids.</p> <p><i>Why? Manages effort involved to procure the construction contracts</i></p>
9	<p>Define the scope of work to attract companies that have the capability to operate with multiple crews simultaneously</p> <p><i>Why? To improve consistency of the work while reducing the level of effort to manage all the Contractors.</i></p>
10	<p>Demonstrate that contractors are qualified to perform the work. Contractors should be required to provide examples of projects with similar scale and scope to qualify for bidding. Unqualified contractors have shown that the critical schedules cannot be met, and the quality of work performed is lacking.</p> <p><i>Why? To improve the quality of the work, to deliver on KPI expectations particularly related to budget and schedule.</i></p>
11	<p>Manage the number of LSLR sites included in a work order (i.e., 200 to 500 addresses).</p> <p><i>Why? Optimizing the Contractor's amount of work will lead to better management of their work load and</i></p>

	<i>quality of work. This also allows the Program to be responsive to changing field conditions. The range of sites included in a work order will be determined during the annual ALSLR planning exercise.</i>
12	Establish the needs for master plumbers to a) connect the service line to the water main, b) install water meter boxes where needed, and/or c) inspect the meter box installation as part of developing the contract documents. Require bidders to carry to master plumbers. <i>Why? Inadequate staff of plumbers could delay meter installs and leave Property Owners without water.</i>
13	Ease the evaluation of contractor bids by assuming that at least two full LSL replacements are completed per day per contractor crew. This is an average used for bidding purposes. If a crew works a 10-hour day, an average value of four LSL replacements will be completed per day. <i>Why? This will aid in the evaluation of bid pricing, assess level of effort bid, and determine how many crews are needed to meet the targeted rate of annual LSL replacements.</i>
14	Have Contractors be responsible for documenting conditions at a property before the work commences, using photographs with notes. This will then provide the basis of any customer questions about the work. <i>Why? This puts the onus of documentation (or proof) on the Contractor and reduces risk to the Owner.</i>

Table III.D-4: Lessons Learned from Other Jurisdictions – Delivery Risk

Item No.	Description
1	Large programs need protocols for reporting and tracking data in a consistent and timely manner that allows for QA review. Although it is reasonable to expect changes to data handling will occur over the life of the Program, managing these changes to reduce the risk of delays and potential claims is recommended. <i>Why? To promote quality and timeliness in data handling while providing some degree of consistency to the contractors with respect to executing the scope of the work.</i>
2	Strategies to promote continuity over the life of the Program should be built into the ALSLR Plan and LRP in general. For example, having a mechanism that promotes for knowledge transfer as staff assigned may change over the 15-year life of the program. <i>Why? To realize program efficiencies year-over-year and supporting the Learning-by Doing element of the LRP. The intent is to reduce the impact of delays or inefficiencies when transitioning from one year to the next.</i>
3	Know the stakeholders involved and collaborate work with them to earn support for the LRP in general. Manage stakeholders through the COE Plan. <i>Why? The LRP will benefit from stakeholder input and proactively managing this will limit the potential for surprises.</i>
4	The success of the ALSLR Plan depends on participation of the property owner (and resident if not the same person) and as such the number of replacements that can be completed each year depends on earning consent from the property owner as well as the resident performing certain actions. Coordination with the COE Plan and clear protocols for multiple opportunities to communicate with the property owner and residents need to be developed. <i>Why? Poor participation rates could make it challenging to meet the annual target for LSL replacements.</i>
5	With multiple capital programs operating in the neighborhoods, coordinating schedules among the various programs for water main, road work, or other infrastructure improvements will reduce the potential inconvenience to residents in addition to realizing schedule and cost savings. Annual planning efforts for the ALSLR Plan would benefit from incorporating schedule considerations from these other infrastructure programs. <i>Why? This will demonstrate project organization to the Property Owners and reduce potential Property Owner complaints for extra work being performed.</i>

The proposed procurement strategy, contract documents to support the ALSLR Plan and the associated procedures that the work will follow are being developed based on the lessons learned from other jurisdictions and feedback received from area contractors at Industry Day and Pre-Qualification meetings.

Finding Lead and the Predictive Model

Introduction and Overview

Planning the annual lead service replacement locations and achieving the annual replacement numbers depends on knowing where lead services are in the system, so that replacement can be planned based upon:

- Individual premises with historic lead levels above 15 ppb and/or demographic risk; and
- Geographic areas with cumulative opportunities to reduce lead exposure.

As Denver Water updates its Lead Service Line Inventory (see section III.B), probability models can be used to predict where lead is likely to be found before proceeding with LSLR at a particular property. As further described in the Appendix III.B.3 (Predictive Model and Prioritization) and briefly described herein, the probability of a service line being constructed of lead will be incorporated into ALSLR planning efforts using the current service line categories as shown in Table III.D-5. To implement the ALSLR Plan, a list of properties on which to act must be extracted from the inventory on a regular basis (annually or more frequently). Actions on properties will be determined based on service line category. The service line categories and action groups in Table III.D-5 are based on the current model predictions.

Under the LRP Phase I inventory model, properties identified to have suspected or possible lead service lines will be enrolled in the Filter Program and provided with filters that are NSF certified for lead removal. Properties within LSLI Groups A and B (known, suspected, or possible lead service line, see Table III.D-5) are the focus of the ALSLR Plan as further described below. The properties with a suspected or possible LSL (Group B) will be subject to additional investigation methods and LSL replacement, if confirmed to be lead. The investigation methods will consist of either water quality sampling and/or potholing as necessary (in that order) to confirm service line material. A desk-top review will be performed along with COE as necessary on select properties unlikely to have a lead service. Frequent reviews of properties in the Predictive Model will be conducted to identify changes in Property's service line assumption category. Desk-top and field methods will be applied to the Group A and Group B properties to determine whether or not a lead service exists, with the intention of either replacing the LSL (if lead is confirmed) or removing the property from the Filter Program (if no lead is confirmed). The phased investigation methods are summarized in Table III.D-6 and were designed to answer the question "does the predictive model make sense" when assigning service line categories to properties. Details will be refined as the predictive model is used with subsequent updates to the LSLI each year.

Table III.D-5. Service Line Category and Actions

Group	Service Line Category	ACTION AND RESPONSES		
		Filter Program	Lead Inventory	ALSLR Program
A	Known lead service line	Provide Filter	Add to lead inventory as confirmed lead	1. Add to list for replacement 2. Remove from inventory / Filter Program through replacement
B**	Suspected and Possible lead service line	Provide Filter	Confirm materials (per Table III.D-6)	1. Add to list for replacement 2. Remove from inventory / Filter Program through replacement
C	Unlikely lead service line	Desk-top review / COE as necessary / Review Predictive Model output regularly for change in service line material assumption		
D	Confirmed to be lead-free	COE		
E***	Other (fire lines, recycled water taps, consecutive system)	No Action / COE		

*Table was developed using information in Appendix III.B.2 (Preliminary Identification of Lead Service Lines) and Appendix III.B.3 (Predictive Model and Prioritization).

(**) Water Quality sampling will be used to confirm the service line material for properties found in Group B.

(***) Inclusion in Group E is based on an application process, not likelihood of lead. Service lines will be maintained in the inventory. Should the application change in the future, COE material will be provided that indicates the water supply is not a suitable source of drinking water.

Table III.D-6. Summary of Phased Investigation Process

Service Line Category (probability value of lead service line)	Sequence of Investigation Method	Comment
Known or Suspected lead service line (≥ 0.8)	Confirm lead as part of replacement planning	For a property with a probability value of 0.8 or higher, the property is treated as if there is a known lead service with an investigation as part of the replacement activities.
Possible lead service line (≥ 0.5 to < 0.8)	<p>These properties will be provided with a filter that is NSF certified for lead removal in year one of the LRP.</p> <p>During year one, Denver Water will perform additional work to update the probability value determination and categorization of the property as having a known lead service line or non-lead service line.</p> <ul style="list-style-type: none"> ○ For example, a property with a probability value of 0.7 or higher* will first be subjected to a visual inspection, following by potholing, and if necessary, excavation to confirm the service line material. ○ For example, a property with a probability value of 0.6 to 0.8*, the data used to determine the p-value will be reviewed, followed with water quality sampling and contact with the property owner to understand the history of upgrades to the property. 	Denver Water will focus on investigations independent of lead service line replacements to build back-log for the ALSLR Program in subsequent years and confidence in the Predictive Model.
Unlikely to have a lead service line (< 0.5)	<p>Review historical data used to determine the probability value: does the data make sense and can outliers be explained?</p> <ul style="list-style-type: none"> ○ If not, follow-up with water quality sampling to assess likelihood for finding lead ○ If water quality sampling results are inconclusive, visit the property and conduct visual assessment and contact property owner to understand history of updates to the property, if any <p>If still inconclusive, proceed to more invasive field inspections, starting with potholing.</p>	Where a low probability value is determined for a property that appears to be an anomaly in a street or neighborhood with known lead services, Denver Water will review the factors that contributed to the probability value determination and escalate investigation as needed to confirm the presence of lead or non-lead.

(*) Indicates that the probability values are subject to change as the inventory is better detailed.

Preliminary 2020 ALSLR Plan for Discussion Purposes

The 2020 ALSLR Plan will focus on Groups A and B as outlined in Table III.D-7. Within each of these Groups, Denver Water has categorized three LSLR Groups by various types of LSL properties' conditions (Table III.D-7); Geographic LSLR Area, Individual LSLR, and Investigations of LSL types. The estimated number of LSLRs used in the 2020 ALSLR Plan is 5,250 LSL and is based on the August 2019 estimate of 63,955 LSLs with a 15% safety factor. The LSLR volumes in each category will be further developed as the LRP matures over the next 2 to 4 years and as the predictive model is

better calibrated using the Group B investigation results as well as information from Group A replacements.

Table III.D-7. 2020 ALSLR Plan Summary

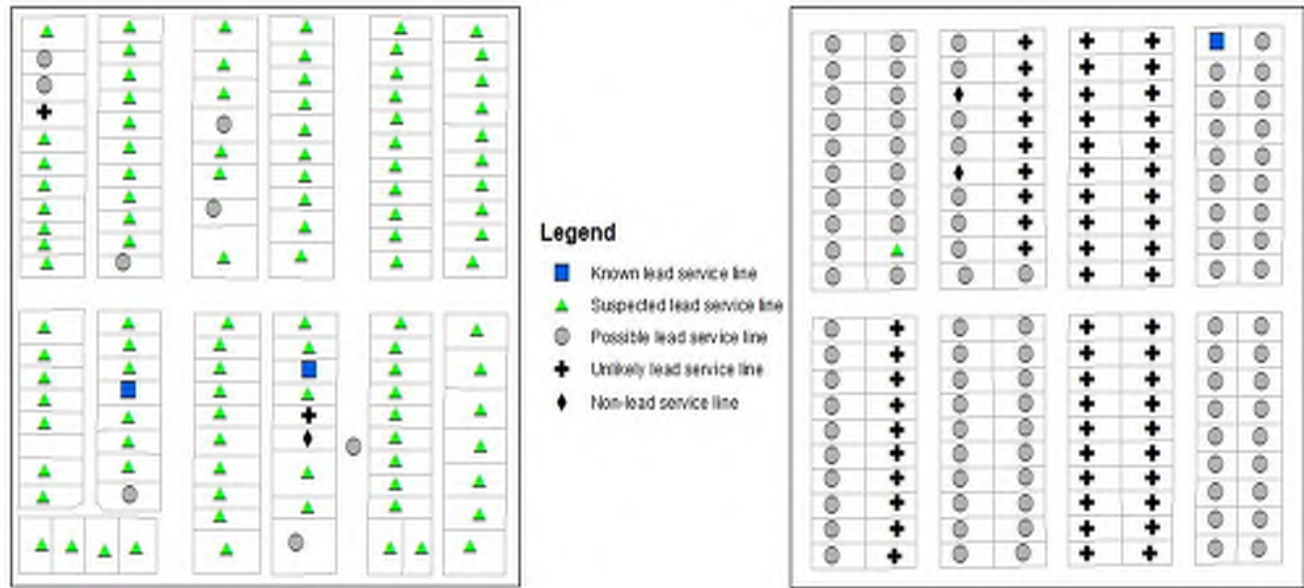
Group/Type		Est. Annual LSLR & LSL Investigation	Group Subtotals for Est. Annual LSLR and LSL Investigation
GROUP A – LSLR by GEOGRAPHIC AREA	Water main Replacement	400	
	Block by Block or Street by Street	3,000*	
	Municipal Pavement and Road Improvement Programs	450*	3,850*
GROUP A – LSLR by INDIVIDUAL	Leaks	300	
	Individual & High Priority LSLR	600*	
	Scrape Off and Redevelopment Properties	500	1,400*
GROUP B - INVESTIGATION	Investigations for areas with suspected and possible LSL	500*	
	Water Quality Testing of areas with expected or somewhat expected to have LSL	1,500*	2,000*

(*) asterisk indicates the values are subject to change.

A geographic depiction of an initial 2020 ALSLR Plan is presented below to provide an example of how the predictive model will be used to help plan the work. The example below incorporates the estimated ALSLR and LSL Investigations in Table III.D-7 (to be updated per the LSLI). In general, the Geographic Area defined by Group A (known lead) is expected to have higher per day of LSLR rates resulting from reduced effort for mobilization/demobilization while Individual LSLRs will have a lower LSL replacement rate as the result of greater efforts needed for mobilization/demobilization across an expanded geographic area. The ALSLR Plan will incorporate individual LSLRs within the Geographic Areas when located near each other and it is practical to do so.

The Geographic Area map of Figure III.D-A integrates various prioritization and risk parameters to allow the criticality of geographic areas to be ranked; this in turn is used to determine the highest priority areas to plan for a given program year’s ALSLR inventory to be addressed.

Figure III.D-A. Geographic Area (left) and Individual (right) Map Visual Representation



An example of Geographic Area LSLRs (left-side) from Group A (known lead) are shown above in Figure III.D-A. As an example, the blue (square), green (triangle), and grey (circle) colors (symbols) reflect known lead, suspect lead, and possible lead service lines, respectively. The properties, shown on the right-side map, are individual LSL properties identified in a predominately non-lead area. The properties were recognized as a high risk based on prioritization parameters that use a consequence risk analysis. Individual properties may not be in highly concentrated areas like in the geographic areas. A separate ALSLR strategy is developed for Denver Water to mobilize LSL replacement crews to address these high-risk individual properties since the level of effort will not be comparable to LSLRs in the Geographic Area model. However, the impact of replacing these Individual LSLs is just as important in terms of public health.

Properties types targeted for Individual LSLRs include:

- multi-family units,
- daycare centers,
- private schools*, and
- health facilities.

These property types have a broader impact on Denver Water’s customer base because their service lines provide clean drinking water to more than a single-family or customer.

*Service lines at all Denver public schools have been replaced.

A prioritization parameter, for both Groups A and B, is municipal (infrastructure) project data (i.e., planned project locations and times) which is used to aid in determining key areas to perform work, whether it’s pavement restoration or water main replacement. Incorporating these municipal projects into the ALSLR work is key because of the ability to reduce disturbances to Property Owner’s, reduce project costs, and facilitate service line material investigations.

Accelerated Lead Service Line Replacement Plan

Denver Water Lead Service Line Standards

Denver Water has years of experience executing LSLRs both as part of water main replacement projects as well as at individual properties. Denver Water plans to utilize their existing lead service line replacement design standards to act as a guideline for LSL replacement process completed under the ALSLR Plan. The Denver Water LSL standards state that lead service lines shall be replaced with copper service lines, provided that Denver Water is given consent by property owners. Denver Water’s

goal under the ALSLR Plan is to replace all non-copper (lead or galvanized downstream of lead) service lines from the water main to the first fitting inside the residents dwelling. The ALSLR Plan goal is to replace LSLs at a cumulative program year average replacement rate of 7.0% throughout the 15-year program.

To achieve this goal, the ALSLR Plan will require close coordination among the Filter Program, Approvals/Permits, COE Plan activities, LSLI and predictive modeling tasks, and the various stakeholders during the full life-cycle of the LSLR process. Denver Water's continued proactive approach to LSLR will require activities to be closely coordinated during three phases of the LSLR: Pre-Construction Phase, Construction Phase, and Post-Construction Phase.

ALSLR Pre-Construction Phase

The Pre-Construction Phase uses the predictive model's biannual identification of Group A and B LSL replacements and investigation of properties (see Table III.D-8), based on the hierarchical approach described earlier. These properties classified in Group A and B categories will be the focus of the ALSLR. The properties included in Group A are to be replaced in the given year based on a geographic or individual approach. The Group B properties are scheduled for investigation of the service line material type in a given year. The investigation process will require potholing and/or water sampling to determine the expected material type of the service line. If any part of the service line material is verified as lead, the properties service line information will be updated in the LSLI. The properties will be allocated to the appropriate ALSLR Group for replacement in the future. If the service line material is verified as copper, then the service line information will be updated in the LSLI, and the properties will be removed from the LSLR list. The property information will be used by Denver Water to obtain the necessary permits and approvals from the respective agencies to conduct LSL replacements. The COE Plan describes how to inform property owner (and residents, if different) of the upcoming LSL replacement. Concurrently, the Filter Program will coordinate with the resident(s) to ensure the filter devices are made available and being used.

Denver Water's current LSLR program has a standard communication timeline. The Denver Water timeline illustrates the responsible parties and specific times before, during, and after construction when Denver Water staff must contact Property Owners. The Denver Water communications outline for LSL replacement (see Figure III.D-C) will act as the foundation with updates as necessary for the larger Denver Water ALSLR Pre-/Post-Construction Property Owner Communication Timeline.

Trained program staff will distribute and collect signed Resident Consent forms to perform LSL replacement, and conduct with consenting residents a detailed explanation of the work to be performed and address any questions residents may have. A LSLR Contractor will then proceed to verify the service line material prior to starting LSLR work. Pre-Construction activities are designed to enhance the LSLR rates through earlier identification of lead services at properties with unknown service materials. Furthermore, Denver Water will document pre-construction conditions (exterior and interior) for all properties consenting to LSL replacement.

In summary, this delivery process with the associated plans overview, objectives, and metrics being measured are described in Table III.D-9 and are intended to lay the ground work for successful LSL replacement through close collaborations with all LRP elements.

Table III.D-8. LSLR Contracting Groups Summary

LSLR Groups	Descriptions
Group A (Known Lead) - Geographic LSL Replacement Area	Water main Replacement - Confirm service line material and replace LSLs concurrently with water main replacement projects.
	Block by Block or Street by Street - Confirm service line material and replacement of LSLs on Blocks or Streets. These are LSL replacements that are confirmed to have a partial- or full-lead. High priority properties will be integrated via the prioritization model. For more details, see the Appendix III.B.3 <i>Predictive Model and Prioritization</i> .
	Municipal/Transportation/Pavement Improvements - Confirm service line material and replace LSLs in coordination with Municipal, Transportation, and/or Pavement improvement projects.
Group A (Known Lead) - Individual LSL Replacement	Individual and High Priority - Confirm service line material and replace LSLs for properties providing water to day-cares, schools, nursing, jails, dialysis and critical customer facilities. Properties are known to have high lead concentrations (> 15 ppb) and consequence (depending on risk factors).
	Redevelopment and Scrape Offs - Confirm service line material and remove existing LSLs. Developer to install new service line and tap.
	Leaks - Confirm service line material and replace LSLs jointly with Denver Water's service leak repair projects.
Group B (Suspected or Possible Lead) - LSL Investigation	Investigation – Potholing and/or water sampling LSL inventory with a relatively high probability of lead classification (possible or suspected, $p \geq 0.5$). Work is to be performed separately from LSL replacement contracts. Intent is to verify if service lines are lead or non-lead.
	Declined Consent Investigation – If Resident Consent is declined, the service line material to be verified will be listed in the LSLI as not verified and placed on a list of non-consenters and supplied to Denver Water legal department. (TBD per Approved Non-Consenter Policy)

Figure III.D-C. Denver Water’s Communications Outline for LSL Replacement

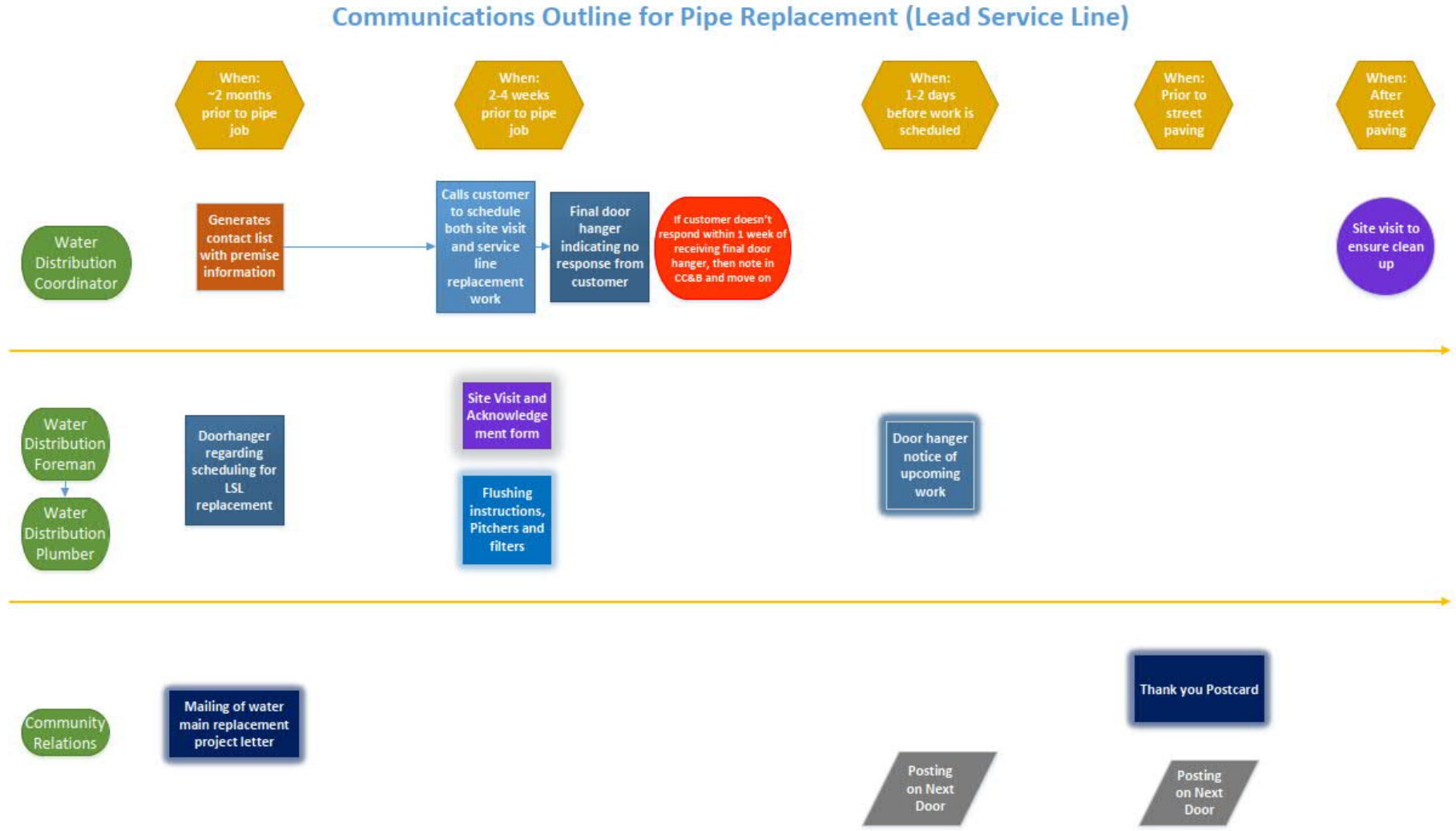


Table III.D-9. LSLR Pre-Construction Components

PREDICTIVE MODEL	APPROVALS / PERMITS	COE ALSLR PLAN
OVERVIEW		
<p>The predictive model uses the lead service line inventory to annually plan the works schedule for Group A (Geographic and Individual LSLRs) and Group B (LSL Investigations) using a hierarchical approach as described above in Table III.D-8. The Group B properties will consider field investigation results.</p>	<p>Obtain the necessary approvals, permits, and documentation prior to ALSLR work, including local governments, property owners and residents with a known, suspected, or possible LSL. The Resident Consent Form is an important approval and the protocol to engage the property owner and resident is described in the COE Plan.</p>	<p>The COE ALSLR Plan will engage public stakeholders and residents in seeking customer/resident approvals to move forward with LSLR. Program representatives will work closely with all public stakeholders and residents/customers to perform the necessary COE activities. The COE Plan describes up to three touch points with residents to confirm and obtain Resident Consent Form Approval. Efforts will be coordinated with the COE team.</p>
OBJECTIVES		
<ul style="list-style-type: none"> • Define annual ALSLR Plan. • Categorize replacements into ALSLR work groups: Investigation (green), Per Area (blue), and Individual (orange) • ALSLR work groups will act as the basis for Contracts <ul style="list-style-type: none"> ○ <i>Per Geographic Area</i> will be completed in a Block by Block or Street by Street manner. ○ <i>Individual</i> will include single LSLs in non-concentrated area and locations at properties determined to be of high lead potential and consequence. ○ <i>Investigation</i> will classify services based on likelihood (suspected or possible) that line is lead that requires confirmation. • Improve calibration of the predictive model as service line materials are confirmed; update predictive model twice a year. • Maintain independent LSL Investigation Contracts to support year-over-year planning by eliminating uncertainty of lead service line materials. <ul style="list-style-type: none"> ○ If service line is verified (potholed) to be lead, after Property Owner consent is received, it will be re-allocated to the appropriate ALSLR work group. ○ If Property Owner consent for investigation is declined, the service line material to be verified will be listed in the LSLI as not verified and placed on a list of non-consenters and supplied to Denver Water legal department. ((TBD per Approved Non-Consenter Policy) 	<ul style="list-style-type: none"> • 8 Weeks Prior to Construction (timing to be confirmed): <ul style="list-style-type: none"> ○ Apply for necessary permits (CC&B, Municipality Traffic Control Plan, Tree Protection, Stormwater Permit, Stormwater Management Plan, Dewatering Permit, Sewer Discharge Permit, Street Restoration Plan, Street/Occupancy Permit, and Regional Building Permit). <p><i>Note: Estimate of the permits needed, will vary by geographic location of service line replacements.</i></p> • 6 Weeks Prior to Construction: <ul style="list-style-type: none"> ○ Program schedules a coordination meeting with property owners and answers any questions. • 4-5 Weeks Prior to Construction: <ul style="list-style-type: none"> ○ Program holds a coordination meeting with property owners, performs a pre-construction site inspection, and determines the tie-in location of service line. • 2-3 Weeks Prior to Construction: <ul style="list-style-type: none"> ○ Contractor will contact Denver Water Sales Administrators to schedule a water main tap and survey the property for utilities. ○ Contract must verify any conflicts noted during utility survey prior to LSLR. • 2 Weeks Prior to Construction: <ul style="list-style-type: none"> ○ Program will follow-up with any non-responsive property owners to obtain consent to perform the LSLR. ○ If consent is declined by property owner, Denver Water will follow non-consent procedure. 	<ul style="list-style-type: none"> • 45-Days Prior to ALSLR Construction: <ul style="list-style-type: none"> ○ Mail LSL replacement project letters and consent form to the property owners (in their first language). • 4-5 Weeks Prior to Construction: <ul style="list-style-type: none"> ○ Program places signage in the geographic area for reminder of LSLR work to be performed. • 2-3 Weeks/Days Prior to Construction: <ul style="list-style-type: none"> ○ Program distributes informational door hangers. ○ Follow-up with property owners to address any uncertainty about the upcoming work and confirm they have signed the Resident Consent Form. • 1 Day Prior to Construction: <ul style="list-style-type: none"> ○ Provide 24-hour water outage notice in advance of LSL replacement.
METRICS		
<p>The metric to assess performance is outlined in Appendix IV.A.</p>	<p>The metric is to obtain Approvals and Permits to achieve a confirmed ALSLR with a backlog of 4 Weeks of approved Resident Consent Forms.</p>	<p>The metric to assess performance is detailed further in Appendix IV.A.</p>

TABLE III.D-9. LSLR Pre-Construction Components (Continued)

FILTER PROGRAM	ALSLR PLAN
OVERVIEW	
Customers with known, suspected, possible lead service lines will be automatically enrolled into the Filter Program and supplied with a filter kit and educational materials regarding use of the filter.	Activities will include confirmation that the Contractor has obtained the necessary approvals and permits, has all equipment and materials mobilized to the site, and is ready to commence with the ALSLR.
OBJECTIVES	
<ul style="list-style-type: none"> • 4-5 Weeks/Days Prior to Replacement: <ul style="list-style-type: none"> ○ Denver Water distributes additional NSF certified filters to remove lead, if required, during the property owner coordination meeting. • Denver Water to reinforce the message of continued use of the filters that are NSF certified to remove lead through six (6) months following LSLR. 	<ul style="list-style-type: none"> • Contractor mobilization is complete and necessary plans, permits, and approvals are in place. • Safety Plans are in-place and Crews are briefed. • COE and Filter Plans have been reviewed. • Proactively obtain Resident Consent forms. • Contractor staff trained on how to engage with the public, who to contact for help, how to safely enter a property, etc. • For properties where consent for the LSLR is not earned, the property will be placed on a list for follow-up and CDPHE notified.
METRICS	
The metric to assess performance is detailed further in Appendix IV.A.	The metric to assess performance is detailed further in Appendix IV.A.

ALSLR Construction Phase

Once the Pre-Construction Phase activities have been addressed, the ALSLR Contractor will proceed to replace LSLs per the contracting model (see Table III.D-8). The Construction Phase focus is to replace lead service lines that are known or have gone through an investigation process that has confirmed the presence of lead service lines and/or galvanized downstream of lead. The investigation process is conducted using the progressively calibrated predicative model. Based on the determination, the Program will actively work with property owners to replace the lead service based on Property Owner/Customer approval of the Resident Consent Form. The different possible insitu lead service line configurations are shown in Figure III.D-D.

Denver Water will use the configurations of Figure III.D-D to document the level of LSLR and report the LSLR credit toward the total number of replacements completed each program year. In addition to the full replacements illustrated in Figure III.D-D, Denver Water may have a unique scenario that requires only partial LSLR. When Denver Water replaces water mains, the existing service line will need to be transferred from the old water main to the new water main. This LSLR activity provides Denver Water the opportunity to replace Property Owners service lines. If the existing service line at the water main is identified as lead, Denver Water will request resident consent to investigate the service line’s material up to the first fitting inside the dwelling. However, if the property owner does not consent to having their lead service line replaced, Denver Water will only replace the LSL up to the meter regardless of the service line material from the meter to the first fitting inside the dwelling. This will not be considered a partial replacement, and it will not contribute to the cumulative program year average 7.0% LSLR.

During construction, Denver Water's Construction Inspectors (CIs) will provide field quality assurance and quality control (QA/QC) oversight for the work being performed by contractors to ensure compliance with the Contract Documents and Specifications. LSL replacement work will be overseen in the field by CIs; and the Project Engineers will review the LSL replacement data submitted, by the CI or Contractor, based on the work completed in the field. The Project Engineers will review the LSL replacement data or any reports, to ensure it is correct, before including it into the LSLI database for use by the Predictive Model.

ALSLR Post Construction Phase

Once the LSLR has been completed through the Construction Phase, the ALSLR will move forward to the Post-Construction activities to ensure the new copper service line is ready for use per AWWA/ANSI Standard C810-17 (Standard C810-17) for Replacement and Flushing of Lead Service Lines. Upon completion of the flushing procedures and water quality testing, the property's results of LSL replacement will be recorded and stored in the appropriate data management system. The Post-Construction Phase activities are further highlighted in Table III.D-10 for each component of the LRP.

Figure III.D-D. Non-Copper Service Line Replacement Scenarios

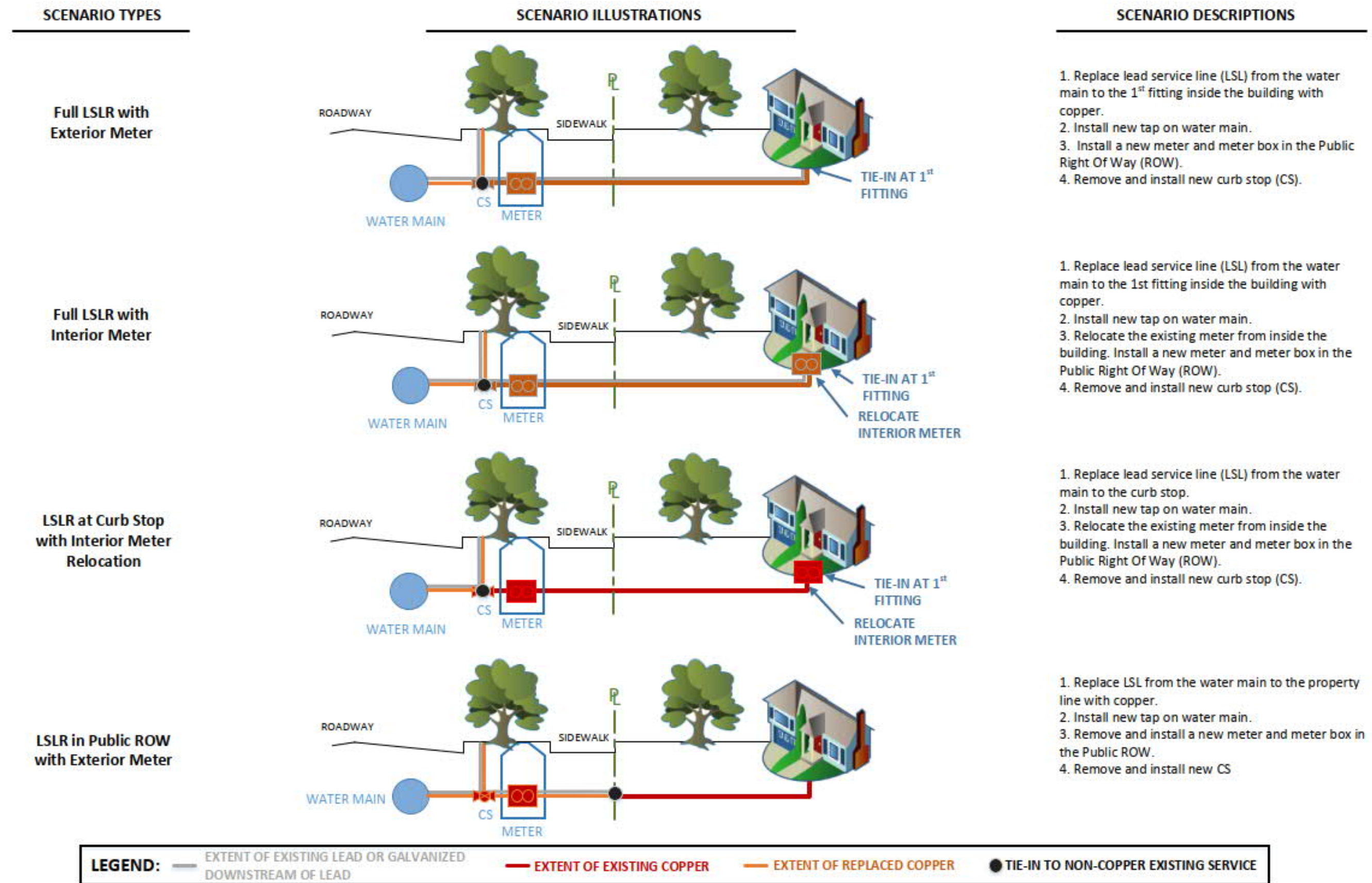


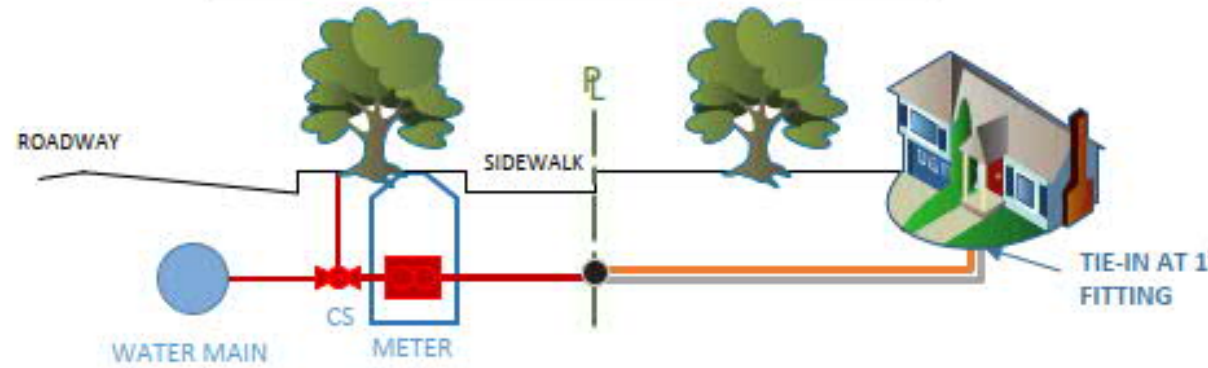
Figure III.D-D. Non-Copper Service Line Replacement Scenarios (Continued)

SCENARIO TYPES

SCENARIO ILLUSTRATIONS

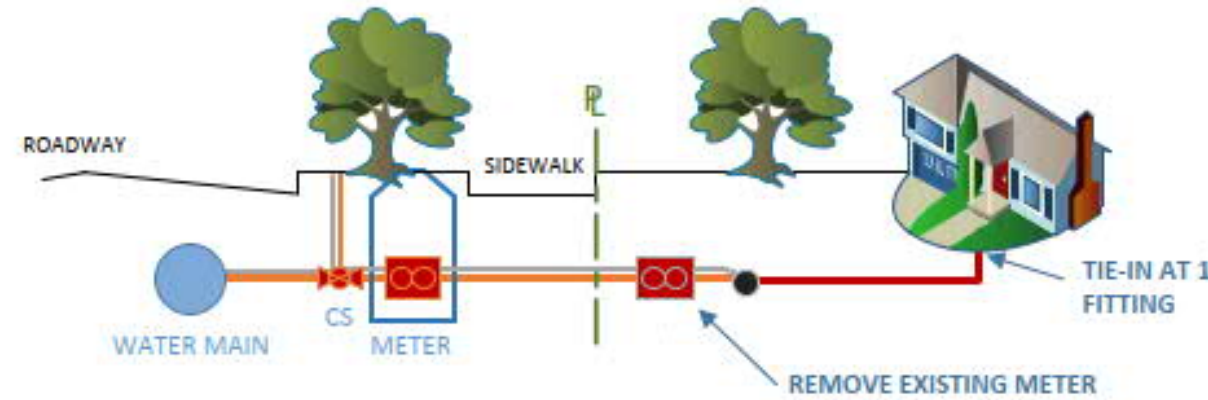
SCENARIO DESCRIPTIONS

LSLR with Lead Service on Private Property



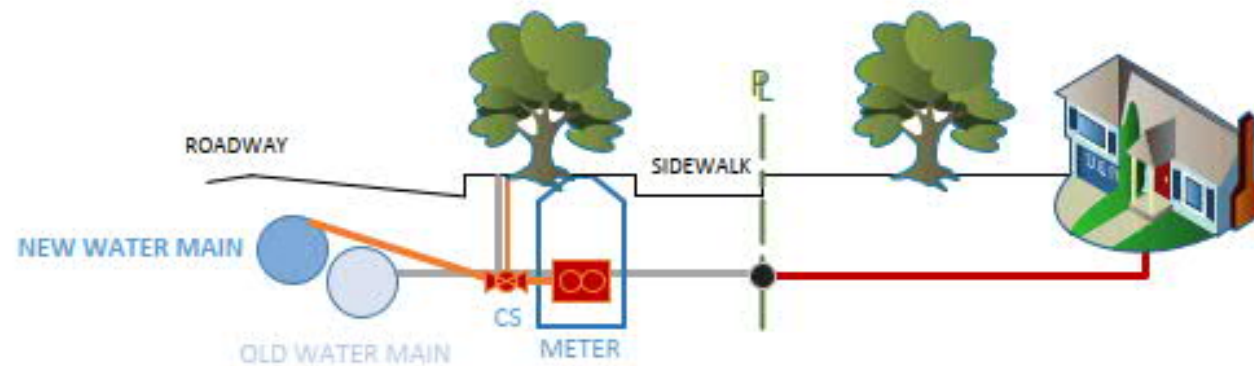
1. Remove LSL from the property line to the 1st fitting inside the building with copper.
2. Tie-in new copper service on private property to the copper service on the public property.

LSLR on Public and Private Property with Exterior Meter Relocation



1. Replace LSL from the water main to the 1st fitting inside the building with copper.
2. Install new tap on water main.
3. Remove and install a new meter and meter box in the Public ROW.
4. Remove and install new CS.

Water Main Replacement without Consent



- Consent not given by Property Owner to replace LSL during Water main Replacement Project:**
1. Replace LSL from old water main to the meter.
 2. Install tap on new water main.
 3. Remove meter and install new meter with copper service line.
 4. Remove and install new CS.
 5. Inform Property Owner that non-consent will result in a Lien on the Property's Title.

LEGEND: — EXTENT OF EXISTING LEAD OR GALVANIZED DOWNSTREAM OF LEAD — EXTENT OF EXISTING COPPER — EXTENT OF REPLACED COPPER ● TIE-IN TO NON-COPPER EXISTING SERVICE

Table III.D-10. ALSLR Post-Construction Components

PREDICTIVE MODEL	APPROVALS / PERMITS	COE PLAN	FILTER PROGRAM	ALSLR PLAN
OVERVIEW				
The LSLI will be updated with ALSLR information to reflect progress to refine the Predictive Model.	The approvals and permits must be closed out, once Group A - Geographic Area is complete.	Program team will notify the property owner of the water quality sample results and provide additional support as needed after the LSL replacement.	The Filter Program does not end with LSL replacement, Denver Water will deliver to the Property Owners the necessary information and materials to conduct a property plumbing flush and how to obtain a water quality sample.	Property Owners (Residents) will receive a new copper service line and restoration is completed.
OBJECTIVES				
<ul style="list-style-type: none"> The LSLI database will be updated through ongoing reporting and provide the Predictive Model the necessary information to develop the annual LSLR program. The LSLR crew rates will be documented to demonstrate the replacement rate of crews in the periodic LSLR progress reports. Current year LSL replacements will be monitored to confirm Denver Water is meeting the cumulative program year average replacement rate 7.0% target. 	<ul style="list-style-type: none"> Once water service has been returned to the property owner, the Program will schedule restoration work to be completed on the property. Provide list of properties where consent is denied to Denver Water legal department and CDPHE for follow-up. Place/designate non-consent residents into Denver Water LSL inventory as noted for future follow-up. 	<ul style="list-style-type: none"> Program team to provide education materials to describe how and when to flush the home by the resident. Program team to distribute water quality sampling kit, four (4) months after the LSL replacement. Program team will inform the property owners of the water quality sample results for the four (4) month post replacement sample. If water quality sample test result reveals lead level is high, the Program team will reach out to the property owner to provide additional education materials on how to identify potential sources of lead within the dwelling (plumbing), provide information on additional mitigation measures, and contact information for Community Organizations. 	<ul style="list-style-type: none"> Program team will communicate with the property owner with handouts to ensure the property owner understands the flushing and sampling programs that will be required post-construction. Program team will continue to supply filter cartridges that are NSF certified to remove lead, as needed, up through six-months following the LSLR. 	<ul style="list-style-type: none"> Program team to perform 15-minute service line flush immediately after replacement. Contractor commences restoration of the Resident's property to its pre-construction condition, which will be based on documentation obtained prior to construction. Any non-salvageable materials generated from construction will be disposed of in accordance with the local regulations. CI completes post-construction documentation (videos/photographs) of all areas restored.
METRICS				
The metric to assess performance is detailed further in Appendix IV.A.	<ul style="list-style-type: none"> No outstanding Permits with municipalities. Inspection approvals are received. 	The metric to assess performance is detailed further in Appendix IV.A.	The metric to assess performance is detailed further in Appendix IV.A.	The metric to assess performance is detailed further in Appendix IV.A.

ALSLR Contracting Strategy

Introduction

Denver Water and other third parties have been replacing approximately 1,200 LSLs over the last few years. To meet the 7.0% program year ALSLR rate, Denver Water will contract with outside resources for the additional LSLR crews as discussed above. The proposed contracting strategy is to seek qualified local contractors to support Denver Water LSLR crews to meet the 7.0% program year ALSLR rate. The procurement strategy must consider approaches to the three LSLR groups discussed in Table III.D-8: geographic area, individual LSL, and LSL investigations. Denver Water will strive through planned Industry Day events to inform the Denver Metro contracting community of the LRP's goals, objectives, and resource needs. Through Industry Days and a qualification-based selection process, Denver Water will proactively identify a shortlist of qualified ALSLR Contractors and the number of LSLR crews needed to meet the planned replacement rate. Denver Water will use a pre-qualification approach to select qualifying contractors from the qualified contractors list, request price bids that will be used in selecting the most responsive and lowest cost contractors that can either individually or collectively provide the needed ALSLR crews to support in accomplishing the 7.0% ALSLR rate.

Overview LSLR Contract Types and Goals

The different LSLR groups and contract types from Tables III.D-7 and III.D-8 will be categorized through the Predictive Model to guide the Program in the ALSLR planning and contracting strategy. Based on these LSLR groups and contract types, a rough order of magnitude (ROM) estimate was developed for the annual LSLR volume for each of the main LSLR Groups supported by each subgroup category as shown in Table III.D-11. The estimated annual LSLR targets were defined using present Denver Water replacement rates and those from other jurisdictions. The 2 LSLR crew replacement rate selected ensures Denver Water will achieve the goal of 5,250 LSLRs per program year. Group A utilizes this replacement rate. Estimated annual LSLR volumes (with an asterisk) are determined from historical data, while LSLR volumes (with no asterisk) are estimated values assigned to each group type to meet the 7.0% cumulative average LSLR. The annual work days of 200 is used to determine the total number of annual LSLRs per group type. To maintain consistency with Table III.D-2, the estimated replacements per group type is set at 2 LSLRs per crew. The replacement rate used in the calculated volumes and rates consider production differences between LSLR crews per each group type due to the nature of the work. The difference in group type production efficiency is what attributes to the number of LSLRs per day minor differences. In summary, Denver Water will need approximately 13 ALSLR crews to achieve the 7.0% LSLR cumulative average. Scrape offs/Redevelopment Properties will be performed by their respective developers and hence, Denver Water will not be providing LSLR crews for this work. However, Denver Water through the collaboration with the City and County of Denver will define a SOP to work closely to monitor these activities and account for LSL being replaced.

Table III.D-11. ROM of Annual LSLR Volume Summary

LSLR Group Type		Est. Annual LSLR Completed	Est. LSLR/Day	Est. LSLR Crews	Pre-Const. Scope	Construction Scope	Post-Const. Scope
GROUP A - GEOGRAPHIC AREA	<u>Water main Replacement</u>	400	-	-	Coordinate, schedule w/ Denver Water, COE	Verify and Replace LSL	Filter, Flushing and Restoration Work
	<u>Block by Block or Street by Street</u>	3,000*	15.0	5	Permitting, COE	Verify and replace LSL	Flushing, Restoration Work
	<u>Municipal Pavement and Road Improvement Programs</u>	450*	2.25	1	Permitting, COE	Verify and Replace LSL	Filter, Flushing and Sampling, Restoration Work
	<u>Subtotal</u>	3,850*	17.25	6			
GROUP A - INDIVIDUAL	Service Line Leaks	300	-	-	Permitting, Notifications	Leak Repair Verify and Replace LSL	Flushing, Restoration Work
	Individual & High Priority LSLR	600*	3.0	2	Permitting, Notifications	Verify and Replace LSL	Flushing, Restoration Work
	Scrape Offs and Redevelopment Properties	500	-	-	Permitting, Coordinate with Property	Replace or Remove LSL Based on New Use	Filter, Flushing and Sampling, Restoration Work
	<u>Subtotal</u>	1,400*	3.0	2			
	<u>Combined Total</u>	5,250*	20.75	8			
GROUP B - INVESTIGATION	Field Investigations for areas expected or somewhat expected to have LSL	500*	5.0	1	Permitting, Notifications	Field Verify LSL	Restoration Work and Report Findings
	Water Quality Testing of areas expected or somewhat expected to have LSL	1,500*	-	-	Notifications	Obtain Water Quality of Property	Report Findings
	<u>Total</u>	2,000*	5.0	1 - 2			

(*) asterisk indicates the values are provisional and subject to change.

(-) hyphen indicates that these group types will be completed by internal Denver Water crews.

As shown above, Denver Water’s Preliminary 2020 ALSLR Plan estimates approximately 5,250 planned LSLRs and does not include the Group B investigation category since no LSLR will be conducted as part of these investigations. Denver Water will use external contracted crews to staff up

to 13 ALSLR crews to meet the 7.0% cumulative program year average replacement goal. The Group B, Investigation category has not been included in the total due to the difficulty determining the number of non-lead service lines that will be encountered. However, the investigation category has been established to assist Denver Water in better understanding the LSL inventory that has been identified, via water quality testing or investigation activities, in areas of their system that are defined in Group B – suspected and possible to contain LSL. As discussed in the LRP, where contractors are conducting investigations only, if copper service lines are found, the lead service line inventory will be updated to reflect the copper service and be incorporated into the 7.0% compliance count. Residents in the Filter Program, found to have a non-lead service line, will be removed from the Filter Program.

Contractor Performance

In late 2019, Denver Water plans to solicit and shortlist qualified Contractors to support the ALSLR Plan. Denver Water will be seeking to identify a minimum of 16 LSLR crews or more as needed to conduct the ALSLR work in 2020. Denver Water reviewed two types of ALSLR contracting strategies;

- **Option 1 - On a single-year basis** - request price bids from the shortlist of qualified contractors to obtain the necessary qualified crews prior to the following program year (2020) ALSLR work. By awarding a finite quantity for each work type over a defined period, contractor performance can be monitored and if necessary, determine paths for improvement. This will allow Denver Water to reward the outperforming contractors with additional work during the contract period based on adjustments to their bid quantities and if necessary, unit price adjustments. The annual single year contract award will keep bid quantities and associated prices to a defined and manageable amount and scope. This will allow Denver Water the ability to manage the various aspects of the LSLRs and ensure the specific areas and needs are completed in a timely manner prior to moving to another location. This contracting process would repeat each program year by soliciting price bids from the qualified shortlist. Under the multi-year contract, task orders would be issued to the selected contracts for approximately 200 properties to help in managing the annual ALSLR program and if needed, to make adjustment during the program year.
- **Option 2 - On a multi-year basis** - request bids from the shortlist of qualified contractors to obtain the necessary qualified crews prior to the following program year (2020) ALSLR work. Denver Water will award the first-year (2020) contract to the most responsive and low-price contractor(s). The multi-year contract would have a two or three-year extension clause that would allow for annual unit quantities and price adjustments. The option for the subsequent program year's ALSLR work will be based on contractor performance: If ALSLR targets are not being met, the Contractor will be removed from the LRP. If it is determined that ALSLR targets are met, Contractors will be given the option to extend their contract for the next program years' work after successful negotiations on their unit prices. The multi-year contracts will continue with maintaining/updating bid quantities and associated prices to a defined and manageable amount and scope. This will allow Denver Water the ability to manage the various aspects of the ALSLRs and ensure the geographic and individual LSLR areas and needs are being addressed in a timely manner prior to moving to another location. Under the multi-year contract, task orders would be issued to the selected contracts for approximately 200 properties to help in managing the annual ALSLR program and if needed, to make adjustment during the year.

Denver Water favors Option 2 because of the flexibility in contracting and reduction in administrative costs to repeat the annual contracting and bidding process if not warranted. In addition, this will allow Denver Water the opportunity to adjust bid schedule unit prices (increasing or decreasing) which reflect competitively priced field tasks. In addition, this option will incentivize Contractors to perform at a higher-level of production and quality while meeting the overall LSLR goals. The incentive clause will consider three primary objectives; safety, quality, and replacement rates. Furthermore, within the first 90 days, Denver Water will use lessons learned for improvement and adjustment to the overall ALSLR

process. This multi-year approach will allow Denver Water the opportunity to make Contract Document adjusts prior to subsequent program years’ work extensions or during the recomplete of new contracts.

Learning by Doing

Denver Water’s business practice is founded on the philosophy of continual improvement and development as an organization. To that end, Denver Water will instill this philosophy through the Learning by Doing element of the LRP into the ALSLR Plan and the associated construction contracts. Bi-annually, the Learning by Doing approach will include Roundtable Partnership Meetings that will be conducted with ALSLR contractors to discuss and articulate lessons learned to promote greater safety, quality, LSLR crew efficiencies, and opportunities for improvement in all areas of the ALSLR Plan including being good neighbors in the community. The Learning by Doing approach will provide a sounding board for contractors to discuss opportunities for improvements that will help meet ALSLR objectives and provide a better understanding of issues that have arose during the program year (see Table III.D-12 for proposed discussion topics).

Table III.D-12. Learning by Doing Meeting Schedule and Proposed Topics

Meeting Type (Month)	Key Topics Discussion Items
2 nd Quarter Review	Safety Review, Communications (between Contractor-Denver Water and Contractor-Property Owner), Delays (Field Issues), Risks, Data Management (Submittal of information), LSLR Process (Best Practices), Other
4 th Quarter Annual Review	Safety Review, Communication, approvals/permits, filter, Contracting (Resources), Procurement (Unit Pricing), Replacement Rates vs. Target, Improvements to Contract & Specifications, Restoration, Data Management, Risks Review, Other Risks and Items not previously identified, Other

ALSLR Regulatory Performance Criteria

The LRP Plan is required to meet the basis of regulatory compliance by meeting the 7.0% cumulative program year average rate of replacement such that all known lead service lines are replaced within 15 years, For details please refer to Appendix IV.A, Proposed Terms and Conditions.

To evaluate the sensitivity of the calculation used to determine the cumulative rate of replacement for each program year, sample calculations were prepared Several scenarios were developed and analyzed to understand how different assumptions affect compliance and the performance of the 15 year Program, including:

- Maintaining baseline compliance replacement rates of 7.0% (baseline condition).
- Starting the Program above 7.0% replacement rates over the first half of the Program and decreasing the rate of replacement in later years of the Program (fast start, slow end).
- Completing the Program early by maintaining high replacement rates through a majority of the Programs life (early completion).
- Recovering the (cumulative program year average after with one year of poor performance (baseline plus one year poor performance).

- Starting the Program slowly with a 6.0% replacement rate in program year 1 and 6.5% replacement rate in program year 2, then maintaining the 7.0% replacement rate from program year 3 until the end of the Program (slow start).
- Poor performance (below 7.0% replacement rate) on multiple occasions in the first half of the Program to determine if it is possible to recover the cumulative program year average (failure condition).

It is evident from the results (shown in Table III.D-13) of the six scenarios that it is paramount that the Program maintain or exceed the 7.0% replacement rate. It is possible to recover from one poor performing year by exceeding the 7.0% goal for several years thereafter, but recovery after more than one year of poor performance is unlikely. Therefore, Denver Water will closely monitor ALSLR crews' performance throughout the life of the LRP and if necessary, make adjustments to address factors that hinder performance. It is anticipated that the Group A targeted rough order of magnitude LSLR volume for each type of group (Geographic and Individual) and number of crew estimates will evolve over the life of the LRP such that all known LSLs are replaced within 15 years.

Table III.D-13. Sensitivity Analysis ALSLR Performance Scenarios

Program Year	BASELINE CONDITION			FAST START/SLOW END			EARLY COMPLETION			BASELINE CONDITON + 1 YEAR POOR PERFORMANCE			SLOW START (YEAR 1 AND 2 MINIMUM) + BASELINE CONDITION			FAILURE SCENARIO		
	LSLR per Year	Average	Cumulative Average	LSLR per Year	Average	Cumulative Average	LSLR per Year	Average	Cumulative Average	LSLR per Year	Average	Cumulative Average	LSLR per Year	Average	Cumulative Average	LSLR per Year	Average	Cumulative Average
1	4477	7.0%	7.0%	5250	8.2%	8.2%	5600	8.8%	8.8%	4477	7.0%	7.0%	3837	6.0%	6.0%	3200	5.0%	5.0%
2	4477	7.0%	7.0%	5000	7.8%	8.0%	5600	8.8%	8.8%	4477	7.0%	7.0%	4157	6.5%	6.2%	3400	5.3%	5.2%
3	4477	7.0%	7.0%	5000	7.8%	7.9%	5600	8.8%	8.8%	4477	7.0%	7.0%	4477	7.0%	6.5%	4477	7.0%	5.8%
4	4477	7.0%	7.0%	4800	7.5%	7.8%	5600	8.8%	8.8%	4477	7.0%	7.0%	4477	7.0%	6.6%	3200	5.0%	5.6%
5	4477	7.0%	7.0%	4800	7.5%	7.8%	5600	8.8%	8.8%	4477	7.0%	7.0%	4477	7.0%	6.7%	4477	7.0%	5.9%
6	4477	7.0%	7.0%	4700	7.3%	7.7%	5250	8.2%	8.7%	4477	7.0%	7.0%	4477	7.0%	6.8%	4477	7.0%	6.1%
7	4477	7.0%	7.0%	4500	7.0%	7.6%	5250	8.2%	8.6%	1000	1.6%	6.2%	4477	7.0%	6.8%	4750	7.4%	6.3%
8	4477	7.0%	7.0%	4500	7.0%	7.5%	5250	8.2%	8.6%	6000	9.4%	6.6%	4477	7.0%	6.8%	4750	7.4%	6.4%
9	4477	7.0%	7.0%	4500	7.0%	7.4%	5250	8.2%	8.4%	5250	8.2%	6.9%	4477	7.0%	6.9%	500	0.8%	6.2%
10	4477	7.0%	7.0%	4400	6.9%	7.4%	5250	8.2%	8.5%	5250	8.2%	6.9%	4477	7.0%	6.9%	5724	9.0%	6.1%
11	4477	7.0%	7.0%	4300	6.7%	7.4%	5000	7.8%	8.4%	4477	7.0%	6.9%	4477	7.0%	6.9%	5000	7.8%	6.2%
12	4477	7.0%	7.0%	4250	6.6%	7.3%	4705	7.4%	8.3%	4477	7.0%	6.9%	4477	7.0%	6.9%	5000	7.8%	6.4%
13	4477	7.0%	7.0%	3300	5.2%	7.1%	-	-	-	4477	7.0%	7.0%	4477	7.0%	6.9%	5000	7.8%	6.5%
14	4477	7.0%	7.0%	3255	5.1%	7.0%	-	-	-	4477	7.0%	7.0%	4477	7.0%	6.9%	5000	7.8%	6.6%
15	1277	2.0%	6.7%	1400	2.2%	6.7%	-	-	-	4477	7.0%	7.0%	2237	3.5%	6.7%	5000	7.8%	6.7%

(-) Dash denotes no further work to be performed.

Average – Means the program year replacement rate.

Procurement Strategy

Introduction

The ALSLR Plan contracting strategy will use Denver Water's procurement office to establish a standardized procurement process to notify and solicit qualifications and bids from outside contractors. To support this procurement process, Denver Water will provide an ALSLR Contract Document that includes standard front-end contract documents supported by technical specifications, supplemental specifications, and standard drawings for all components of the ALSLR work. The LSLR Contract Manual will contain the necessary bid forms that will govern the work to be conducted and payment for this work on a unit price basis. Denver Water will use three bid schedules based on the type of Groups identified above; Geographic, Individual, and Investigation.

Denver Water Purchasing utilizes the Rocky Mountain E-Purchasing System that helps to provide greater visibility to the contracting industry. The Rocky Mountain E-Purchasing System will be utilized as well as other notifications process for Industry Day, the subsequent Request for Qualifications (RFQ).

Denver Water promotes inclusiveness in their procurement process based on setting goals for Minority, Women, and Veterans owned businesses or Special Business Enterprise (SBE) and Minority Business Enterprises (MBE). To continue with best practices in the community and construction industry and to foster inclusion of qualified SBE's/MBE's, Denver Water will establish minimum goals for participation as a percent of construction dollars for construction contracts under the LRP.

ALSLR Contractor Procurement

Qualified Contractors who have been determined as most responsive and lowest price will be selected based on a task order format to focus on three LSLR Group areas: Geographic Area, Individual, and Investigations as further described below. The Plan may adjust the contracting and procurement strategy for this work as the ALSLR work evolves and specific or specialty work items are better identified that would warrant individualizing a specific scope of work outside of those already planned.

Lead Service Line Replacement Contractors will have a task order that defines scope of work (upwards of 200 properties) to replace lead service lines from the main to the first fitting within the dwelling and conduct restoration of disturbed areas. The LSL replacements scope will include from connection to the water main, meter box replacement (if not already located outside the property), curb stop replacement, and plumbing connections inside the resident home. ALSLR contractors will be expected to have excavation, boring, and plumbing capabilities to complete the replacements. Contractors will mobilize to one geographic area to replace multiple services in a given block, while others will replace individual lead service lines in high priority locations. Construction Liaisons will be present during construction to manage communications with Property Owners and Contractors. The Contractor will not be expected to interface or coordinate with the Property Owners.

Investigation Contractors will have a task order scope of work to verify whether a lead service line exists ahead of the replacement crews. These contractors will be expected to use different methods of excavation, hand digging, potholing, meter box viewing, and interior dwelling investigation. Their productivity and ability to verify the presence of a LSL will help in better updating the LSLI and calibration of the predictive model. By improving the LSLI database, the predictive model will help in

assuring task orders for various LSLR groups will assist in keeping the replacement contractors on schedule and achieve the annual ALSLR target. Construction Inspectors will report their findings to the Program team so that the LSLI can be updated, the prioritization model can be adjusted, and planning for replacement can be performed. Construction Liaisons will be present during construction to manage communications with Property Owners and Contractors. The Contractor will not be expected to interface or coordinate with the Property Owners.

Scheduling and Coordination

To promote the LRP, ready the contracting community for ALSLR work, and gauge the interest of the contracting community, an open house (referred to as an Industry Day) will be planned for early August 2019. During the Industry Day, contractors will learn more about the LRP goals and expectations and Denver Water can also use this event as a forum to receive Construction Industry feedback. This will benefit not only potential bidders, but also the Program team in finalizing the contracting and procurement strategies. The dialogue from the Industry Day will be used to discuss unit price bidding options, clarify specifications, and aid in assigning risks within the construction contract document. The event will be advertised through the Rocky Mountain System BidNet, the Colorado Contractors Association, Denver Water's Public Information, and other appropriate channels. This event will be in advance of the formal qualification process so that the information gathered and shared can be used by Denver Water to develop the qualification package and contract documents.

A Request for Qualifications Process will follow the Industry Day to solicit specific information on relevant work experience, bonding, insurance, key staff, and overall capacity and approach. The qualifications packages will be evaluated, and a short list of contractors will be developed. If needed, interviews can be conducted during this stage. Once the short list of contractors is developed, these contractors will be invited to a price bid on three bid forms; Group A – geographic, Group A – individual, and Group B - Investigations.

All Contractor Procurement Contract Documents are expected to be finalized by October 15, 2019 and to allow the bid process to move forward once the LRP variance is approved. The current timeline and milestones for the Procurement and Contracting of the ALSLR Plan are illustrated below in Table III.D-14.

Table III.D-14. Timeline and Milestones for Procurement and Contracting, Example

Description	Estimated Timeframe
Request for Qualifications (RFQ) Notification	August 2019
Receive RFQ	Mid-September 2019
Shortlist Qualified Contractors	Early October 2019
Finalize Accelerated Lead Service Line Contractor Contract Documents	October 15, 2019
Finalize ALSLR 2020 Work Plan	Mid October
Request for Unit Bid Price Proposals (RFP)	Mid October
Pre-Bid Meeting	TBD
Bid Opening	Early November
Bid Awards	Mid November
Notification of Selected ALSLR Contractors (Multiple)	TBD
Issue Task Orders	TBD
ALSLR Notice to Proceed	January 2020

Summary

Denver Water through a proven process will procure the needed qualified contractors for successful implementation and completion of the annual ALSLR Program. Denver Water is committed to providing the necessary resources to meet the ALSLR cumulative program year replacement rate goal of 7.0%.

APPENDIX III.E.1 - LEAD SEQUENTIAL SAMPLING STUDY

September 2019

Appendix III.E.1

Lead Sequential Sampling Study

Background

The purpose of this study is to gain a better understanding of the comparative influence of existing lead service lines (LSLs) and copper with lead solder (Cu w/ Pb) in addition to galvanized (GAL) plumbing downstream of an existing or replaced lead service line on lead levels at customers' taps.

Sequential sampling of individual homes was used to capture water quality samples representing various plumbing material types within a single premise to understand the amount of lead released from those materials.

Sequential sampling entails taking multiple water quality samples from a customer's tap, one after another, to discern how water quality changes throughout the premise plumbing and service line. Three categories of homes were sought to take part in the study: 1) homes with lead service lines (LSL), 2) homes with copper with lead solder (Cu w/ Pb) and 3) homes with galvanized (GAL) plumbing downstream of an existing or replaced lead service line. To date, thirty-two Denver Water customers' homes have been potholed in search of homes that meet the criteria of the study. This report highlights the results of the three rounds of quarterly sampling that took place in Q4 of 2018 as well as Q1 and Q2 of 2019.

Study Design

- The sampling methods used for this study were informed by the work of Michael Schock et. al as outlined in the presentation, "Lead Tap Sampling Approached: What Do They Tell You".
- Lead concentration were measured via the EPA method 200.8 and are presented as dissolved lead in this report.
- The sequential sample volumes outlined below were collected after a minimum 6-hour stagnation time from the cold-water kitchen or bathroom faucet.
 - o 125mL, 125mL, 250mL, 250mL, 250mL, 500mL (as many 500mL samples as necessary to capture service line volume back to the main based on a calculated volume of the plumbing system).
 - o Five additional 1000mL samples were collected at the end of the sequence after the 1st round of sampling to ensure that final sample represented water originating from the main and not sitting in the service line during stagnation.
- A volume weighted lead concentration of the first 5 samples (1000mL cumulative) was calculated to determine the "Calculated 1st Draw" lead concentration. This concentration represents the expected concentration of an LCR compliant first draw sample.

First Round Sampling Results

- Lead Service Line Homes
 - o Seven of the identified homes were confirmed by potholing to have lead service lines.
 - All results for the first-round sampling of LSL homes are shown in Figure 1 below.
 - The average "Calculated 1st Draw" lead concentration was 6.1 ppb.

- The average of the highest measured lead concentration from all LSL homes was 13.9 ppb. The maximum lead concentration for any LSL home was 23.4 ppb.
- Copper with Lead Solder Homes
 - Seven of the identified homes were confirmed by potholing and internal plumbing inspection to have copper with lead solder.
 - All results for the first-round sampling of Cu w/ Pb homes are shown in Figure 2 below.
 - The “Calculated 1st Draw” lead concentration for all Cu w/ Pb homes except one was below the minimum reporting limit (MRL) of 1 ppb.
 - The one exception (Garrison St.) had a “Calculated 1st Draw” lead concentration of 4.9 ppb and a maximum lead concentration of 8.6 ppb. It was hypothesized that the results from this home were artificially high due to particulate that was observed in the samples and believed to be caused by closing the hot water shut off valve for the “first time in 20 years”, according to the customer.
 - Re-sampling was performed at this home the following month and lead concentrations of all samples were below 1.7 ppb with a “Calculated 1st Draw” lead concentration of 1.2ppb. The re-sampling results are labeled “S Garrison RS” in the Figure 2 below.
 - None of the Cu w/ Pb homes had a single sample with a lead concentration of 1.8 ppb or greater (initial Garrison results excluded).
 - The average of the highest measured lead concentration from all copper with lead solder homes was 1.1 ppb (2.2 ppb when including the initial Garrison results).
 - During the first round of sampling, no homes were identified to have galvanized plumbing downstream of an existing or previously replaced lead service line.

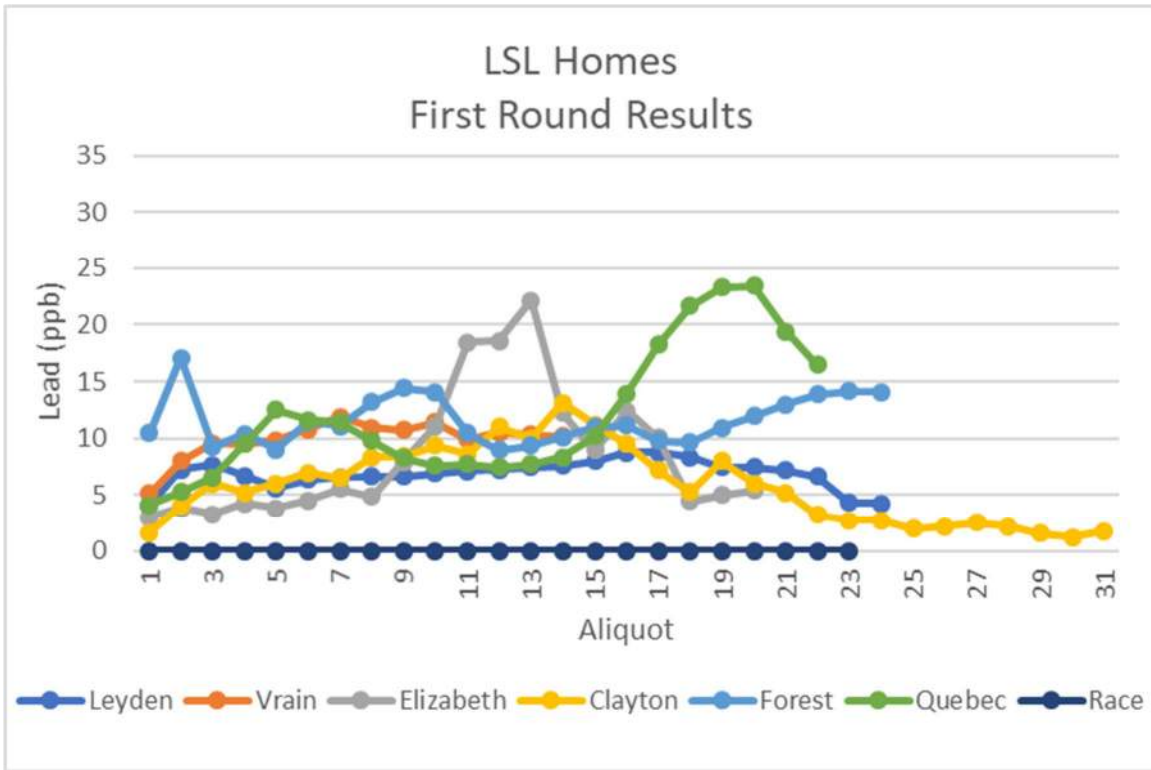


Figure 1 – First Round LSL Homes Results

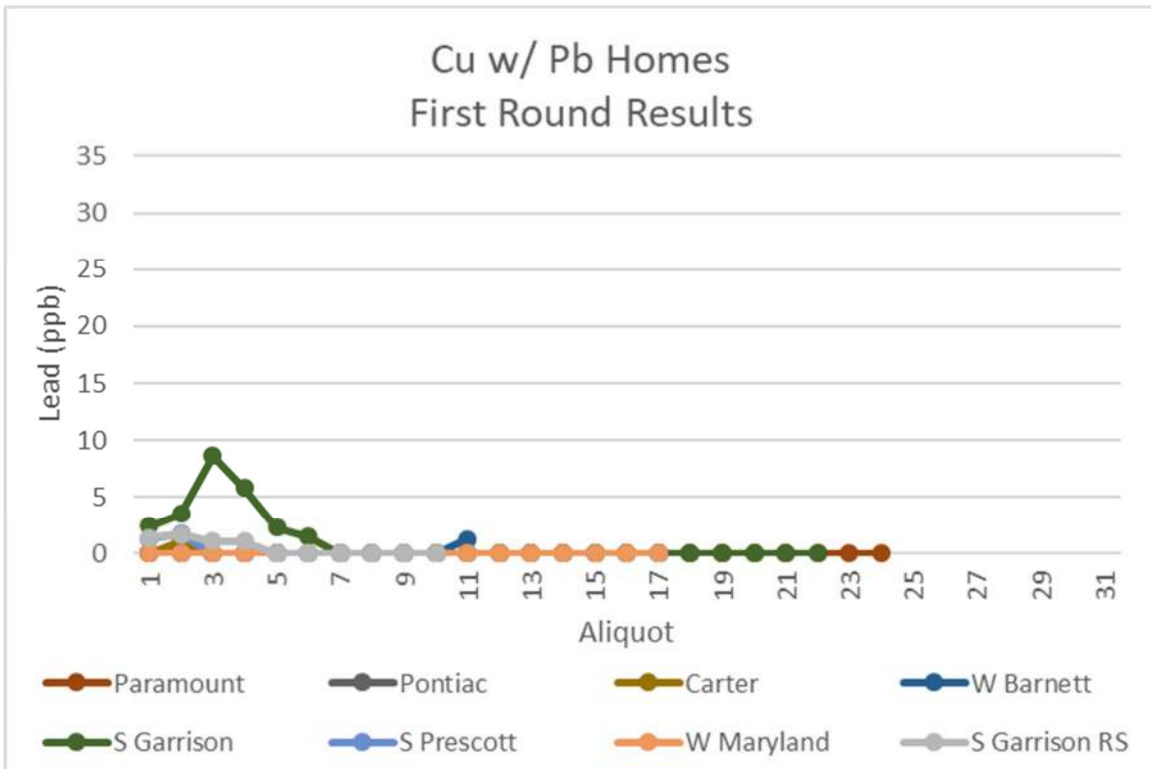


Figure 2 – First Round Cu w/ Pb Homes Results

Second Round Sampling Results

- Lead Service Line Homes
 - o The same seven lead service line homes from the first round of sampling were sampled again 2-3 months later. Two additional lead service line homes were identified to represent portions of the distribution system not captured in the initial round of sampling for a total of 9 homes sampled.
 - All results for the second-round sampling of LSL and GAL homes are shown in Figure 3 below.
 - The Race St. home was confirmed to have a lead service line despite all samples measuring below the MRL.
 - The average "Calculated 1st Draw" lead concentration for LSL homes was 4.6 ppb.
 - The average of the highest measured lead concentration from all LSL homes was 15.9 ppb. The maximum lead concentration for any LSL home was 33.6 ppb.

- Copper with Lead Solder Homes
 - o Six of the copper with lead solder homes sampled in the first round of sampling were sampled again 2-3 months later. One of the homes dropped out of the study.
 - All results for the second-round sampling of Cu w/ Pb homes are shown in Figure 4 below.
 - The average "Calculated 1st Draw" lead concentration for Cu w/ Pb homes was below the MRL.
 - The average of the highest measured lead concentration from all copper with lead solder homes was 1.5 ppb.
 - No sample from any of the Cu w/ Pb homes in the second round of sampling had a lead concentration greater than 4.3 ppb.

- Galvanized Plumbing Downstream of a Replaced Lead Service Line
 - o All results for the second-round sampling of GAL home are shown in Figure 3 below.
 - o Only one home with galvanized plumbing downstream of a replaced lead service line was identified for the second round of sampling. This home is identified as Mariposa in Figure 3.
 - o Of all the 15 homes sampled, the galvanized home had the 3rd highest "Calculated 1st Draw" lead concentration at 8.6 ppb. The galvanized home also had the 3rd highest maximum lead concentration at 25.8 ppb.
 - o The lead levels released from the galvanized home were similar to the lead service line homes.
 - o It is of interest to note that lead levels spike earlier in the sampling sequence for the GAL line compared to LSLs. This is indicative of galvanized internal plumbing acting as a source of lead.

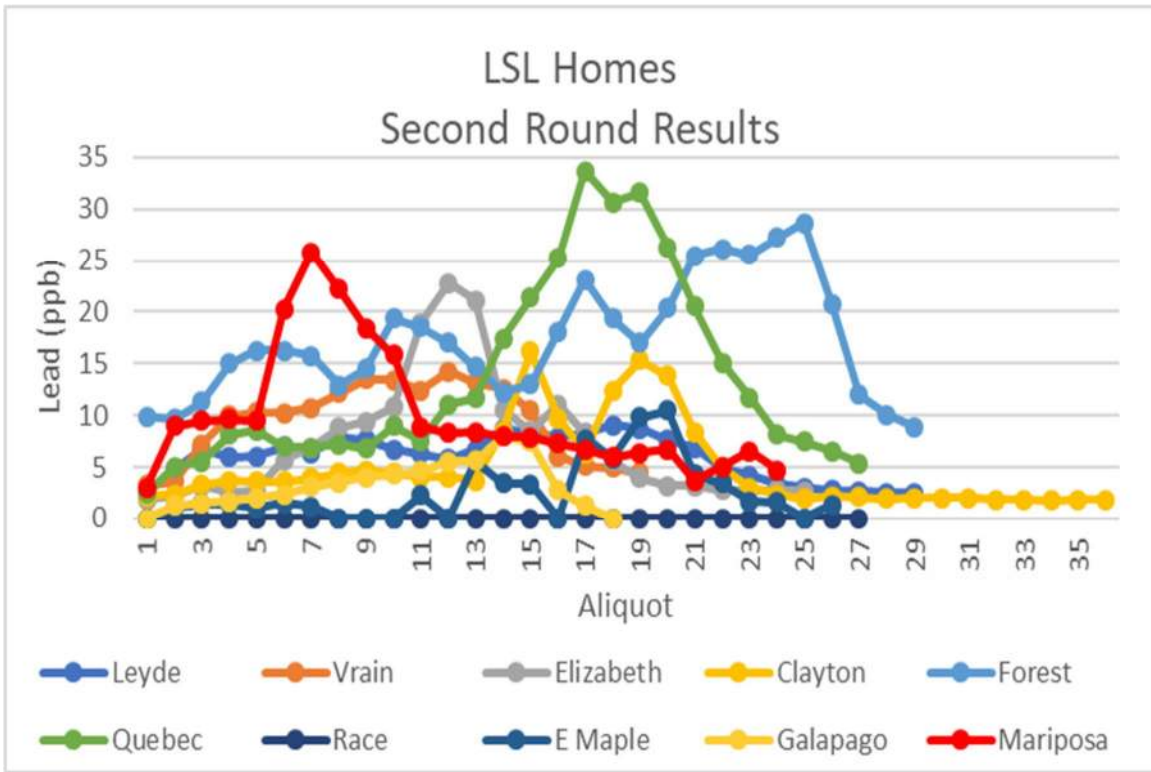


Figure 3 – Second Round LSL and GAL Homes Results

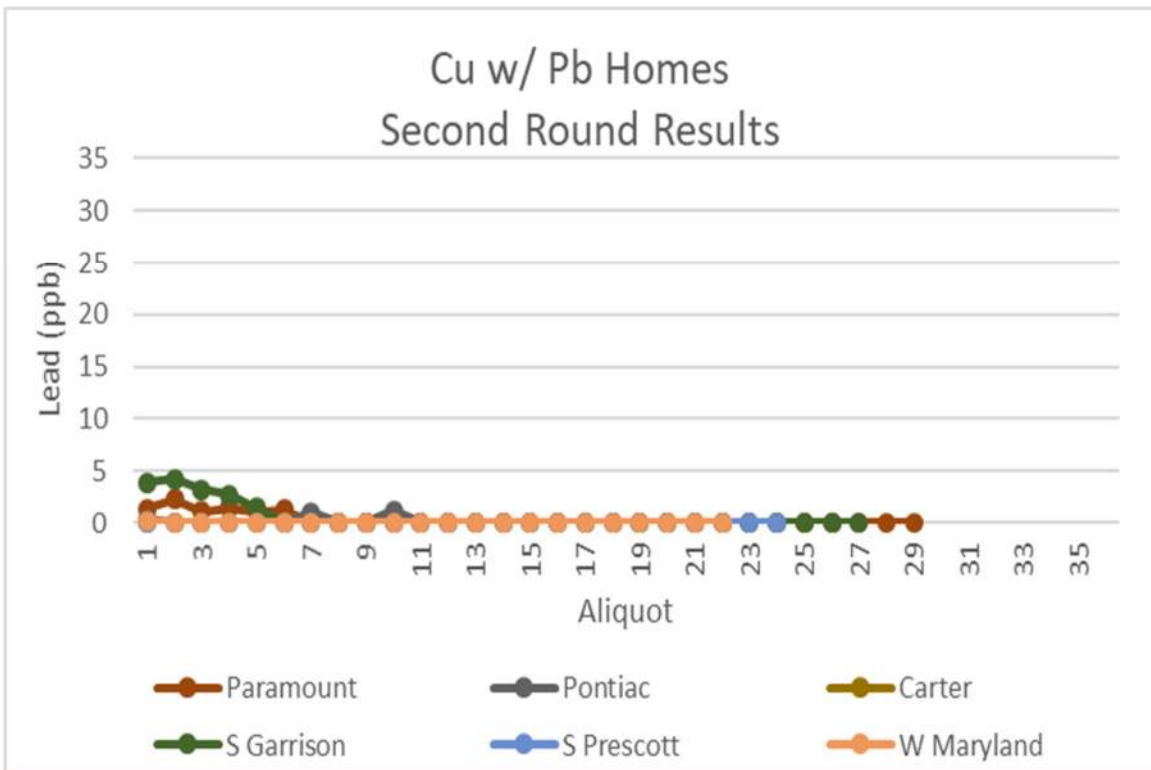


Figure 4 – Second Round Cu w/ Pb Homes Results

Third Round Sampling Results

- Lead Service Line Homes
 - o For the third round of sequential sampling, one of the original homes (Forest St) dropped out of the program. Eight LSL homes remained in the study for the 3rd round.
 - All results for the second-round sampling of LSL and GAL homes are shown in Figure 5 below.
 - Overall, lead levels in all samples were significantly lower for the 3rd round of sampling. The highest measured lead value from any LSL home sample was only 10.4 ppb.
 - The average "Calculated 1st Draw" lead concentration for LSL homes was 1.8 ppb.
 - The average of the highest measured lead concentration from all LSL homes was 7.2 ppb.

- Copper with Lead Solder Homes
 - o The six homes from the second round of sampling were sampled again for round three.
 - All results for the second-round sampling of Cu w/ Pb homes are shown in Figure 6 below.
 - Lead levels from Cu w/ Pb homes were significantly lower for the 3rd round of sampling. Only two samples from any of the Cu w/ Pb homes in the third round had a lead concentration above the MRL, both of which came from the Garrison St. home.
 - The average "Calculated 1st Draw" lead concentration for Cu w/ Pb homes was below the MRL.

- Galvanized Plumbing Downstream of a Replaced Lead Service Line
 - o Despite multiple attempts to contact the owner of the GAL home, samples were not collected for the third round.
 - o One other home has been identified that potentially meets the requirements of the study. At the time of writing this report, sample collection is being scheduled with the homeowner.

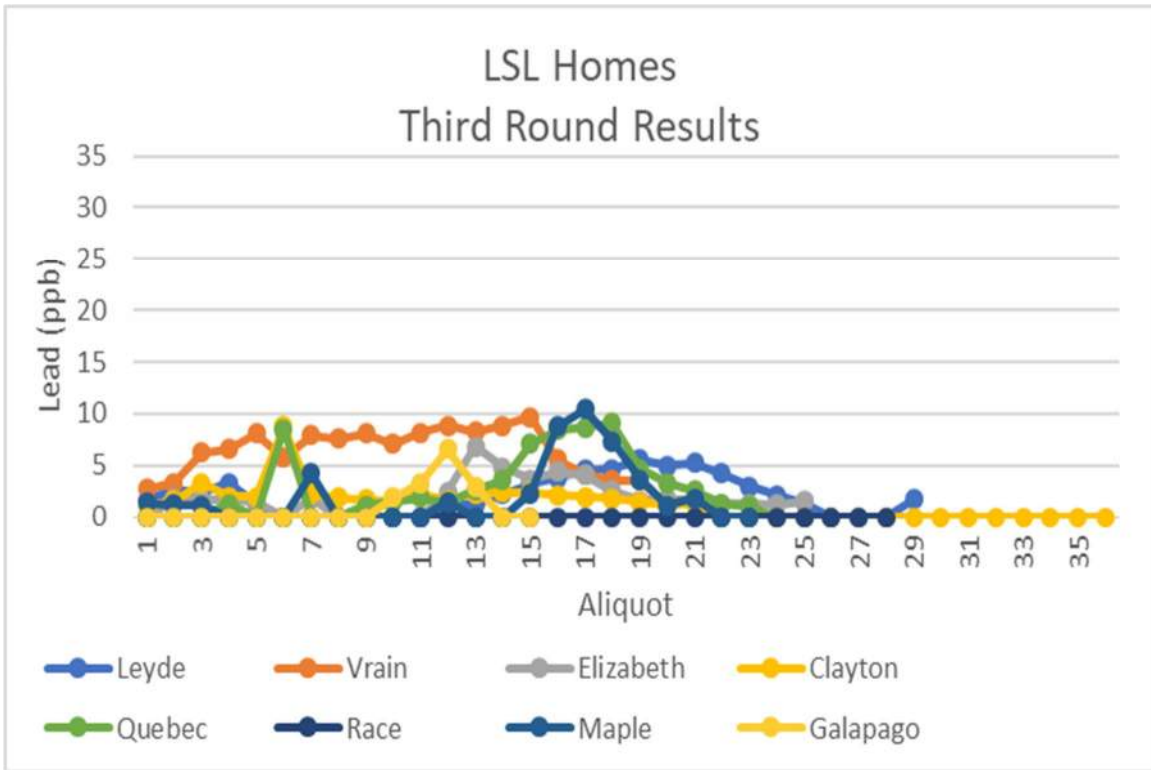


Figure 5 – Third Round LSL Homes Results

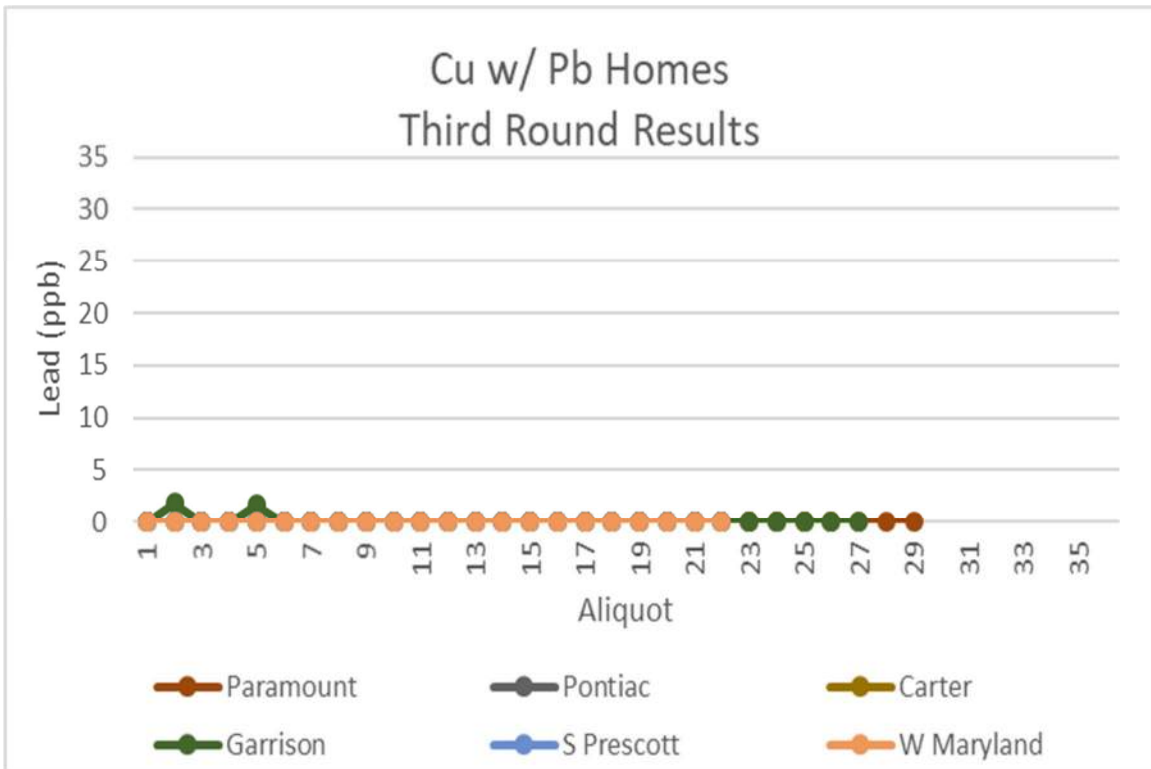


Figure 6 – Third Round Cu w/ Pb Homes Results

Conclusions

- Of the homes sampled in sequential sampling study, lead service lines overwhelmingly represented the greatest source of lead when compared to copper with lead solder.
 - o Not including the first-round initial sampling at S Garrison as explained above, all samples events at copper with lead solder (Cu w/ Pb) homes yielded maximum lead concentrations below 5 ppb.
 - o Conversely, all sampling events at lead service line (LSL) homes yielded maximum lead concentration greater than 5 ppb. The maximum Pb concentration measured from any LSL home was 33.6 ppb.
- The first liter of water from the tap, represented by the first 5 sample aliquots in this study and used to derive the "Calculated 1st Draw" lead concentration, contained nearly all the lead released from a copper with lead solder home in this study.
 - o Only 3 samples from Cu w/ Pb homes had a lead concentration greater than the MRL after the 5th aliquot (representing a 1-liter first draw). These three samples were all less than 1.4 ppb.
 - o These results are consistent with those found in the customer requested sampling program.
 - Table 1 below highlights the similarity of results from the customer requested sampling program (1196 sampling events over 3 years) compared to the sequential sampling study (20 sampling events over 9 months) for Cu w/ Pb homes.
 - First, second, and third draw equivalent samples were calculated based on the sampling procedure described below to make the comparison between the two different data sets.
- The "Calculated 1st Draw" concentrations for lead service lines are lower than subsequent aliquots and therefore under-represents the amount of lead released from a lead service line home.
 - o Only one LSL home during one sampling round had a maximum lead concentration occur in the first five aliquots.
- The single galvanized home participating in the study yielded lead levels similar to LSL homes. However, the peak lead level in the GAL home occurred in an earlier sample in the sampling sequence compared to LSL homes.
 - o Caution must be used when viewing the results from the GAL home. The results from the single GAL home sampled in this study may not be representative of other galvanized homes within the distribution system.
 - o The lead results from GAL home are consistent with the hypothesis that galvanized pipe acts as a lead sink while downstream of a lead source (i.e. lead service line) and then acts as a lead source once the original source of lead has been removed.

Figures 6-10 summarize the lead results from the three rounds of sequential sampling. Lead concentrations below the reporting limit of 1 ppb are reported as 0 ppb.

Table 1 – Comparison Between Customer Requested Sampling and Sequential Sampling Results

	Decade of Home Construction	Average Lead (ppb)			50 th Percentile Lead (ppb)			90 th Percentile Lead (ppb)		
		1 st Draw	2 nd Draw	3 rd Draw	1 st Draw	2 nd Draw	3 rd Draw	1 st Draw	2 nd Draw	3 rd Draw
Customer Requested Sampling Results	1952-1959	1.13	0.62	0.7	0.5	0.5	0.5	2	0.5	0.5
	1960-1969	1.18	0.85	0.72	0.5	0.5	0.5	3	0.5	0.5
	1970-1979	2	0.69	1.14	0.5	0.5	0.5	3	1.5	0.5
	1980-1982	1.19	0.67	0.5	0.5	0.5	0.5	2	1.16	0.5
	1983-1987	1.01	0.48	0.48	0.5	0.5	0.5	2	0.5	0.5
Sequential Sampling Study Results	Copper with Lead Solder Homes	0.8	0.1	0.1	0.0	0.0	0.0	2.9	0.0	0.0

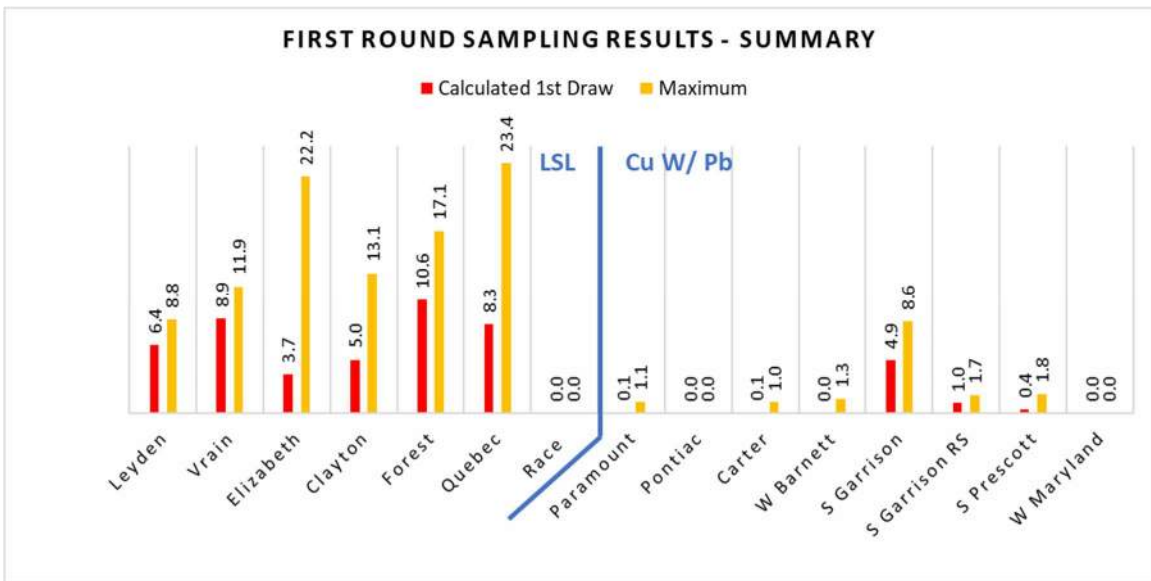


Figure 7 – First Round Sampling Lead Results as ppb

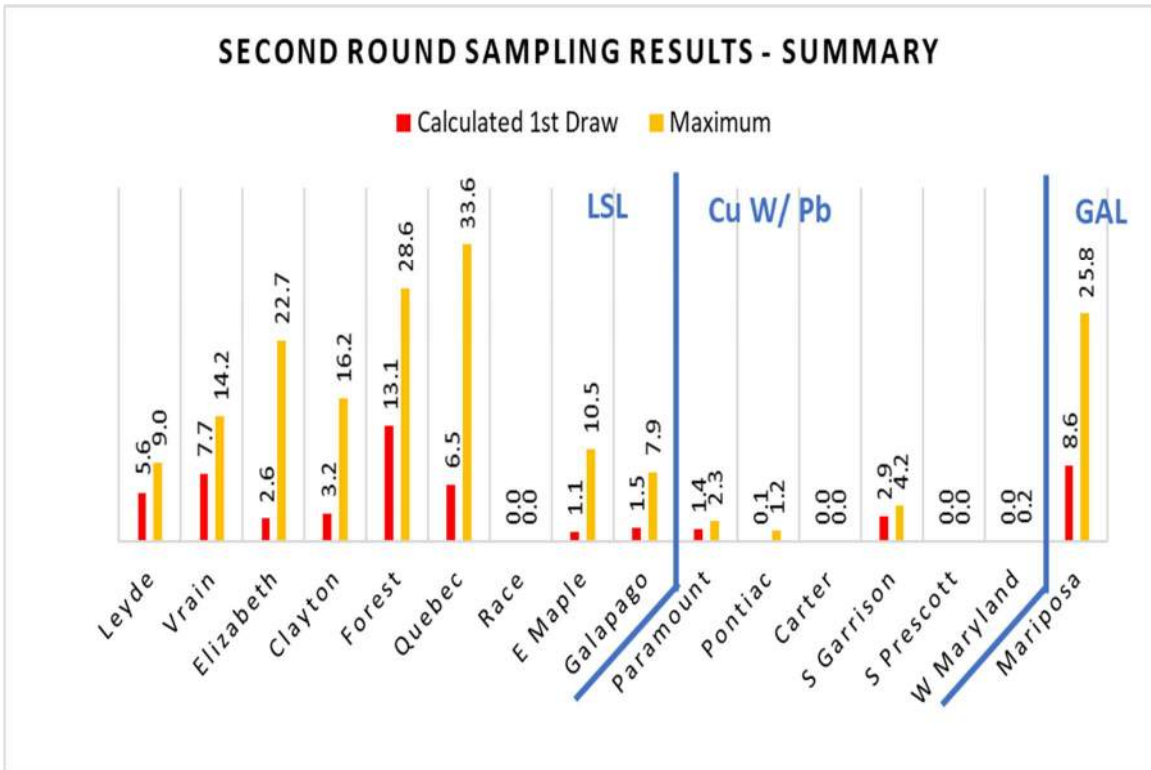


Figure 8 – Second Round Sampling Lead Results as ppb

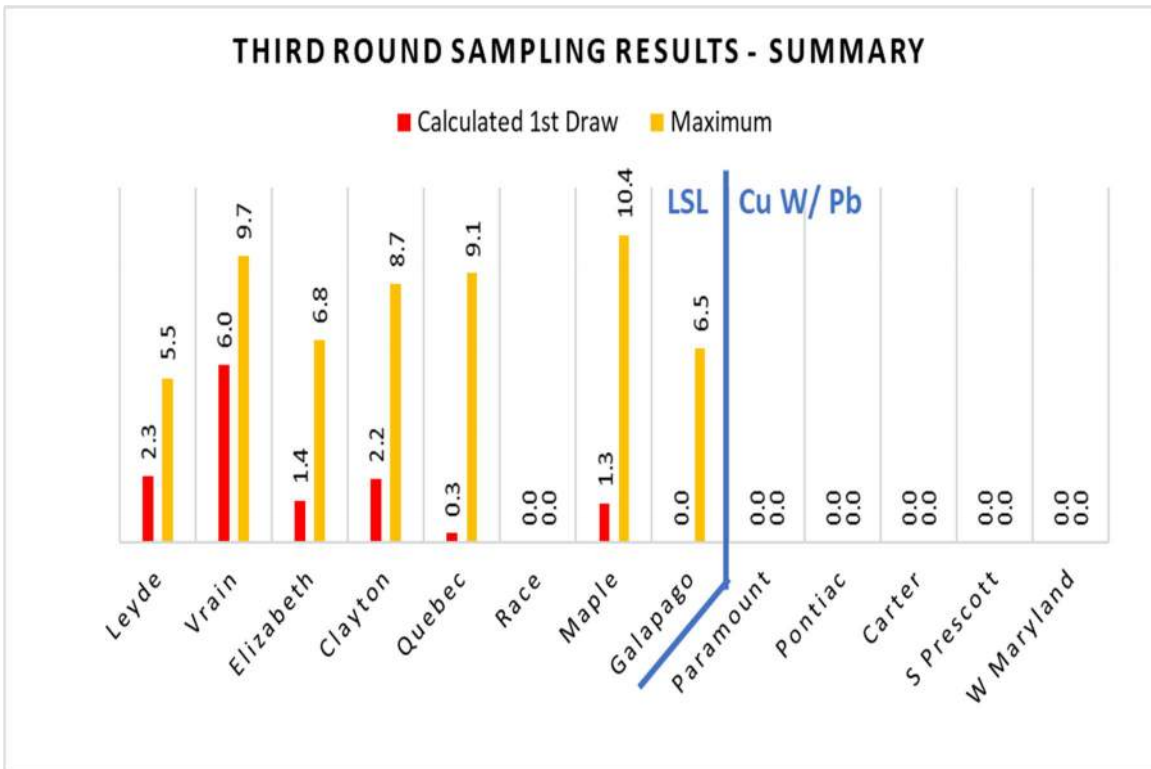


Figure 9 – Third Round Sampling Lead Results as ppb

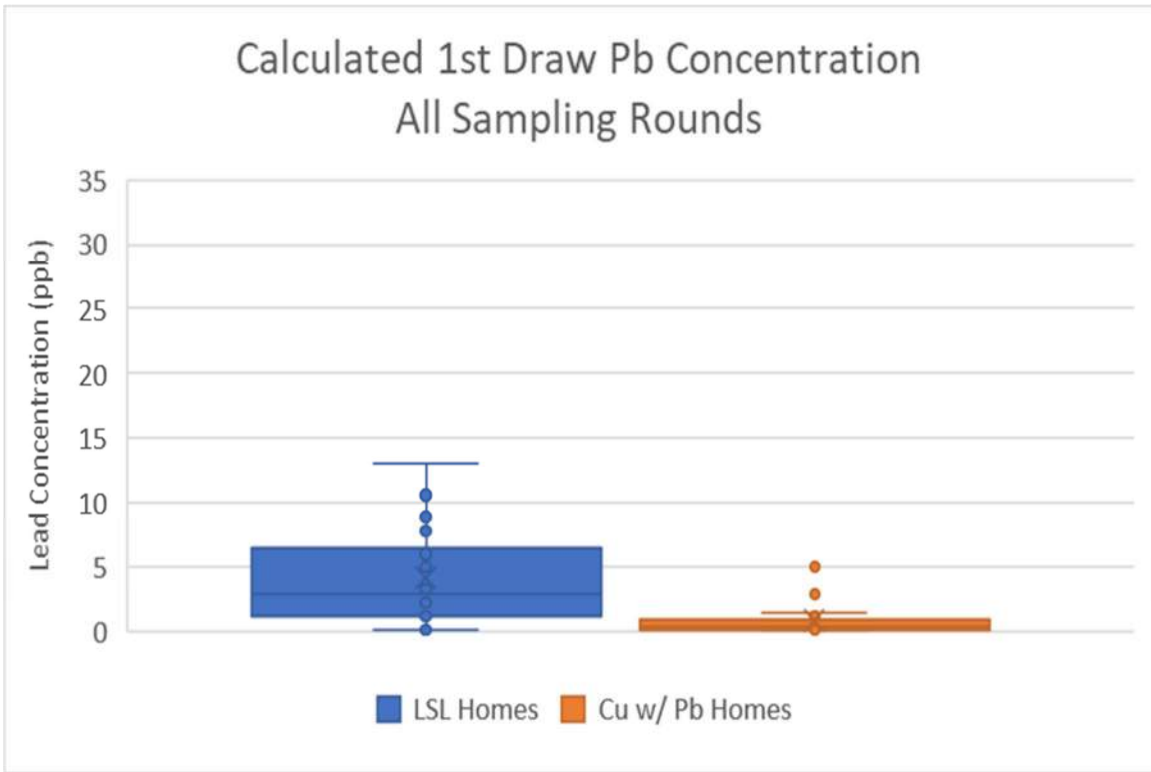


Figure 10 – All Results for Calculated 1st Draw Lead Concentration from Each Home Sampled

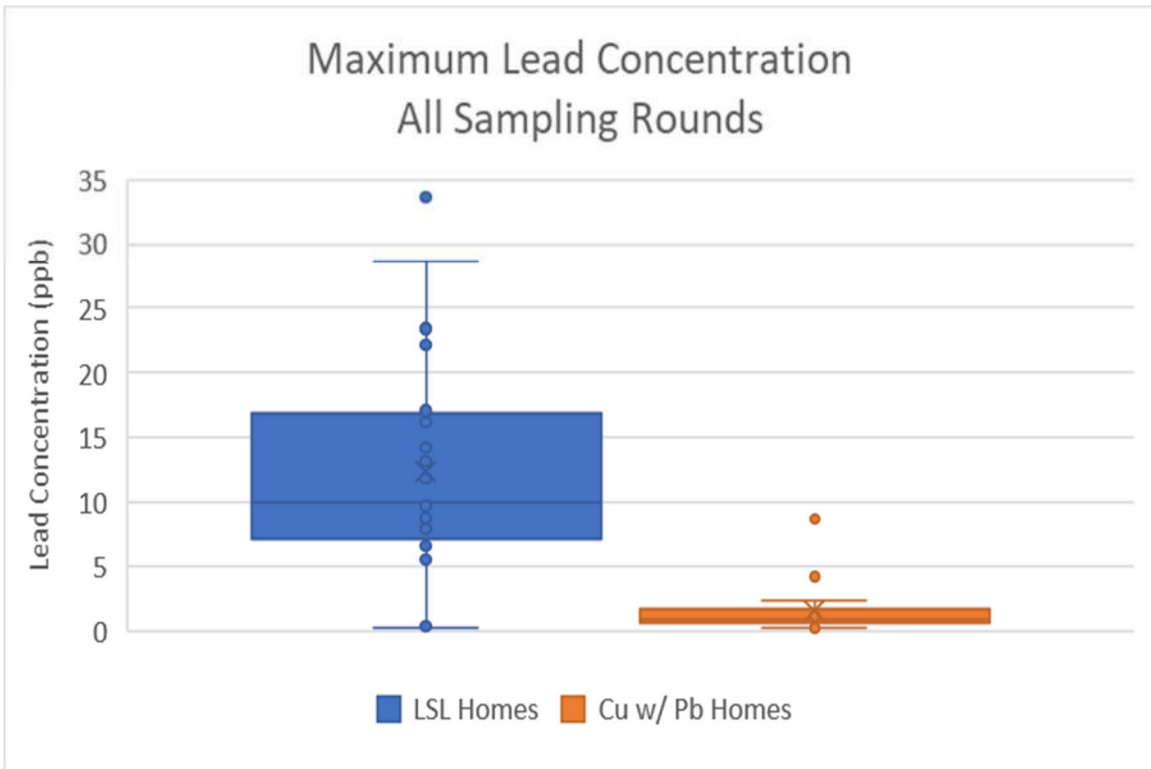


Figure 11 – All Results for Maximum Lead Concentration from Each Home Sampled

Sampling Method Comparison

Denver Water's Customer Requested Lead Sampling program asks customers to collect three 1-liter samples following at least 6 hours of stagnation. The first 1-liter sample is collected immediately following stagnation before any water has passed through the premise. After the first sample is collected, customers are asked to flush for 25 seconds without shutting off the faucet. A second 1-liter sample is then collected. After the second sample is collected, the customer is asked to flush for an additional 25 seconds before collecting the third and final 1-liter sample. Denver Water has measured sampling flow rates when collecting lead samples and has found that flows typically range between 2-4 liters per minute. It is assumed that the flushing rate during the 3-Draw sampling is within this range.

The first 1-liter sample represents the same volume of water that is collected during LCR compliance sampling. This sample is thought to be most influenced by the sampling fixture and internal plumbing nearest to the fixture. The second sample is collected with the intent to capture the lead from internal plumbing without significant influence from the sampling fixture or the service line. The third sample is intended to represent the water stagnating in the service line.

Figure 11 and 12 show the lead concentrations from three homes sampled during the 2nd round of sequential sampling. The three homes include a lead service line home (Quebec), a copper with lead solder home (Paramount) and a home with galvanized plumbing downstream of a replaced lead service line (Mariposa). Overlaid on these figures are the theoretical sample and flushing volumes corresponding to the 3-Draw sampling protocol described above. Note that the horizontal axis represents the aliquot or sample bottle with volumes detailed in the Study Design section above.

The homes selected are not intended to represent all homes of certain plumbing type. They were merely selected as an example. It is impossible to select a "representative home" because of the innumerable variables associated with lead sampling. For example, when looking at the aliquot in which the maximum lead concentration occurred in LSL homes, it varies from aliquot 13-27. This means that for lead service line homes, the maximum lead concentration could occur between the fifth and twelfth liter when sampling.

Given the number of variables that impact lead concentration captured during a sampling event (faucet flow, internal plumbing and service line length, stagnation time, flushing prior to stagnation, etc) and the resources required to process and analyze samples, Denver Water has concluded that the existing 3-draw sampling protocol is the most appropriate method to obtain consistent and reliable data on lead concentrations from homes when sampling lead is requested by customers.

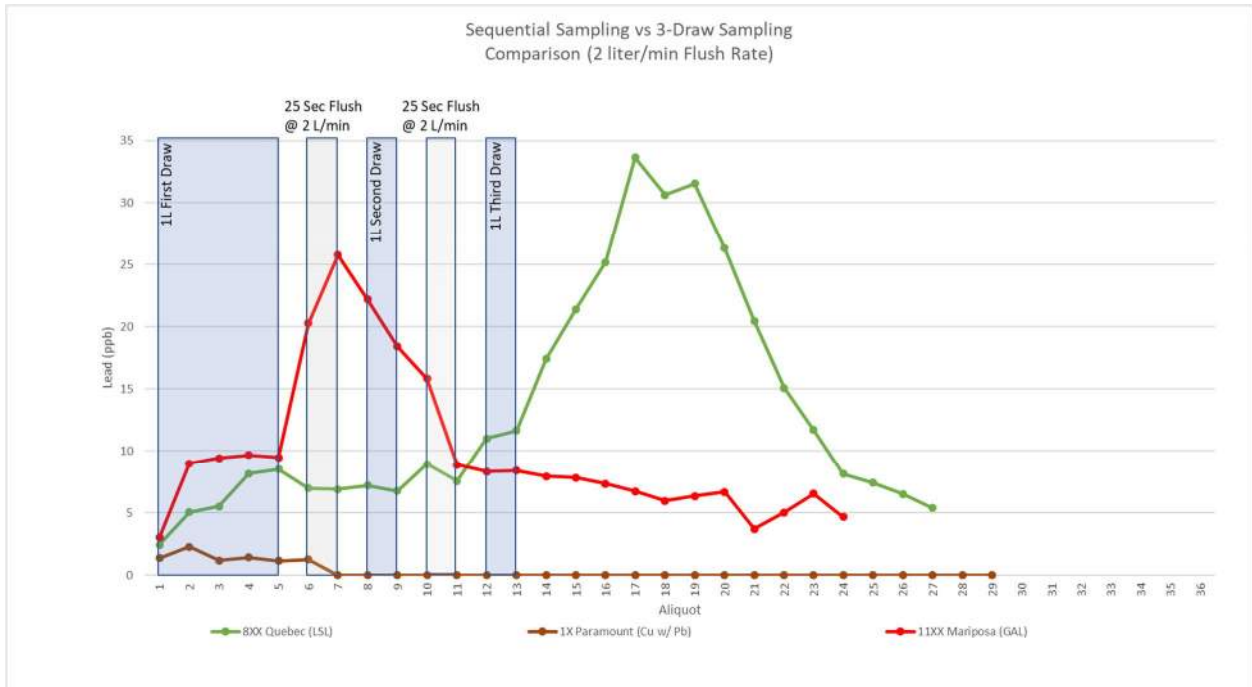


Figure 11 – 3-Draw Sample Volumes at 2 L/min Flushing Compared to Sequential Sampling Results

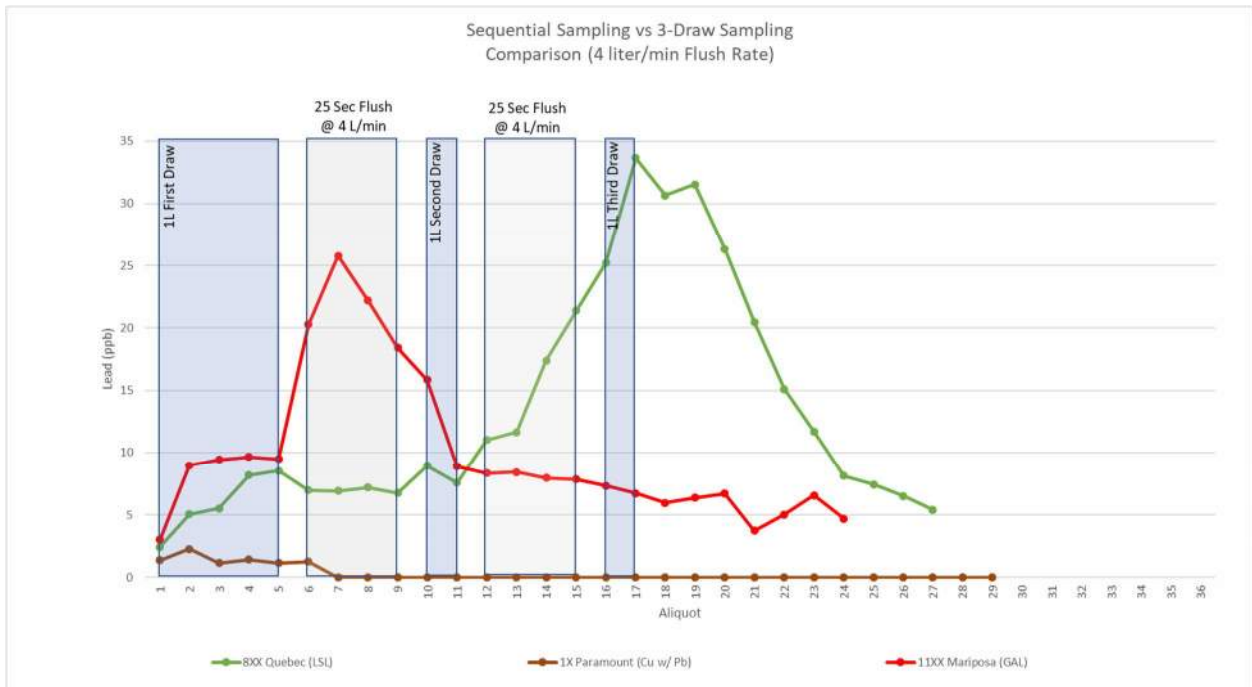


Figure 12 – 3-Draw Sample Volumes at 4 L/min Flushing Compared to Sequential Sampling Results

APPENDIX III.E.2 - LEAD FROM SOLDER

September 2019

Appendix III.E.2

Immersion Study Comparing 2 mg/L of Orthophosphate and pH 8.8 for Controlling Lead Release from Solder

Date: August 16, 2019
To: Denver Water
From: Corona Environmental Consulting, LLC

Research Question

Does 2 mg/L of orthophosphate as PO_4 and pH 8.8 result in equivalent lead reduction from copper with lead solder coupons?

Introduction

Copper service lines joined by leaded solder are known to exist in many homes in the United States, including homes within Denver Water's service area. Copper lines with lead solder will become a dominant source of lead once the lead service lines are removed. The purpose of this Appendix is to summarize the findings of a 17-week immersion study comparing the performance between high pH with alkalinity adjustment and orthophosphate for control lead release from copper with lead solder.

In developed countries the solder used to join copper pipes has historically been lead-tin solder. In the United States, 50/50 lead/tin solder was common (MWH, 2005). Lead bearing solder has been banned from use in drinking water plumbing and 95 percent tin and 5 percent antimony is now more commonly used in the US. As part of the LCR materials survey Denver Water found copper joined by lead solder to be common in homes constructed between 1983 and 1988. The 90th percentile lead levels from Tier 1 homes with copper with lead solder has been consistently below 10 ppb, as shown in Figure 1.

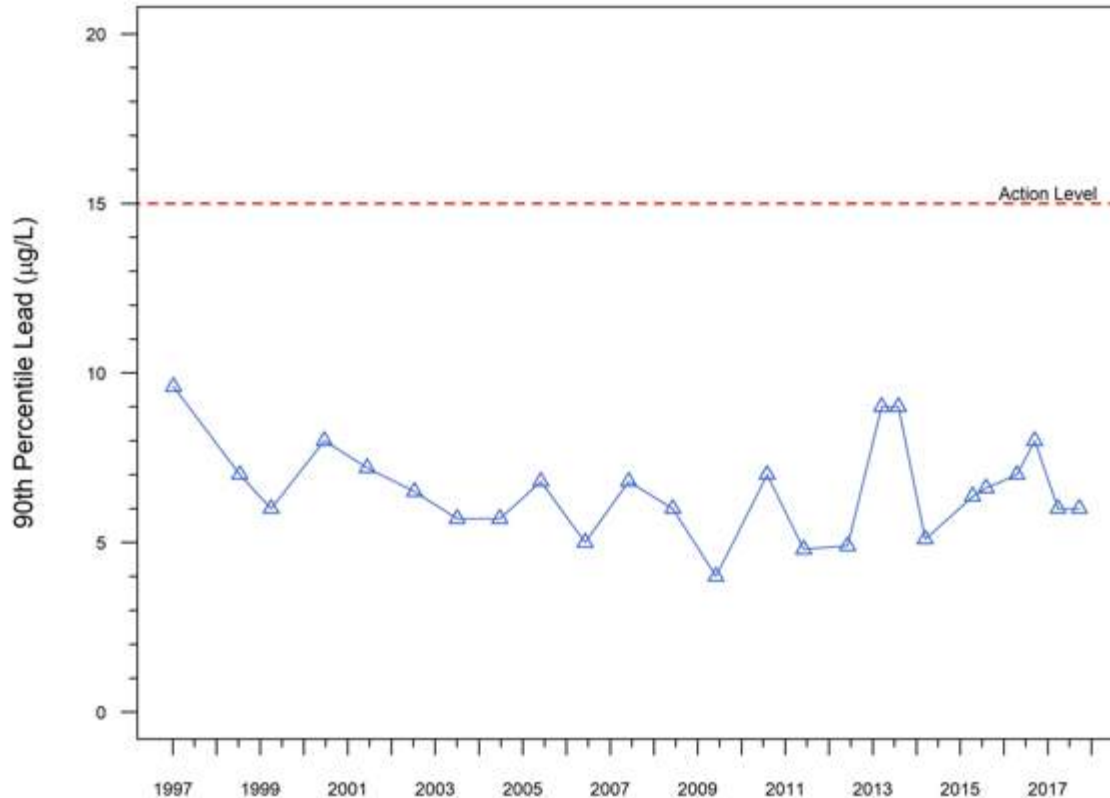


Figure 1. Denver Water's 90th percentile lead levels for Tier 1 homes with copper with lead solder

Similar to lead service lines, the corrosion of copper with lead solder can be reduced by pH/alkalinity adjustment or the addition of a corrosion inhibitor (e.g., orthophosphate). However, the corrosion of lead solder is different from lead pipe because the corrosion of solder is driven by the galvanic cell. Lead release from solder is variable over time and across different sites in a distribution system with similar age and construction (Schock and Lytle, 2011). This is partly due to random particulate lead release (Lytle et al., 1993). Lead release from solder is significantly influenced by the joint's geometry and the workmanship (Lyon and Lenihan, 1977).

In general, only a small amount of solder is exposed to the water and since lead/tin solders are anodic to copper the small anode-large cathode surface area effects apply. In this circumstance the larger the cathode compared to the anode results in greater galvanic current and solder corrosion.

Water parameters found to increase the corrosion of solder are lower pH and higher chloride and nitrate concentrations (Oliphant, 1983). Sulfate in sufficient concentration can mitigate the effect of chloride and the ratio of these predictors (i.e., chloride to sulfate mass ratio or CSMR) have been used as a measure of the potential for galvanic corrosion of copper with lead solder (Oliphant, 1983; Gregory, 1990; Nguyen et al., 2011). Sulfate works by changing the corrosion product to crystalline plates that are more protective. If a utility has a CSMR increase above 0.5 and an alkalinity less than 50 mg/L as CaCO₃ then the utility could potentially have serious lead problems following treatment changes that increase the CSMR (Nguyen et al., 2010). Low pH occurs at the solder metal surface due to corrosion reactions, but alkalinity provides buffering to mitigate the pH decrease and dissolution of lead into the water. For example, in bench scale studies with copper with lead solder Nguyen et al. (2010) found that lead release at an alkalinity of 25 mg/L as CaCO₃ was ~ 2.5 times higher than lead release at 100 mg/L as CaCO₃. The finished water CSMR

at the Marston and Moffat water treatment plants is shown in Figure 2. In general, the CSMR at Marston tends to be higher than at Moffat. Most times the CSMR is below the 0.5 threshold; however, there are several occasions where this is exceeded. The fluctuation in CSMR is likely due to changes in the ionic composition of the source water. Neither addition of caustic soda (NaOH) or orthophosphate as phosphoric acid (H₃PO₄) for corrosion control will affect the CSMR.

Denver Water is converting their ammonia source from aqueous ammonia to liquid ammonia sulfate (LAS) at Marston (~early 2020) and Foothills (late 2020 or early 2021). Longer term, Denver Water is also converting from chlorine gas to bulk hypochlorite at Marston (~2025) and Foothills (~2028). Both of these changes will have a small positive impact on CSMR as detailed in the 2017 OCCT Study (Denver Water, 2017). Specifically, conversion from aqueous ammonia to LAS will result in a net increase in sulfate ions in the finished water, and thus a reduction in CSMR. On average, the three drinking water plants dose 0.63 mg/L as N to form total chlorine for residual maintenance. Converting to LAS, this dose is 2.97 mg/L as LAS and 2.16 mg/L as sulfate. Converting to LAS would result in an average net increase of 2.16 mg/L of sulfate in finished water. Conversion to bulk hypochlorite will reduce the chloride concentration by 0.5 mg/L per mg/L as Cl₂. This will reduce the chloride in the water by about 1.5 mg/L. Taken together, these long-term changes will reduce the CSMR in the Marston water from an average of 0.5 to about 0.4 (-20%). In the Moffat water the predicted change is from an average of 0.3 to 0.2 (-33%).

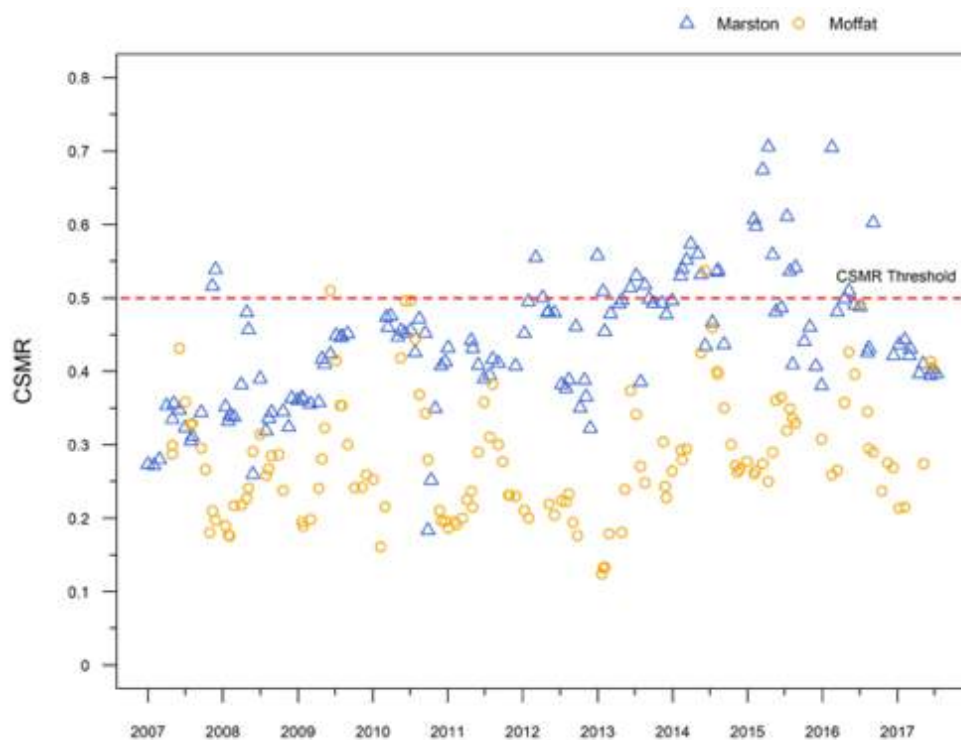


Figure 2. CSMR in the Marston and Moffat finished water

Immersion Study

Past and recent studies of systems similar to Denver Water suggest that it is possible that pH/alkalinity can reduce lead level from solder similar or better than orthophosphate treatment (Boffardi and Sherbondy, 1991; MacQuarrie et al., 1997; Confluence Engineering Group, 2018). Denver Water conducted testing on copper with lead solder coupons in both source waters at bench-scale. The immersion study tested 2 mg/L of orthophosphate and pH adjustment to 8.8 for controlling lead release

from new copper with lead solder. The experimental matrix is presented in Table 1 below. The experiment was designed following the CDPHE document “Lead and Copper Corrosion Bench-Scale Testing Guidance Manual” prepared by Hazen and Sawyer (2019). Each condition was tested in triplicate. Glass jars (250 mL) were cleaned by filling them with 0.1 M hydrochloric acid and allowing to sit for 24 hours. Each test jar was labeled with a unique identifier including the test water ID, test material, and replicate number. Copper with lead-tin solder coupons were prepared by melting a 1-inch long piece of lead solder into a 1-inch long ½” diameter new copper coupling. All coupons were cleaned by immersing them in 0.1 M hydrochloric acid for 30 seconds, rinsing them with deionized water and the allowing them to air dry. Each coupon was suspended in a glass jar using a zip tie attached to the cap and the cap was epoxied to reduce reactions with the atmosphere outside the jars (Figure 3).

Table 1. Testing Matrix for Lead Release from Copper with Lead Solder.

Test Water	pH	Orthophosphate Dose (mg/L as PO ₄)	Number of Cu/Pb Solder Coupons
Marston/Moffat	7.8	0 (Control)	3/3
Marston/Moffat	7.8	2.0	3/3
Marston/Moffat	8.8	0	3/3

55-gallon samples of combined filter effluent were collected from Marston and Moffat treatment plants. A six-week conditioning phase was followed by a nine-week treatment phase. The jars were filled so that they were headspace free. Chloramination and corrosion control (pH adjustment or orthophosphate addition) were performed just before filling. Sample water is collected three times per week with a composite sample being analyzed at the end of each week. The vessels were stored in the dark on a temperature-controlled orbital shaker. Water characterization of the influent waters is presented in Table 2.



Figure 3. Sample immersion vessel

Table 2. Collected combined filter effluent water characterization for immersion testing.

Parameter	Marston Influent	Moffat Influent
pH	7.8	7.8
Alkalinity (mg/L as CaCO ₃)	61.2	39.9
Calcium (mg/L)	34.5	17.8
Magnesium (mg/L)	8.6	2.0
Chloride (mg/L)	26.4	3.7
Sulfate (mg/L)	65.0	17.9
Sodium (mg/L)	17.0	2.8
Conductivity (µS/cm)	362	139
CSMR	0.41	0.21

Lead, pH, and Orthophosphate Data for Immersion Study Conditions

The descriptive statistics and illustrations included below compare lead release data from copper with lead solder immersion studies using Marston and Moffat Plant influent water under conditions of an orthophosphate dose of 2 mg/L (as PO₄), pH adjustment to 8.8 and a control (no treatment). Only data from the last 7 weeks of the treatment are used in the calculations to avoid conditioning effects.

Lead Summary Statistics

Lead concentration data for the three treatment conditions are summarized in Table 3 which shows that the median lead concentrations were lower for both pH adjustment and orthophosphate compared to the control regardless of the source water. However, for the Marston coupons the mean lead concentration for orthophosphate was more than three times higher than the control and eight time higher than the pH condition. This was due to lead spikes that occurred in the last three weeks of the study in one of the Marston orthophosphate replicates. For this reason, we rely on the median and percentile statistics for comparison. For Moffat coupons, the mean followed the same pattern as the median lead release where both orthophosphate and pH adjustment resulted in lower lead levels compared to the control. However, orthophosphate resulted in slightly lower lead release.

Table 3 Summary of lead concentration data for immersion study (Week 11-17)

Condition	Marston			Moffat		
	Control	pH	Orthophosphate	Control	pH	Orthophosphate
Mean (ppb)	45.7	22.4	134.2	19.3	8.7	4.7
Variance (ppb ²)	1759.6	56.1	130579.4	138.8	9.0	1.4
Standard Deviation (ppb)	41.9	7.5	361.4	11.8	3.0	1.2
Minimum (ppb)	21.1	14.0	7.4	7.3	5.1	2.9
1 st Quartile (ppb)	28.7	17.0	8.8	10.2	7.1	4.0
Median (ppb)	32.7	19.4	9.8	13.6	7.8	4.4
3 rd Quartile (ppb)	46.0	29.2	37.9	33.1	9.9	5.4
Maximum (ppb)	221.9	39.5	1590.0	42.0	17.7	7.9
Count	21	21	21	21	21	21

pH Summary Statistics

Between weeks 11-17 the pH before and after the water change was monitored. The time series pH results are shown in Figure 15 in the Appendix. The target mean pH for the control and orthophosphate conditions was 7.8 ± 0.2 and 8.8 ± 0.2 for the pH adjustment condition. Table 4 and Table 5 show that mean pH before and after the water change was within the target pH range for both the Marston and Moffat coupons.

Table 4 Summary of pH data for Marston coupons before and after water change (Week 11-17)

	Control		pH		Orthophosphate	
	Before	After	Before	After	Before	After
Mean	7.78	7.79	8.72	8.56	7.69	7.62
Variance	0.01	0.01	0.00	0.01	0.00	0.02
Standard Deviation	0.11	0.15	0.05	0.10	0.06	0.15
Minimum	7.62	7.57	8.62	8.34	7.60	7.41
1 st Quartile	7.68	7.73	8.69	8.50	7.65	7.52
Median	7.82	7.81	8.71	8.58	7.68	7.59
3 rd Quartile	7.86	7.85	8.75	8.62	7.73	7.68
Maximum	7.95	7.99	8.82	8.72	7.80	8.21

Table 5 Summary of pH data for Moffat coupons before and after water change (Week 11-17)

	Control (pH 7.8)		pH (pH 8.8)		Orthophosphate (pH 7.8)	
	Before	After	Before	After	Before	After
Mean	7.85	7.80	8.84	8.68	7.75	7.65
Variance	0.01	0.01	0.00	0.01	0.00	0.02
Standard Deviation	0.11	0.15	0.05	0.10	0.06	0.15
Minimum	7.63	7.49	8.67	8.40	7.60	7.44
1 st Quartile	7.72	7.72	8.71	8.51	7.64	7.56
Median	7.90	7.81	8.87	8.71	7.71	7.65
3 rd Quartile	7.94	7.87	8.96	8.82	7.87	7.76
Maximum	8.00	8.19	8.99	8.96	7.98	7.87

Orthophosphate Summary Statistics

For the orthophosphate conditions the target was a mean concentration of 2 ± 0.3 mg/L as PO₄. Table 6 shows that the means for the Marston and Moffat coupons were within the target mean. While these results were on the low side, this can be explained from the consumption of orthophosphate by the coupons during the testing period.

Table 6 Summary of 2 mg/L target orthophosphate data after treatment addition (Week 11-17)

	Marston	Moffat
Mean (mg/L)	1.8	1.7
Variance ((mg/L) ²)	0.0	0.0
Standard Deviation (mg/L)	0.2	0.1
Minimum (mg/L)	1.2	1.6
1 st Quartile (mg/L)	1.7	1.7
Median (mg/L)	1.8	1.7
3 rd Quartile (mg/L)	1.9	1.8
Maximum (mg/L)	2.2	1.8

Lead Illustrations

Lead concentration data for the Marston coupons and the Moffat coupons over time are shown in Figure 4 and Figure 5, respectively. Data above 500 ppb are not shown in Figure 4 and Figure 5 and all the data during the study are shown in Figure 16 and Figure 17 in the Appendix. Control charting for the lead data are discussed in the Appendix. Figure 4 and Figure 5 identify the pre-treatment before pH adjustment or orthophosphate addition. The respective target pH or orthophosphate level over time is also shown. These time series figures provide visual information on how lead release from each coupon behaved over time and show that in general the experiment did not exhibit a high level of variability except for a few occasions. It is of note that during the conditioning phase, all the vessels experienced exactly the same conditions except source water. It can be observed that lead concentrations stabilize over time and essentially are unchanged between weeks 5 and 6 meaning conditioning is complete. While there is some replicate-to-replicate variability, most of the lead release has stabilized to about 50 ppb prior to the beginning of treatment.

The lead concentration data for the Marston and Moffat coupons are also shown as boxplots grouped based on the condition for the last 7 weeks of the study (Figure 6 and Figure 7). The boxplot figures allow for comparing lead release under the different treatment conditions, and similar to the time series figures, they also illustrate the variability in lead release. The boxplots have been prepared with the box ranging from the 25th to the 75th percentile with the median shown as a line through the box. The diamond indicates the average value. The whiskers extend from the 5th the 95th percentile. Values outside the 5th and 95th percentiles are shown as dots and the number below the box indicates the number of data points use in the construction of the boxplot.

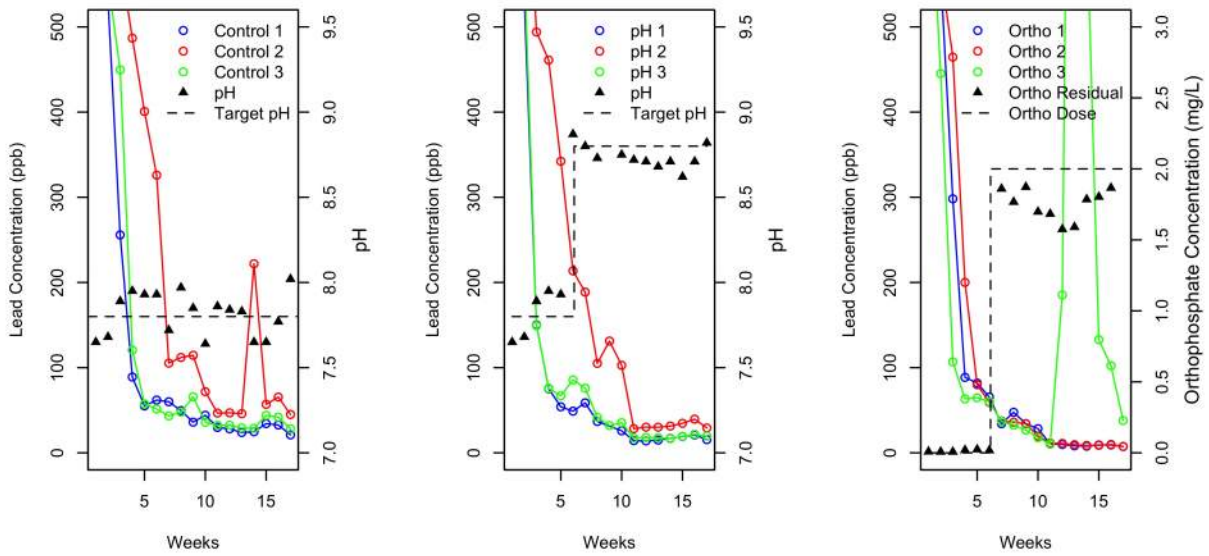


Figure 4. Time series of lead concentration data from lead solder coupons in Marston Water

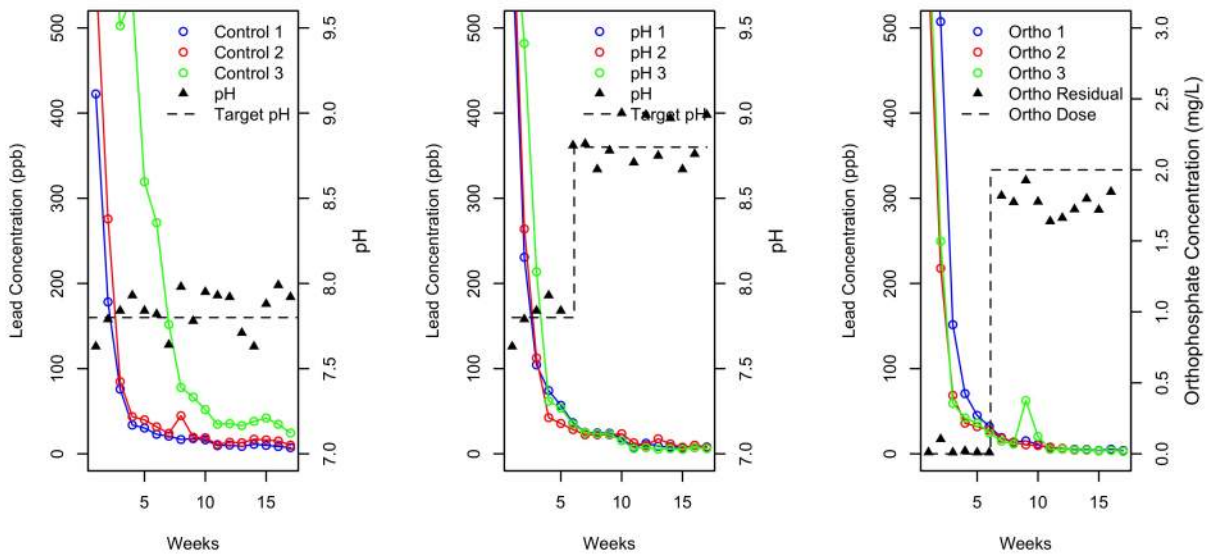


Figure 5. Time series of lead concentration data from lead solder coupons in Moffat Water

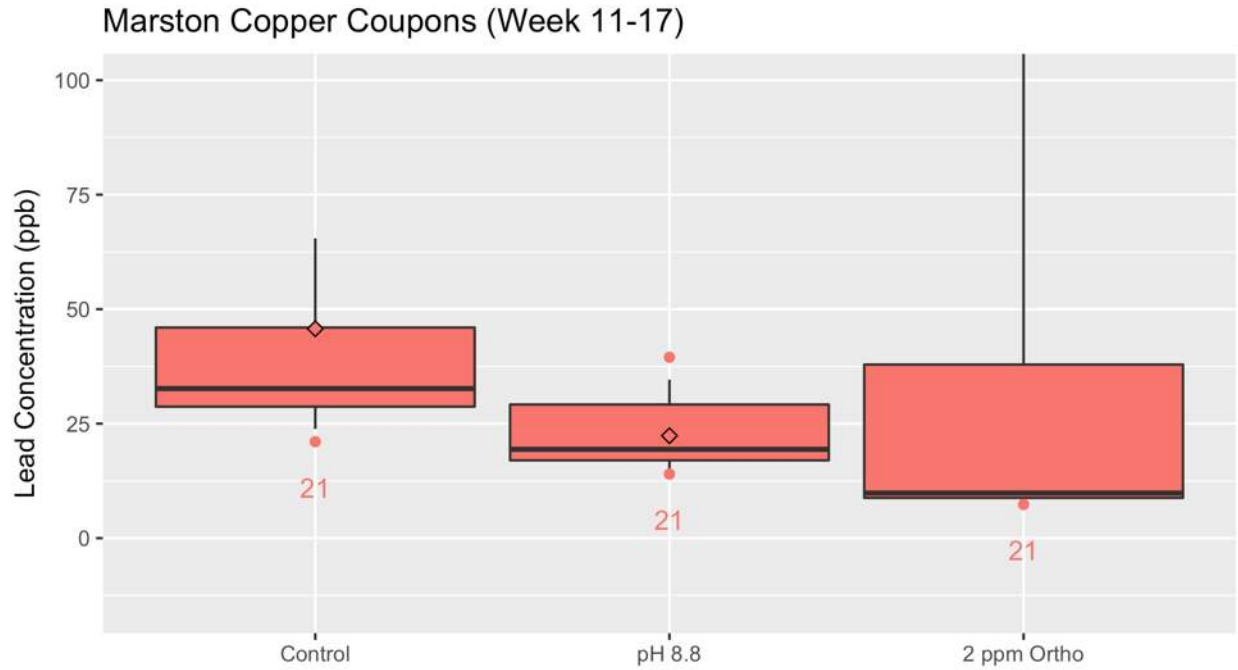


Figure 6 Boxplots of lead concentration data from lead solder coupons in Marston Water

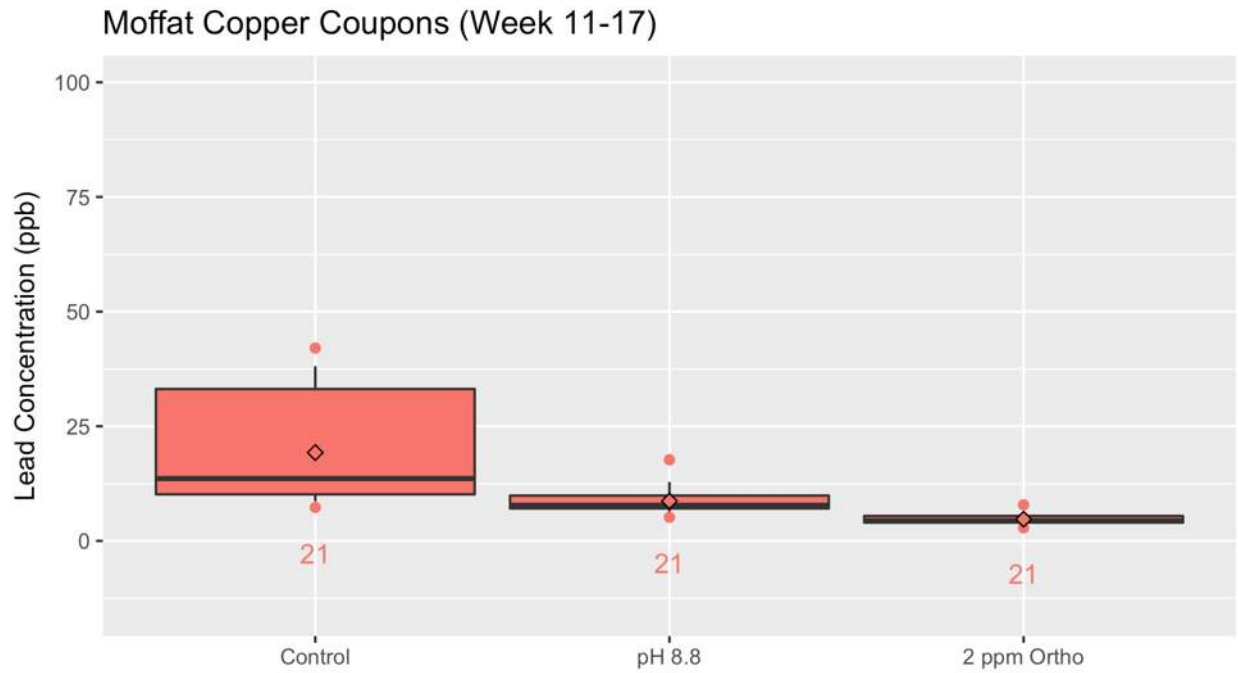


Figure 7 Boxplots of lead concentration data from lead solder coupons in Moffat Water.

The distribution of lead reductions between the control and the treatments was calculated using all the possible combinations of the data without duplication for Marston and Moffat coupons. The distributions of lead reductions are also shown as histograms in Figure 10. The results of the reduction calculations are summarized in Table 7. For both Marston and Moffat, the median lead reduction is greater for the orthophosphate treatment compared to the pH treatment. In other words, the orthophosphate treatment results in greater lead reduction compared to the pH adjustment.

Because negative removals are not expected as a result of the treatment conditions (but instead of variability that is independent of the treatment condition), we recalculated the statistics with all reductions below zero excluded from the analysis (Table 8). Box plots of these data are presented in Figure 8 and Figure 9. Distributions of lead reductions are also shown as histograms in Figure 10 after a 5,000 sample bootstrap.

Table 7 Summary of lead reduction data comparing to control to the treatment conditions

	Marston		Moffat	
	pH 8.8	2 ppm Ortho	pH 8.8	2 ppm Ortho
Mean (%)	37	-280	38	66
Variance (% ²)	960	11387	1425	350
Standard Deviation (%)	31	1067	38	19
Minimum (%)	-88	-7449	-142	-8
1 st Quartile (%)	22	-17	18	53
Median (%)	40	68	44	68
3 rd Quartile (%)	58	78	70	84
Maximum (%)	94	97	88	93

Table 8 Summary of lead reduction data comparing to control to the treatment conditions

	Marston		Moffat	
	pH 8.8	2 ppm Ortho	pH 8.8	2 ppm Ortho
Mean (%)	46	72	49	67
Variance (% ²)	434	183	593	342
Standard Deviation (%)	21	14	24	19
Minimum (%)	0	10	1	9
1 st Quartile (%)	32	66	29	54
Median (%)	46	74	50	68
3 rd Quartile (%)	61	80	71	84
Maximum (%)	94	97	88	93

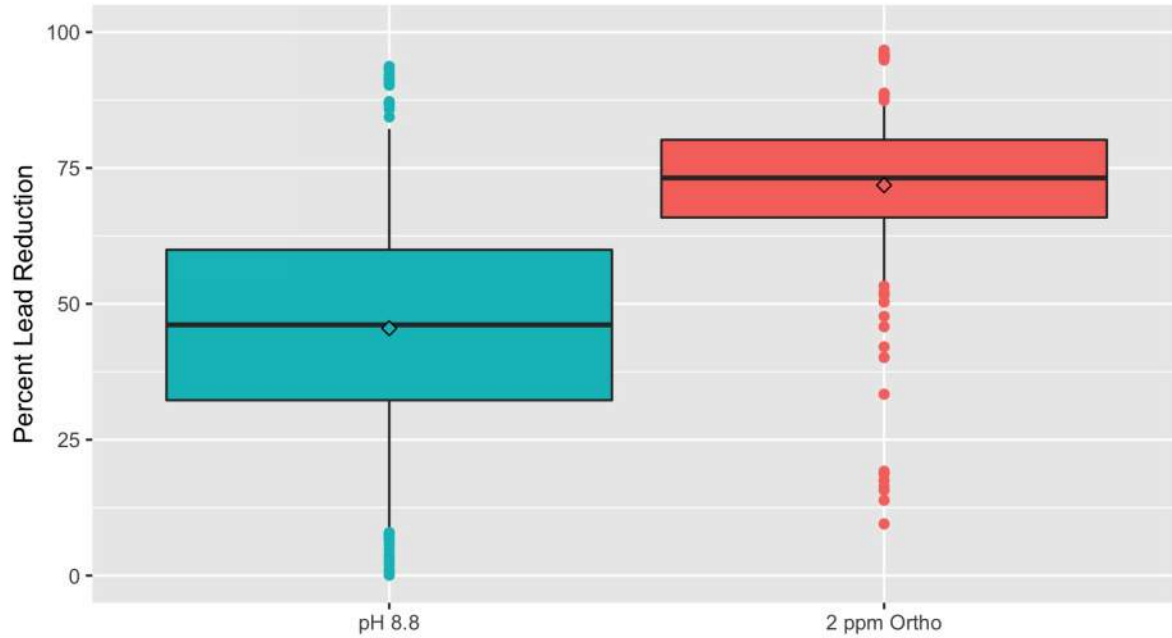


Figure 8 Distribution of percent reduction comparing the control condition to the treatment conditions at Marston

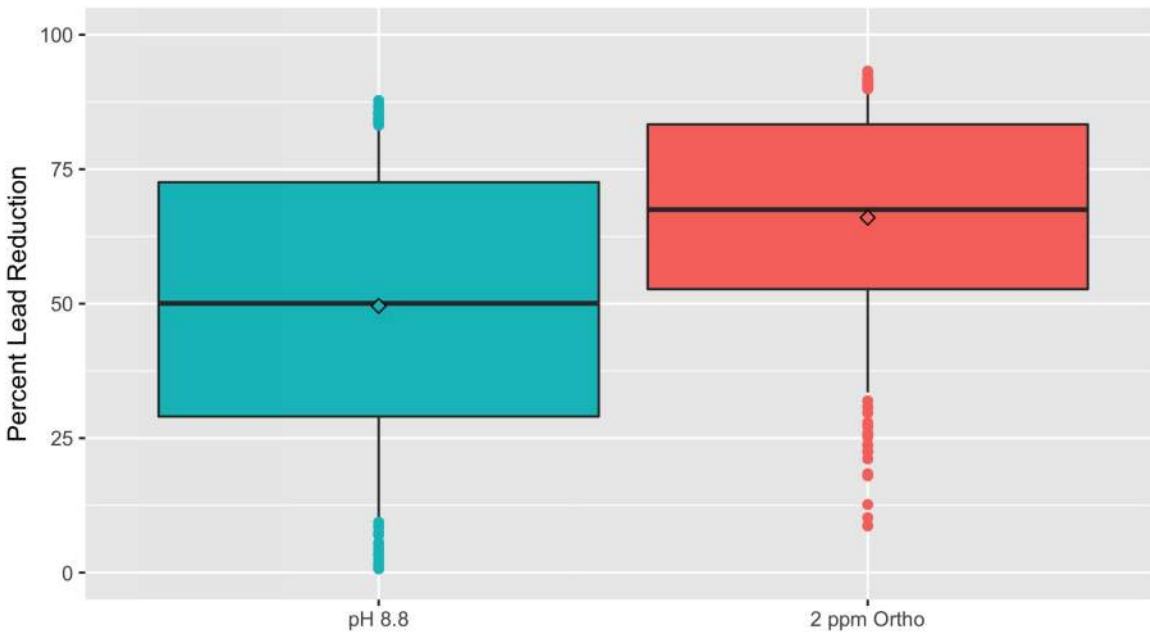


Figure 9 Distribution of percent reduction comparing the control condition to the treatment conditions at Moffat

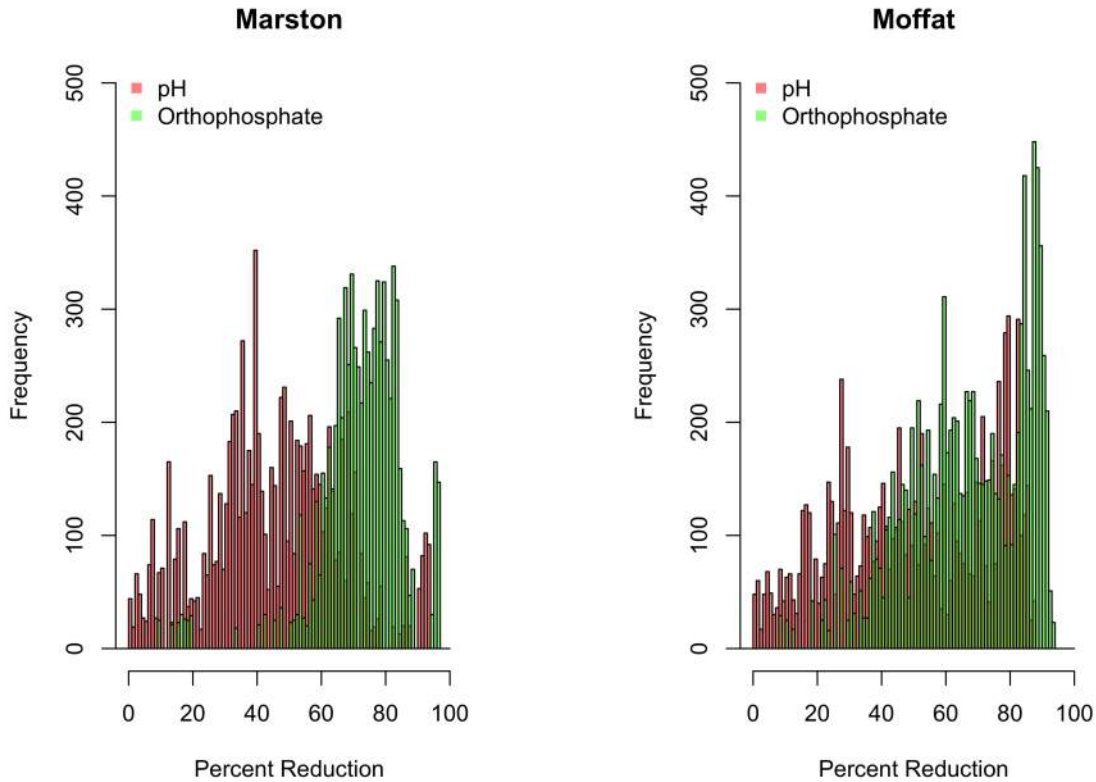


Figure 10 Distributions of lead reduction comparing the control to the treatments in Marston and Moffat coupons

Copper Data for Immersion Study Conditions

The descriptive statistics and illustrations included below compare copper release data from copper with lead solder immersion studies using Marston and Moffat Plant influent water under conditions of an orthophosphate dose of 2 mg/L, pH adjustment to 8.8 and a control. Only data from the last 7 weeks of the treatment are used in the calculations. Copper concentration data for the three treatment conditions are summarized in Table 9.

Table 9 shows that the median and median copper concentrations were lower for both pH adjustment and orthophosphate compared to the control regardless of the source water. For the Marston coupons the mean and median copper concentration for orthophosphate slightly lower than the pH treatment. For the Moffat coupons, the mean and median copper concentration was slightly lower for pH treatment compared to orthophosphate addition.

Table 9 Summary of copper concentration data for immersion study (Week 11-17)

Condition	Marston			Moffat		
	Control	pH	Orthophosphate	Control	pH	Orthophosphate
Mean (ppb)	406.7	185.4	154.5	371.8	134.9	142.1
Variance (ppb ²)	1758.5	550.8	10.74.1	4053.4	357.5	219.3
Standard Deviation (ppb)	41.9	23.5	32.8	63.7	18.9	14.8
Minimum (ppb)	344.9	154.1	50.3	250.7	101.9	118.8
1 st Quartile (ppb)	380.6	167.1	146.0	323.4	121.5	133.3
Median (ppb)	394.6	180.7	165.4	360.9	136.5	138.9
3 rd Quartile (ppb)	447.3	201.2	171.8	416.8	142.8	145.0
Maximum (ppb)	514.6	239.4	201.1	481.6	173.1	187.0

Copper Illustrations

Copper concentration data for the Marston coupons and the Moffat coupons over time are shown in Figure 11 and Figure 12, respectively. For the Marston and Moffat coupons copper release increased during the conditioning phase. After the treatment changes were made copper continued to increase in the control condition but decreased in the two conditions where treatment was added.

The copper concentration data for the Marston and Moffat coupons are also shown as boxplots grouped based on the condition for the last 7 weeks of the study (Figure 13 and Figure 14). The boxplots show that copper release in the control conditions was more variability compared to the treatment conditions. Similar to the lead data, control charts were developed for the copper release data for the three conditions tested in Marston and Moffat Water Racks (Figure 24 and Figure 29) in Appendix.

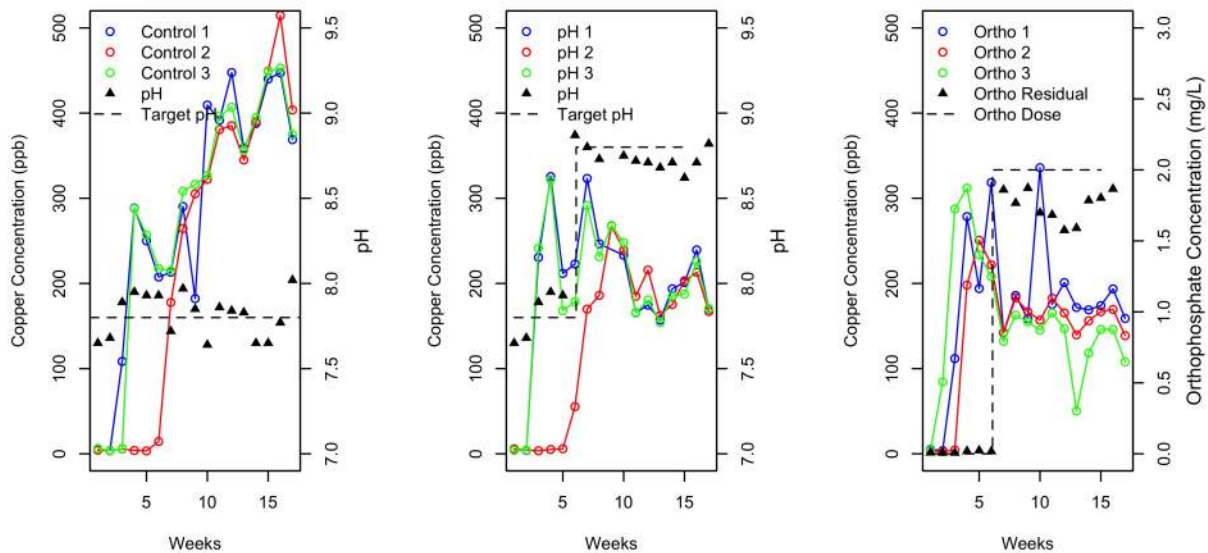


Figure 11. Time series of copper concentration data from lead solder coupons in Marston Water.

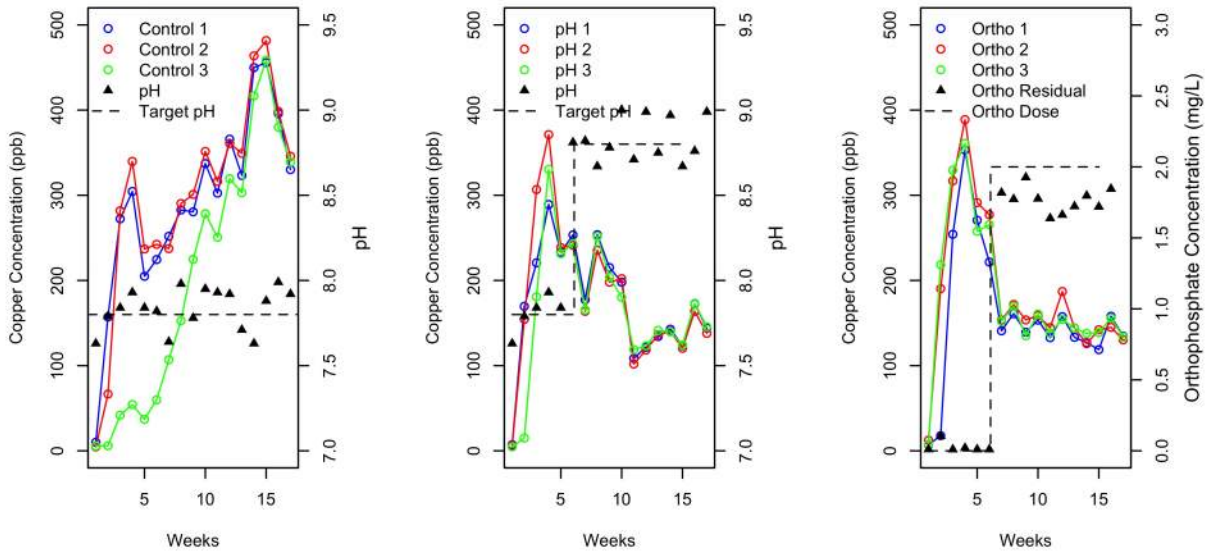


Figure 12. Time series of copper concentration data from lead solder coupons in Moffat Water.

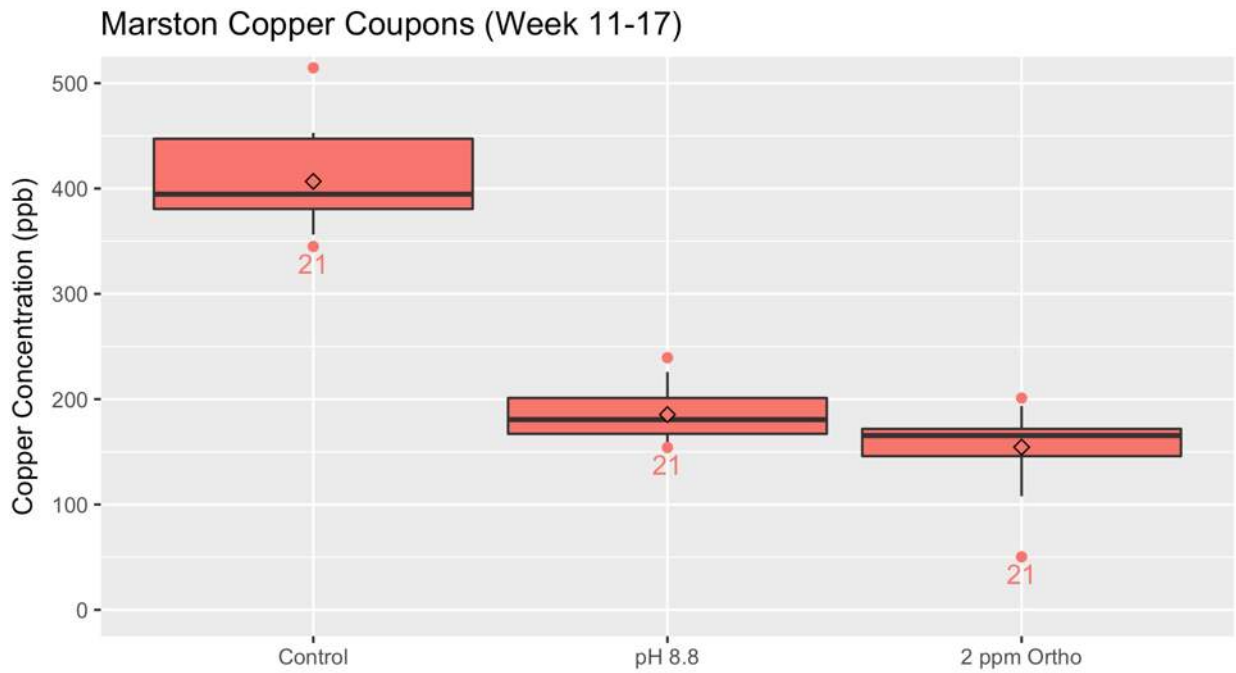


Figure 13 Boxplots of copper concentration data from lead solder coupons in Marston Water

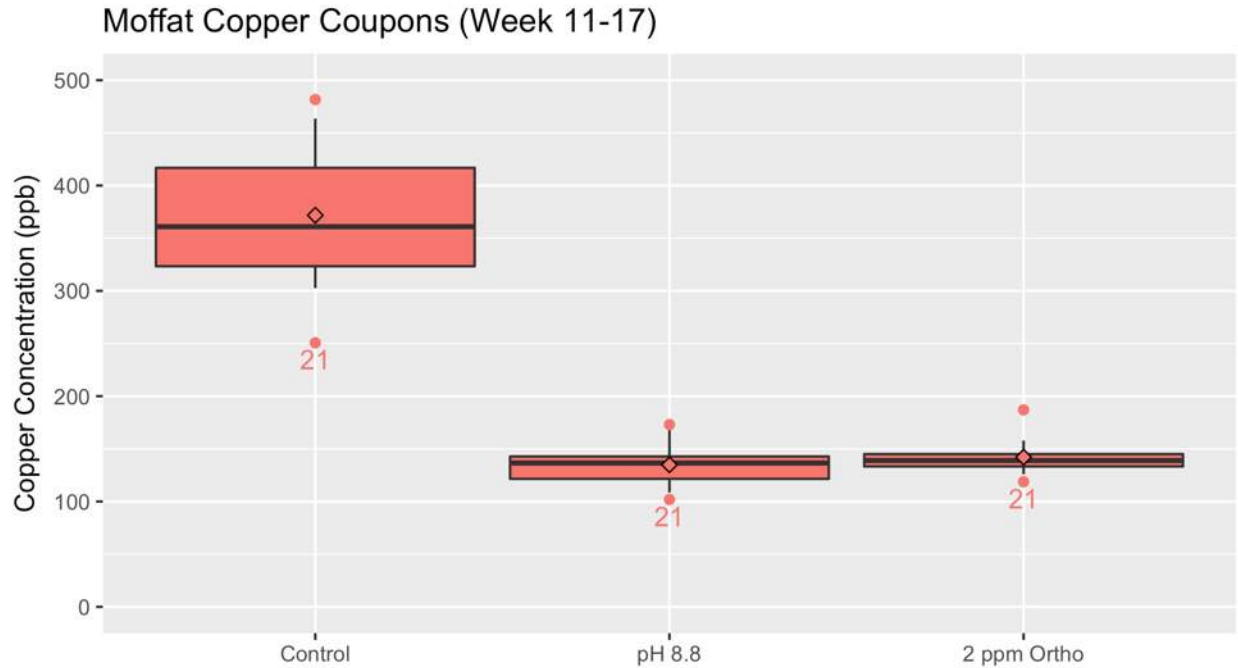


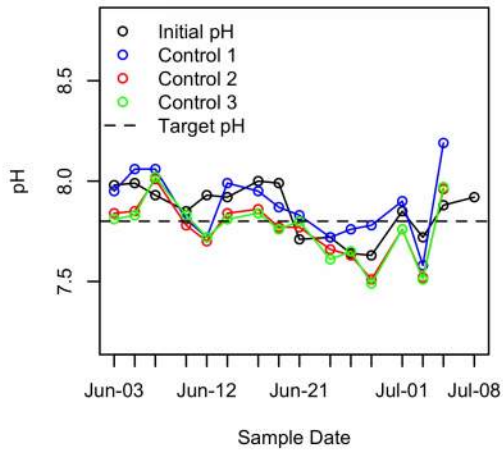
Figure 14 Boxplots of copper concentration data from lead solder coupons in Moffat Water

Summary & Conclusions

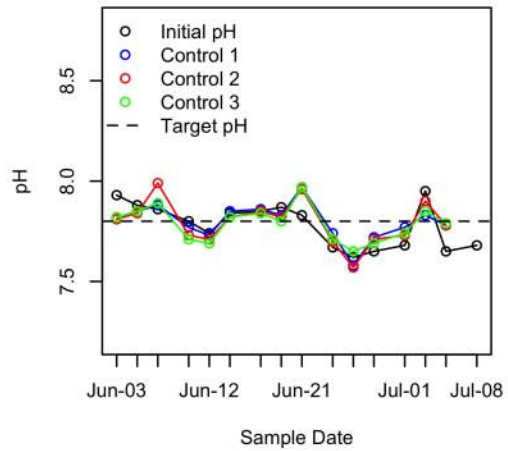
We conclude that the median lead release from copper with lead solder was lower for orthophosphate treatment compared to pH adjustment for both Moffat and Marston waters. The median lead reductions from 2 mg/L as PO₄ were 74% and 68% from Marston and Moffat, respectively. For pH control at pH of 8.8, the median lead reductions were 46% and 50% from Marston and Moffat, respectively.

Appendix

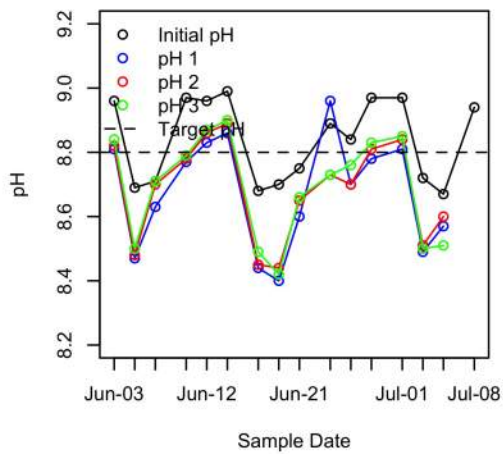
Moffat Control



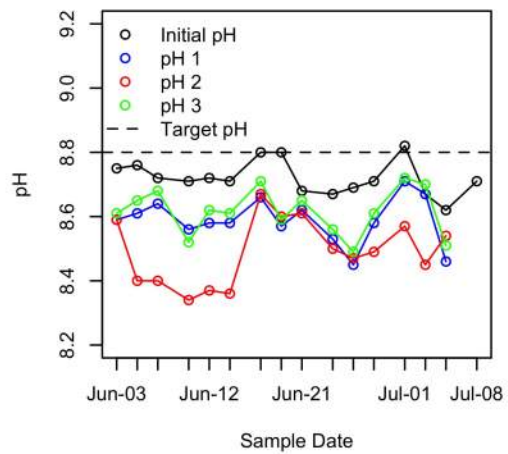
Marston Control



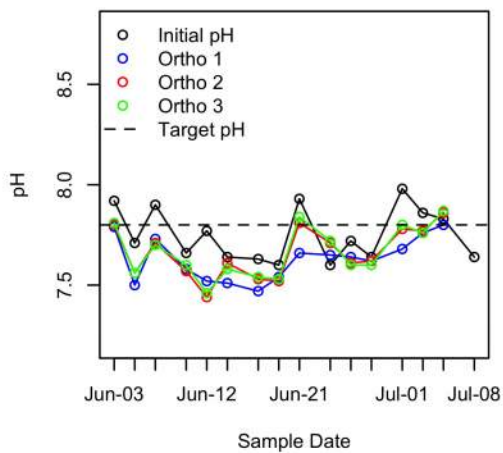
Moffat pH 8.8



Marston pH 8.8



Moffat 2 ppm Orthophosphate



Marston 2 ppm Orthophosphate

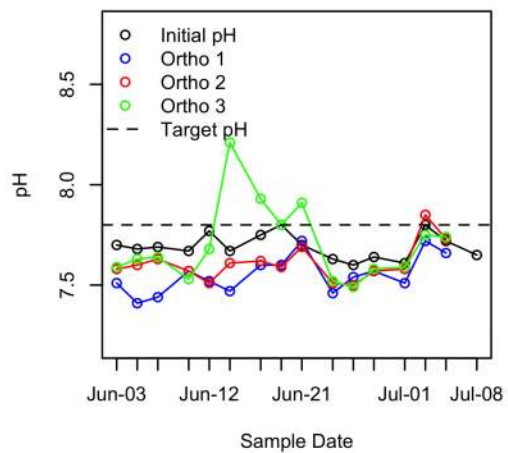


Figure 15. pH in the glass reactors before and after water change

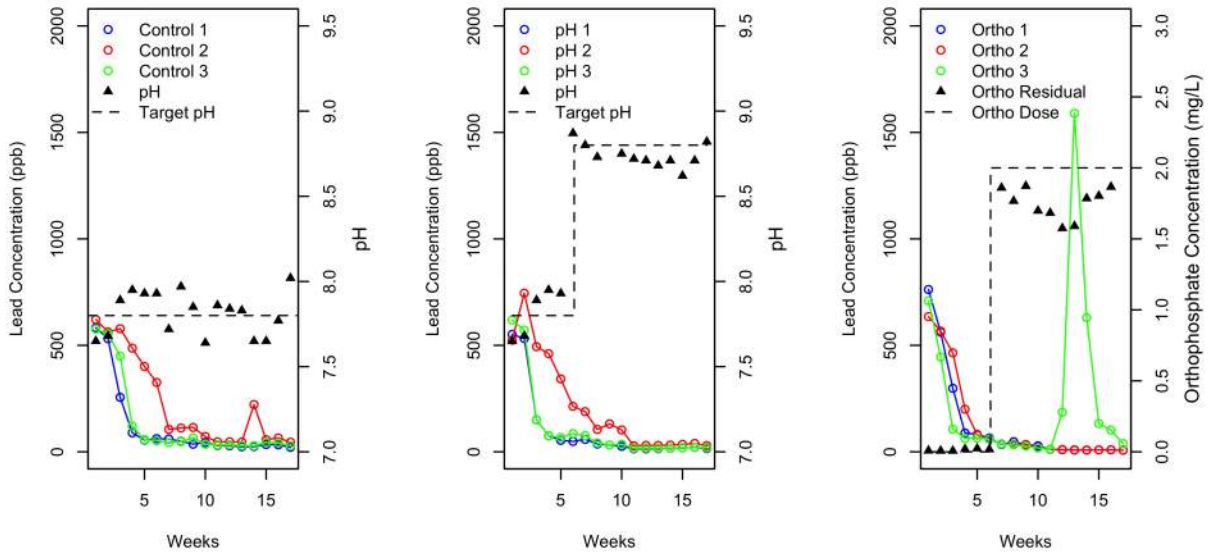


Figure 16. Time series of lead concentration data from lead solder coupons in Marston Water

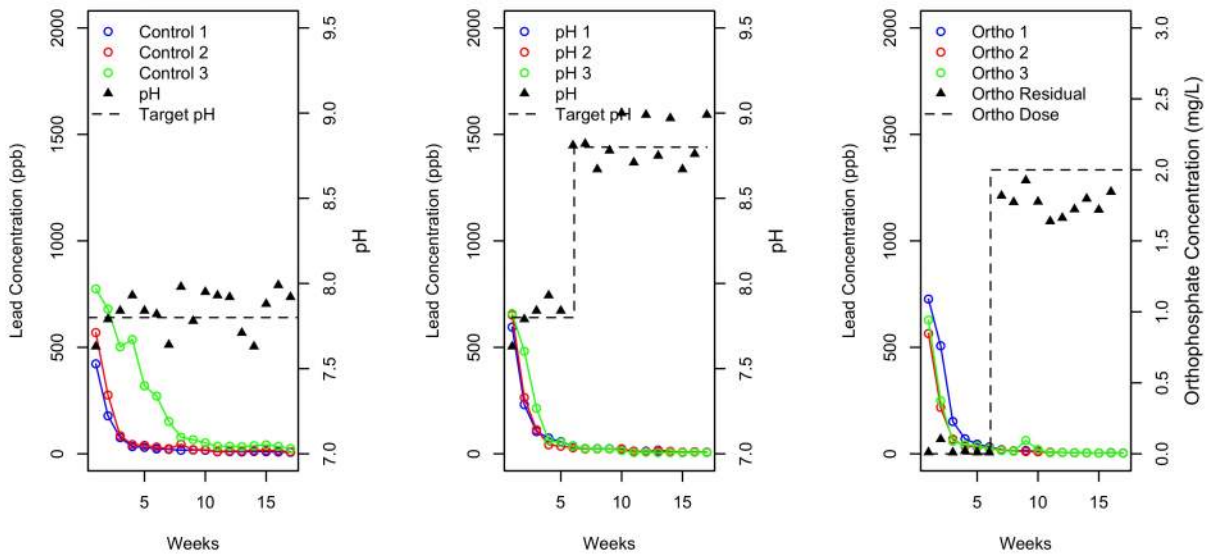


Figure 17. Time series of lead concentration data from lead solder coupons in Moffat Water

Lead Control Charts

Control charts were developed for the lead release data for the three conditions tested in Marston and Moffat Water Racks for data used in the analysis. The control charts display a series of mean day lead

concentrations throughout the experimental period. The center line is equal to the mean of all samples collected and the upper and lower control limits indicate the threshold at which the process output is considered statistically out of control and are drawn at three standard deviations from the center line. The data identified in red indicate data out of control while data identified in yellow indicate when the mean lead concentration for at least seven consecutive weeks with data available fall on one side of the center line. The control chart refers to these points as “violating runs.”

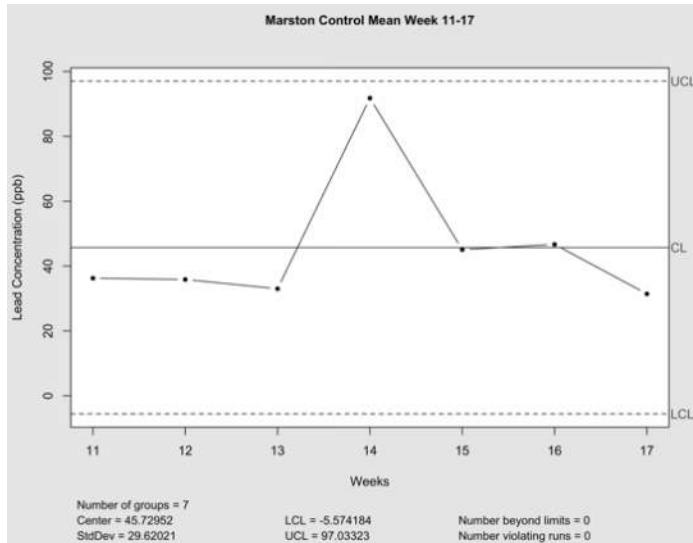


Figure 18 Control charts for pooled lead concentration data from the Marston control coupons

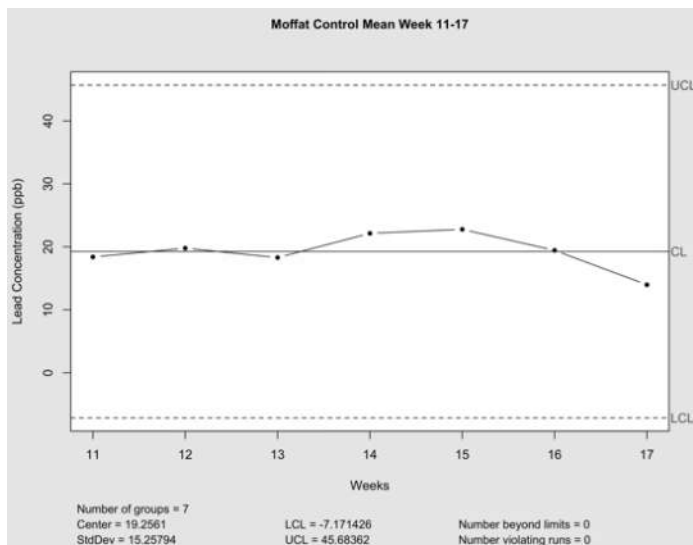


Figure 19 Control charts for pooled lead concentration data from the Moffat control coupons

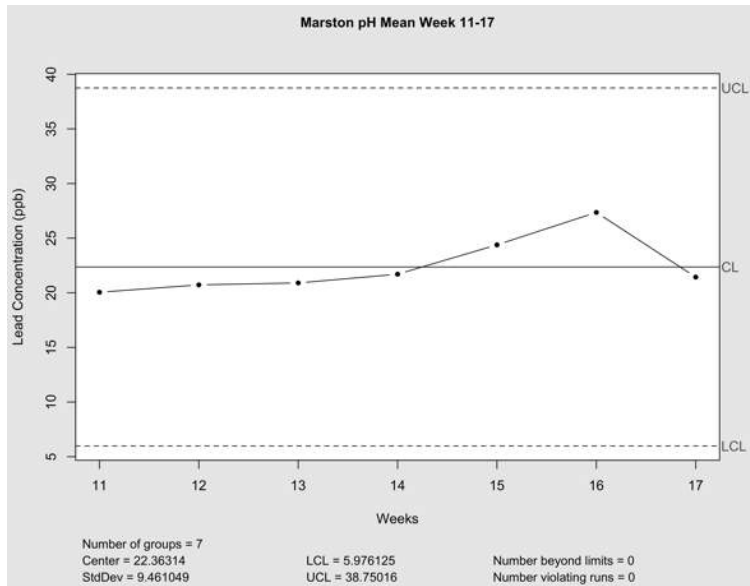


Figure 20 Control charts for pooled lead concentration data from the Marston pH coupons

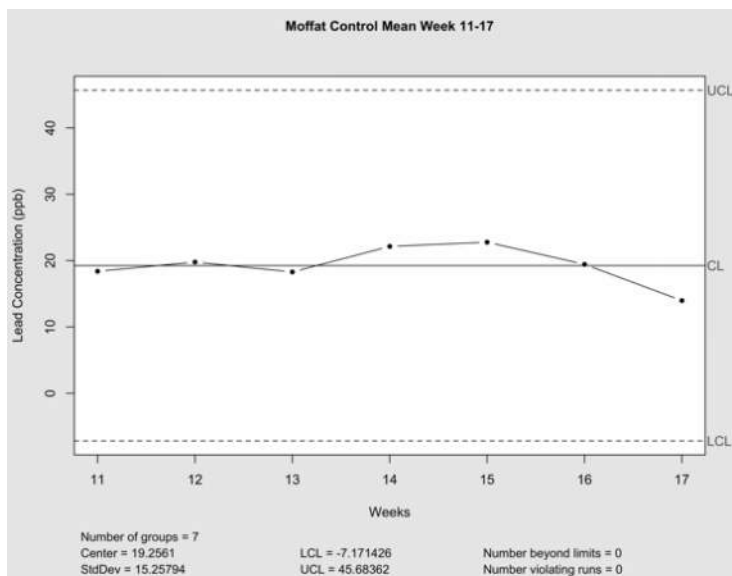


Figure 21 Control charts for pooled lead concentration data from the Moffat pH coupons

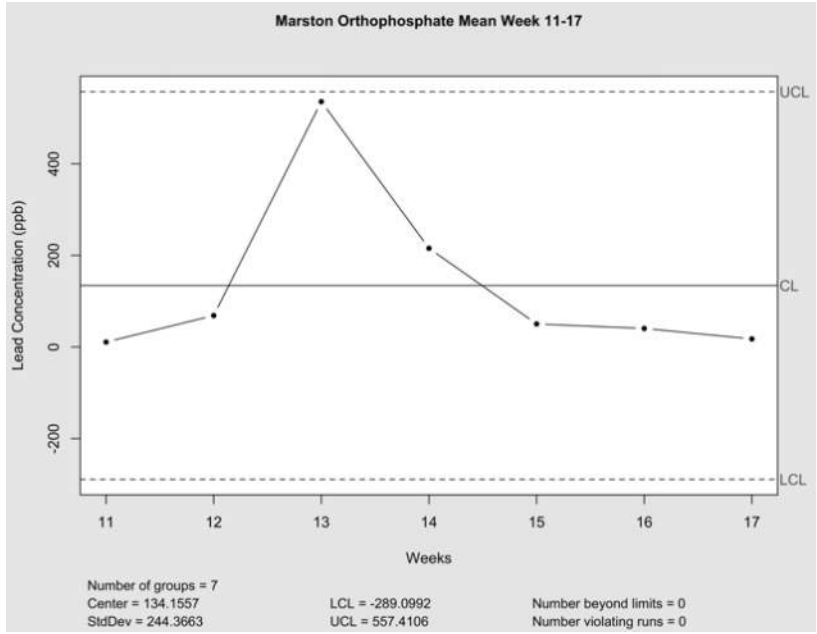


Figure 22 Control charts for pooled lead concentration data from the Marston orthophosphate coupons

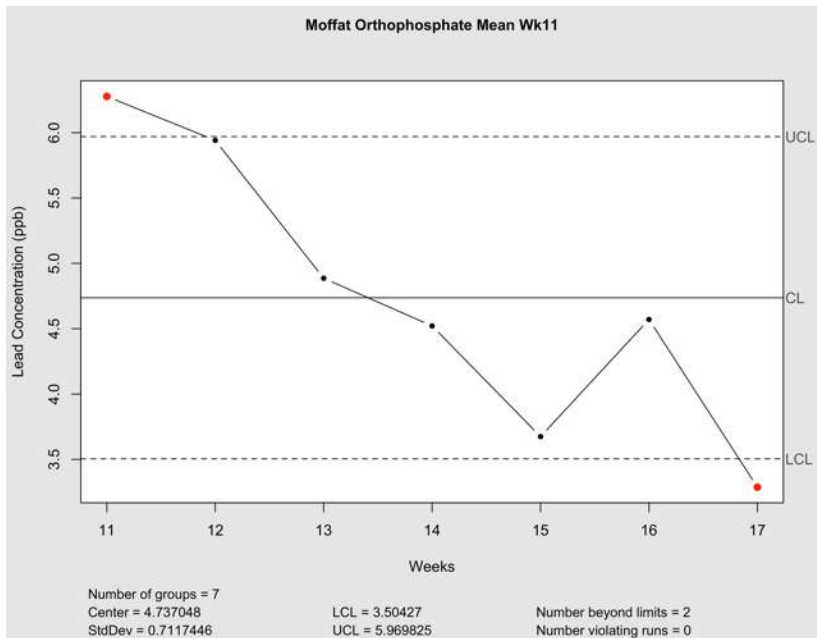


Figure 23 Control charts for pooled lead concentration data from the Moffat orthophosphate coupons

Copper Control Charts

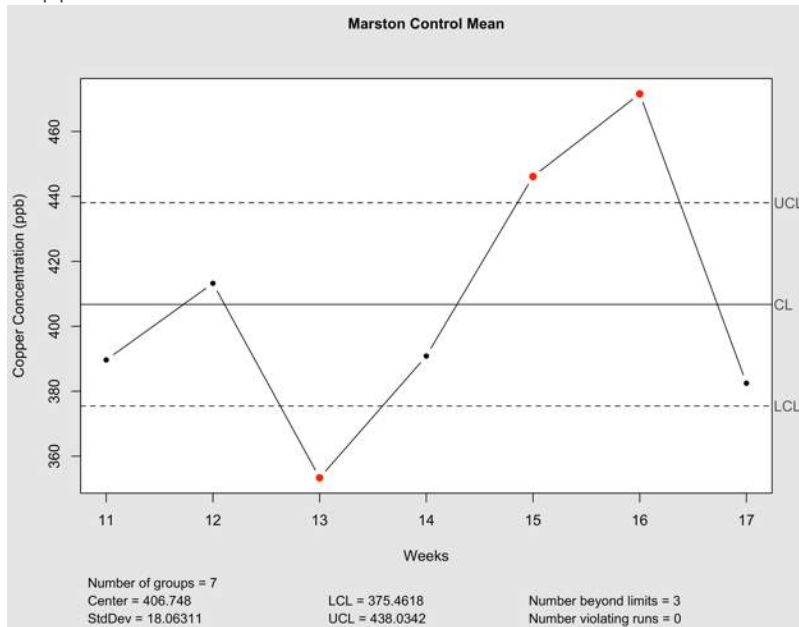


Figure 24 Control charts for pooled copper concentration data from the Marston control coupons

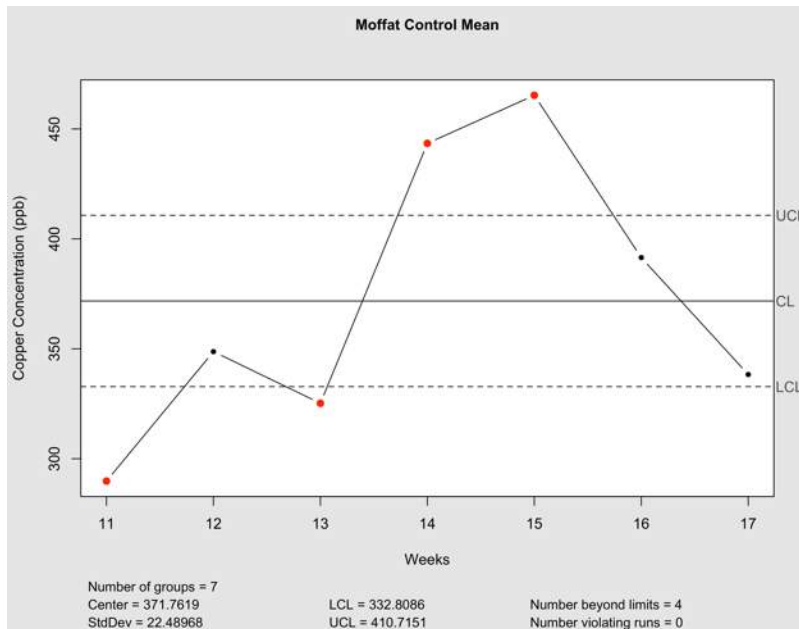


Figure 25 Control charts for pooled copper concentration data from the Moffat control coupons

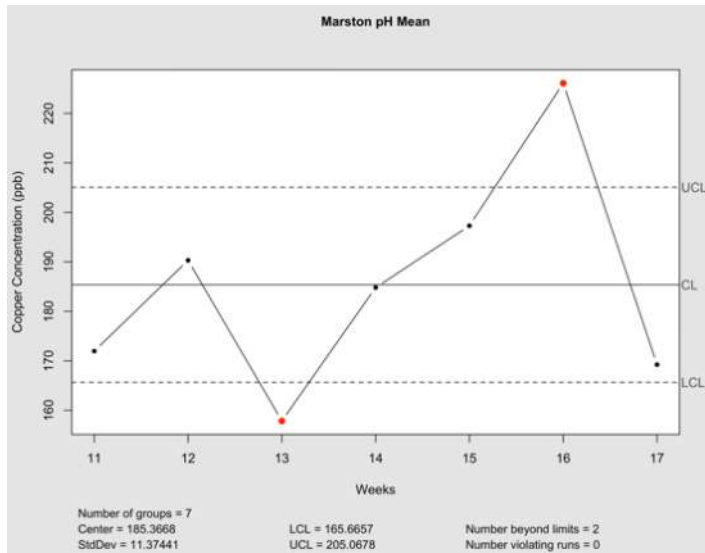


Figure 26 Control charts for pooled copper concentration data from the Marston pH coupons

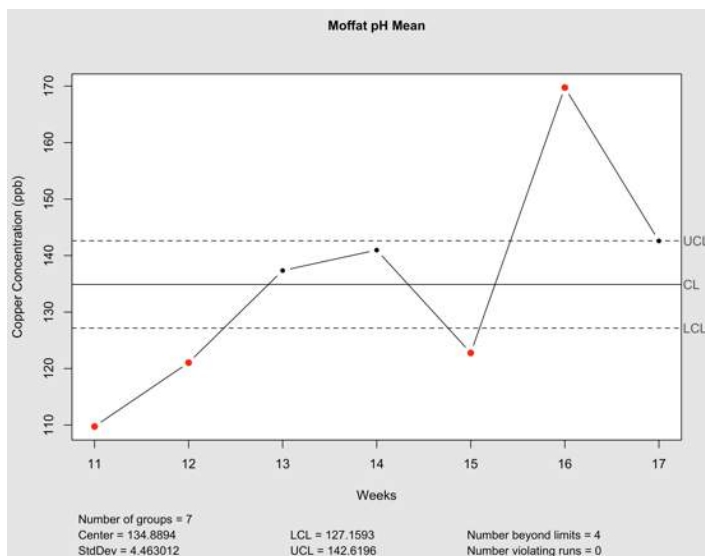


Figure 27 Control charts for pooled copper concentration data from the Moffat pH coupons

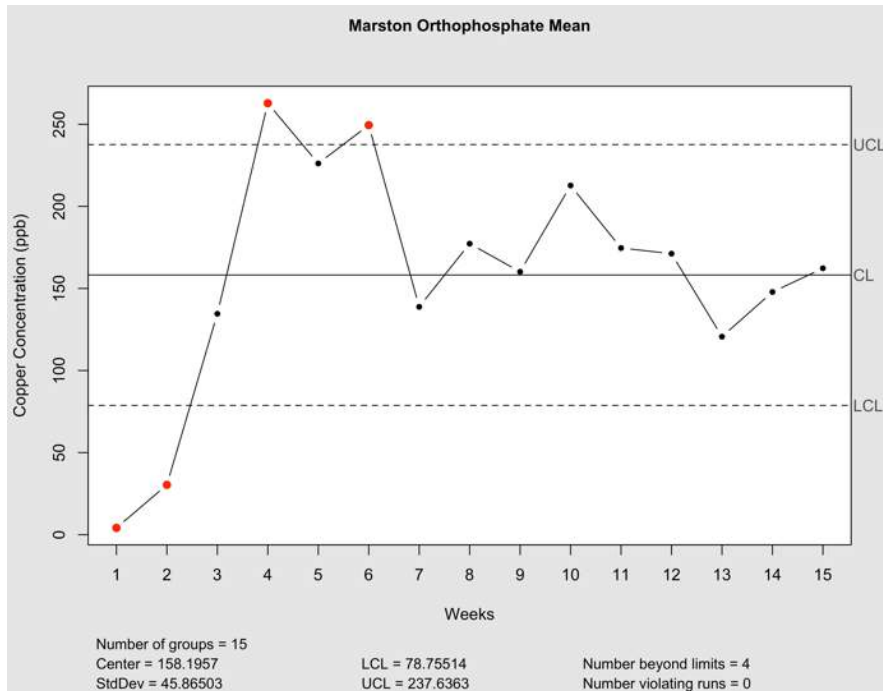


Figure 28 Control charts for pooled copper concentration data from the Marston orthophosphate coupons

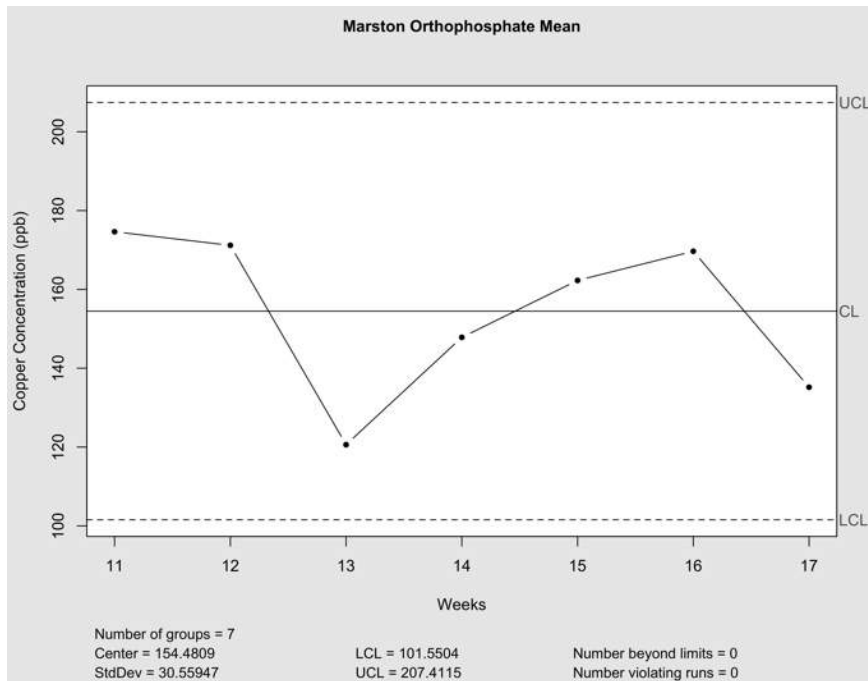


Figure 29 Control charts for pooled copper concentration data from the Moffat orthophosphate coupons

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APPENDIX III.E.3 – NITRIFICATION POTENTIAL OF ORTHOPHOSPHATE ADDITION AND INCREASED pH

September 2019

Appendix III.E.3:

Nitrification Potential of Orthophosphate Addition and Increased pH

Date: September 5, 2019
To: Denver Water
From: Corona Environmental Consulting, LLC

Introduction

The purpose of this appendix is to investigate the potential impacts of the two corrosion control strategies on nitrification occurrence in Denver Water's distribution system. Both corrosion control alternatives, orthophosphate addition and pH adjustment, have the potential to alter microbial communities within the distribution system by altering the C-N-P balance with the addition of phosphate, or by inhibiting microbial growth by increasing the pH.

Nitrification in chloraminated water systems is a common occurrence (AWWA 2013) and has been known to occur within Denver Water's distribution system. Nitrification was investigated in a 2016 Water Quality Model and Study completed by Bohannon Huston (2016), which concluded that episodic nitrification was observed in certain areas of the distribution system generally from September through November. These episodes coincided with decreases in production, and therefore, longer residence times (Bohannon Huston, 2016).

Nitrification is a two-step process that consists of a chemical reaction followed by a biological reaction. The chemical reaction is the auto decomposition of monochloramine which liberates free ammonia to the water. The biological reaction occurs when nitrifying bacteria use the free ammonia as a substrate, consuming the residual disinfectant. Nitrification is typified by the loss of the chloramine residual, increased microbial activity, depressed pH in poorly buffered waters, and the presence of nitrite and nitrate. Waters undergoing nitrification have also been shown to increase the concentrations of N-nitrosamines, such as N-nitrosodimethylamine (NDMA) and total N-nitrosamines (TONO), as well as disinfection by-products (DBPs) in chloraminated drinking water distribution systems depending on water quality conditions (Zeng & Mitch, 2016).

Data Review and Findings

The biological nitrification process requires specific water quality conditions to proceed, such as the bioavailability of nutrients (carbon, nitrogen, and phosphorus) and favorable pH and temperatures to promote nitrifying bacteria growth.

Nitrifying bacteria are mostly autotrophic, using inorganic carbon as their carbon source. In Denver Water's system this carbon source is carbonate. If an abundance of organic carbon exists in a system from the background organic matter, heterotrophic bacteria will outcompete nitrifiers and inhibit nitrification. Thus, nitrification is expected to proceed when there is high nitrogen concentration relative to

bioavailable carbon. Nitrification conditions are favorable in Denver Water’s system as nitrogen is added during treatment as ammonia for chloramine formation.

The Marston and Moffat Treatment Plants’ treated water nutrient conditions in terms of ammonia and bioavailable carbon are presented by a box and whisker plot in Figure 1. The box represents the range from the first to the third quartile with the whiskers extending to the 5th and 95th percentiles. Data outside these ranges are shown as individual dots. Assimilable organic carbon was estimated based on 10% of total organic carbon (TOC) being bioavailable (Camper et al., 2000; Terry & Summers, 2018). Ammonia nitrogen was calculated from the total chlorine residual in the lead pilot, assuming Denver Water’s target chlorine-to-ammonia-as-nitrogen ratio of 4.5:1 (by mass). Denver Water’s carbon and ammonia conditions lie within the region of heterotrophic and nitrifying bacteria colonization and is close to the region in which nitrifying bacteria dominate (Verhagen & Laanbroek, 1991). This indicates a high potential for nitrification and suggests the biological reaction is limited elsewhere.

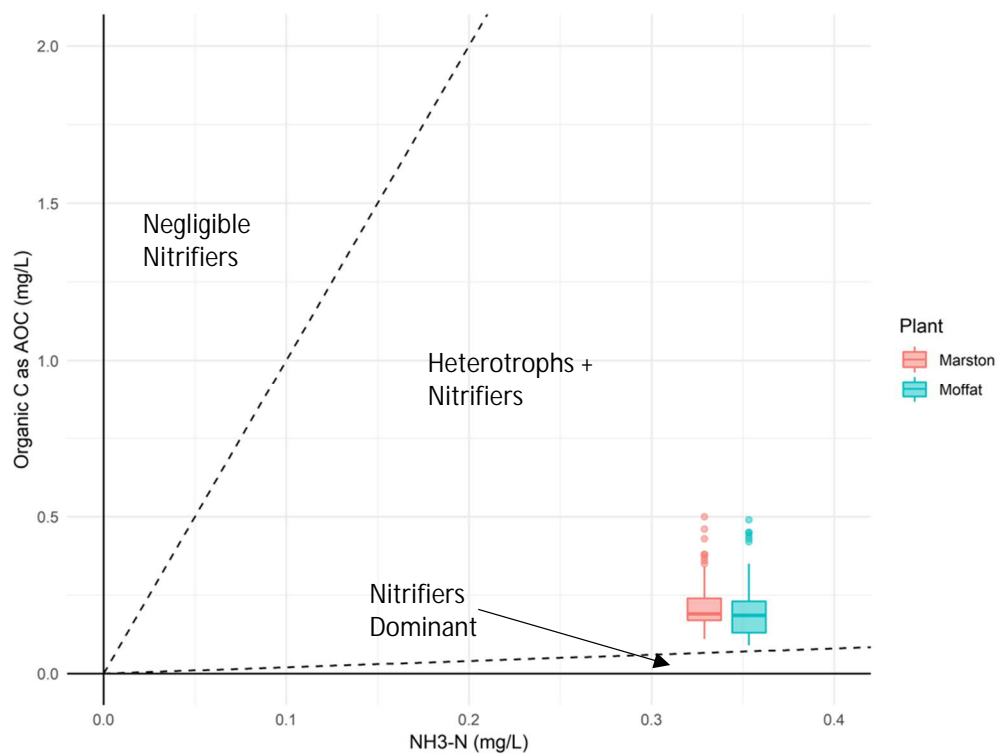


Figure 1 Effluent organic carbon and nitrogen concentrations at the Marston and Moffat Treatment Plants

Limited phosphorus concentrations in drinking water may inhibit the growth of nitrifiers in drinking water systems (AWWA, 2013). Specifically, phosphorus concentrations below 10 µg/L-P are considered limiting and concentrations below 25 µg/L-P are considered potentially limiting (AWWA, 2013). Furthermore, a study conducted by van der Aa et al. (2000) observed that in order to maintain sufficient nitrification, phosphorus concentrations of at least 10 µg/L-P are required. They also observed that concentrations of 30 µg/L-P are required to re-establish ammonia removal by nitrifiers at low temperatures. Phosphorus results obtained from the lead pilot are presented as a box and whiskers plot in Figure 2. Phosphorus in these systems originates from the source water, as phosphorus is not added as part of existing operations. These results indicate that nitrification in Denver Water’s distribution system may be phosphorus limited. While phosphorus limitation in drinking waters is uncommon, it is not unexpected at Denver Water as the

water sources are first-use mountain runoff with few anthropogenic sources of phosphorus. Furthermore, any influent phosphorus is subject to coagulation with alum which tends to bind a fraction of the phosphorus for removal within the treatment plant.

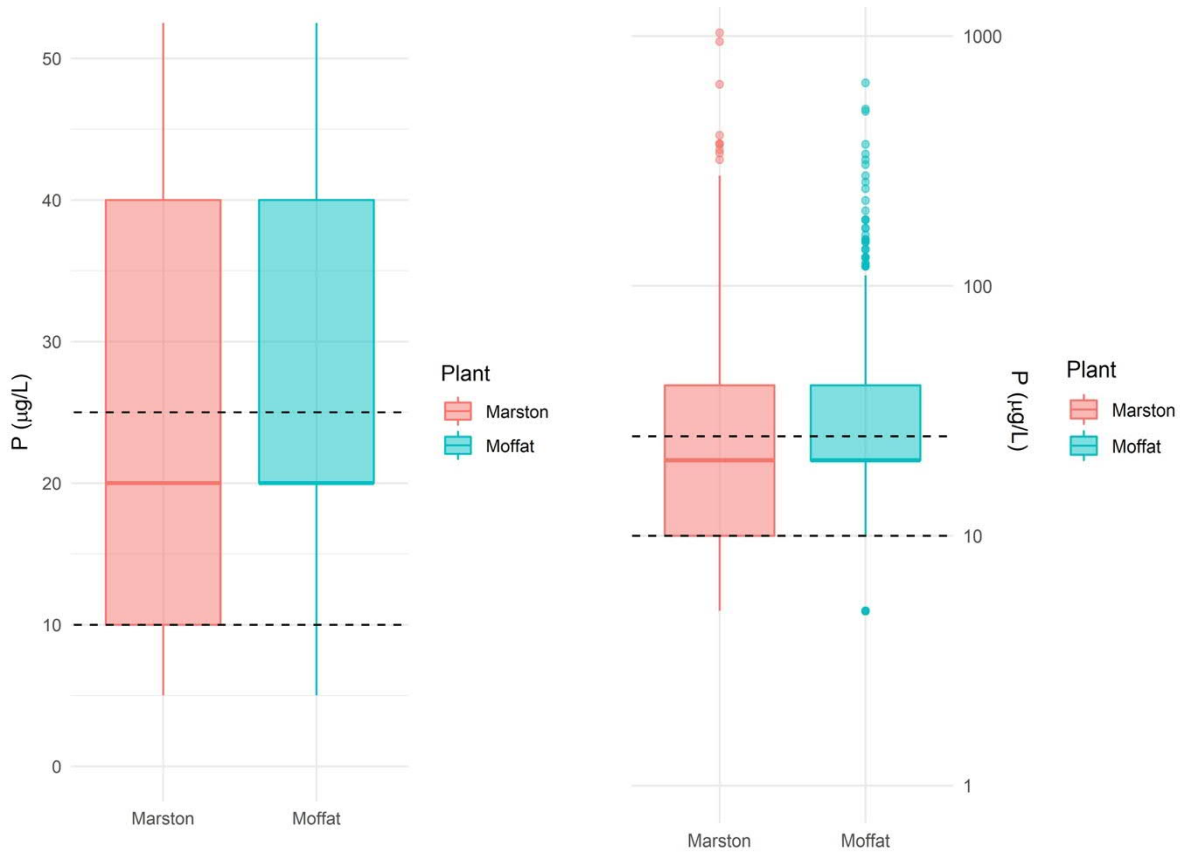


Figure 2 Marston and Moffat plants' influent phosphorus concentrations in arithmetic scale (a) and logarithmic scale (b). The 10 µg/L line represents the minimum concentration of phosphorus required to promote microbial activity, while the 25 µg/L dashed line represents potential phosphate limiting conditions.

Orthophosphate Addition

The addition of orthophosphate for corrosion control in the phosphorus limited distribution system is expected to increase nitrification frequency and severity. Consequently, Denver Water will have to proactively monitor and prevent nitrification to avoid disinfectant residual loss in the distribution system. Lower pH or fluctuations in pH that have been observed in poorly buffered waters, may also exacerbate lead release.

Nitrification control includes strategies to slow the chemical auto decomposition reaction of monochloramine and strategies to inhibit the biological reaction. Denver Water already practices good control of the chemical reaction by i) coagulating organics to reduce concentrations and stabilize the chloramine residual and ii) carefully controlling the chlorine-to-ammonia-as-nitrogen ratio during chloramine formation to minimize free ammonia in the effluent water. The most effective nitrification control strategy available to Denver Water in an orthophosphate CCT scenario is to increase the chloramine dose to prevent the onset of nitrification (Pintar et al., 2005; Zhang et al., 2009; AWWA, 2013). However, increasing the chloramine residual in chloraminated systems can further increase NDMA, TONO,

and other DBPs, as nitrifying biofilms release these compounds' precursors (Zeng & Mitch, 2016). The ability to decrease water age is limited due to Denver Water's distribution system size and the storage management operating strategy. Increasing pH in the orthophosphate scenario as a means to inhibit nitrification is not practical without extensive study as it reduces the effectiveness of lead control (AWWA, 1996).

pH/Alkalinity Adjustment

Under the proposed Lead Reduction Program, corrosion control practices at Denver Water will be modified to operate at a pH of 8.8 instead of the current pH target of 7.8, thereby inhibiting nitrification. Increasing pH to above 8.3 reduces the growth of nitrifying bacteria and reduces chloramine decay (Zhang et al., 2009; AWWA, 2013). Furthermore, Kirmeyer et al. (1993) found that the chlorine-to-ammonia-as-nitrogen ratio became less important at pH above 8.3, as monochloramine residuals are more stable and dichloramine formation (and the associated taste and odor problems associated with dichloramine) is minimized.

Conclusions

Introducing orthophosphate to Denver Water's phosphorus-limited distribution system has the potential to create favorable conditions for microbial growth and consequently, nitrification. Alternatively, increasing pH to 8.8 is expected to inhibit microbial growth, and therefore reduce the potential for nitrification in Denver Water's distribution system. Denver Water has a nitrification action plan, which is due to be updated by the end of the year. This plan describes how chloramine formation is managed, the operations and maintenance practices to reduce water age, and the water quality monitoring program for the distribution system.

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APPENDIX IV.A - PROPOSED TERMS AND CONDITIONS

September 2019

Note: This document sets forth Denver Water’s proposed terms and conditions that will control if the variance to the treatment technique and the modification to the designated OCCT is granted. This document is preliminary and subject to modification.

Denver Water’s Proposed Terms and Conditions for its Variance Request for Optimal Corrosion Control Treatment under SDWA 42 U.S.C. § 300g-4(a)(3)

In furtherance of Denver Water’s variance request from 40 C.F.R. § 141.82(e) of the Optimal Corrosion Control Treatment Requirements under the Safe Drinking Water Act’s Lead and Copper Rule, Denver Water is submitting its proposed terms and conditions which control during the term of the variance approval. The following proposed terms and conditions will become binding on Denver Water only upon the date that a variance becomes effective and so long as the variance remains in place. Except as otherwise provide herein, Denver Water must continue to follow the compliance requirements under the provisions of the Lead and Copper Rule as promulgated under state and federal law, 5 CCR 1002-11, 40 C.F.R. § 141.80-141.91, and as may be modified in the future.

1. Definitions:

A. “*Action level*” has the same meaning as action level in the Lead and Copper Rule, 40 C.F.R. § 141.80(c) and §§ 11.26(1)(c) and (2)(b) of the Colorado Primary Drinking Water Regulations (5 CCR 1002-11).

B. “*Adoption*” or “*Adopted*” for the purposes of the filter survey means that the customer enrolled in the filter program is using a filter NSF/ANSI (53) certified for lead removal for drinking, cooking, and infant fed formula (ingestion). Respondents who indicate that they use bottled water or an alternative NSF/ANSI (53) certified filter for ingestion will count as having adopted the use of a filter under paragraph 5.G.i. below.

C. “*Contact*” means direct mailing, water bill inserts, door hangers, in person contact, email, phone calls, educational materials accompanying filters and cartridges, or any other direct communication channels identified in Denver Water’s communications, outreach, and education plan. Communications via information posted on the Denver Water website, social media websites, water bills, distribution of filters and replacement cartridges alone, or public notices required as a corrective action or a failure to meet a condition are excluded from this definition.

D. “*Customer Premise*”, for the purpose of these terms and conditions only, means a property or a residential unit within a multi-family property that receives water service pursuant to a Denver Water or distributor tap license.

E. “*Customer(s) Enrolled in the Filter Program*” means a customer premise, as defined herein where there is a known, suspected or possible lead service line (LSL), that will automatically be distributed a filter under section 5 below, unless otherwise refused by the customer.

F. “*Day*” means calendar day.

G. “*Effective Date*” means ninety-one (91) calendar days following approval of the variance or issuance of the State’s modification decision, whichever occurs later.

H. “*Integrated System(s)*” means the defined term used in section 11.42(4) of 5 CCR 1002-11, as may be modified in the future. Currently, “integrated system” is defined as a “wholesale system and one or more consecutive systems with distribution systems that are physically connected [that] . . . choose to operate in a manner where the wholesaler assumes responsibility for compliance with one or more regulatory requirements applicable to the supplier responsible for the consecutive system, if the requirements of . . . section 11.42(4) are met.”

I. “*Ingestion*” means the use of tap water for drinking, cooking, and infant fed formula.

J. “*Investigated*” refers to any activity used to identify the service line materials including a lead water quality test, potholing, visual inspection, or other methods that allows for a determination of the service line material.

K. “*Known LSLs*” are based upon direct evidence that gives a 100% estimated probability that a service line is an LSL.

L. “*Known, suspected and possible LSLs*” collectively refers to known LSLs, suspected LSLs, and possible LSLs.

M. “*Lead and Copper Rule (LCR) Regulatory Sampling*” means the collection of lead and copper tap samples for homes that have lead solder without a lead service lines and homes with lead service lines sampled in accordance with § 11.26 of 5 CCR 1002-11 and 40 C.F.R. § 141.86.

N. Lead Reduction Program Plan (LRPP) means Denver Water’s Lead Reduction Program Plan dated September 2019.

O. “*Lead Service Line*” or “*LSL*” means a service line made of lead which connects the water main to the building inlet and any lead pigtail, gooseneck or other fitting which is connected to such lead line. This definition is intended to be inclusive of the term “Lead Service Line” as defined under section 11.26(1)(g) of 5 CCR 1002-11 and 40 C.F.R. § 141.2.

P. “*LSL Replacement*” is defined in paragraph 4.B, below.

Q. “*Orthophosphate Treatment*” means phosphate-based treatment as described in the Colorado Department of Public Health and Environment’s (CDPHE) March 20, 2018 letter to Denver Water designating orthophosphate as optimal corrosion control treatment.

R. “*Possible LSLs*” are based on conflicting or missing data that provides an estimated probability value between 50% to 79% that a service line is an LSL.

S. “*Program Year*” has the same meaning as calendar year.

T. “*Public Notice*” for the purpose of this variance means either:

i. a Tier 2 public notice as described in § 11.33 of 5 CCR 1002-11 and 40 C.F.R. § 141.203, initiated within thirty (30) days following a CDPHE notice of a violation of the variance with messaging approved by CDPHE provided to all customers served by Denver Water;

ii. a public notice that contains the same elements of Tier 2 Public Notice described above initiated within sixty (60) days after learning of the need for corrective action provided to customers enrolled in the filter program to be delivered by making at least two (2) forms of direct contact with the customer subset, with messaging approved by CDPHE;

iii. a public notice by Denver Water that meets the requirements as described in § 11.26(7) of 5 CCR 1002-11 and 40 C.F.R. § 141.85, including public education associated with the Lead and Copper Rule initiated within sixty (60) days to all recipients specified in § 11.26(7)(c) of 5 CCR 1002-11 and 40 C.F.R. § 141.85(b);¹

iv. a notice included in Denver Water’s annual summary report; or

v. a Tier 3 public notice as described in § 11.33(4) of 5 CCR 1002-11 and 40 C.F.R. § 141.204, initiated as soon as possible but no later than 365 days following a violation or situation notification from CDPHE.

U. “*Suspected LSLs*” are based upon available data that provides an estimated probability value between 80% to 99% estimated probability (i.e. homes built before 1951) that a service line is an LSL.

V. “*System*” means the community water system that Denver Water owns and operates (PWS ID# CO0116001) and the integrated systems covered under Master Meter, Read and Bill, and Total Service agreements with Denver Water as detailed in Appendix III.B.1 of the Lead Reduction Program Plan submitted by Denver Water in support of its variance request.

W. “*Variance End Date*” means fifteen (15) years after the effective date, unless extended by EPA.

2. Corrosion Control Treatment:

A. *pH/Alkalinity Adjustment Corrosion Control Treatment*. By the effective date, Denver Water must begin to make adjustment to pH and alkalinity as corrosion control

¹ The public notice requirements under Subpart Q of the LCR (40 C.F.R. § 141.201 *et seq.*) will continue to apply if there is a violation of the schedule, and/or any terms and conditions of the variance –tier 1 and tier 2 notices, respectively.

treatment (CCT) according to an implementation schedule and treatment targets approved by CDPHE. Denver Water must maintain the corrosion control parameters and targets within the ranges designated by CDPHE under § 11.26(3)(d)(iii) of 5 CCR 1002-11 and 40 C.F.R. § 141.82(h).

B. *Monitoring and Sampling:*

i. *LCR Regulatory Sampling for Action Level 90th Percentile Calculation.* During the variance, Denver Water must maintain Lead and Copper Rule (LCR) sampling sites pursuant to § 11.26(2) of 5 CCR 1002-11 and 40 C.F.R. § 141.86 for lead service lines and lead solder sites.

ii. *Use of Sampling Results.* Lead water quality tests collected to identify LSLs for the inventory under this variance and to verify lead concentrations post-replacement shall not be used in the calculation of the 90th percentile. Any customer-requested samples that meet the Tier 1 sampling requirements will still be included in Denver Water's compliance calculations.

iii. *Monitoring for Water Quality Parameters.* Denver Water must follow §§ 11.26(4)(j)-(l) of 5 CCR 1002-11 and 40 C.F.R. §§ 141.82(g)-(i) for treatment technique compliance determinations for continued operation and maintenance of the CCT.

C. *CCT Compliance Metrics, Corrective Actions, and Failures.*

i. *CCT Compliance.* For each six-month sampling period, Denver water must achieve LCR Regulatory Sampling at or below the LCR Action Level based upon the 90th percentile calculation.

ii. *Corrective Action.* If compliance has not been achieved under 2.C.i., Denver Water must follow the requirements of the LCR in the case of a lead or copper Action Level exceedance under § 11.26 of 5 CCR 1002-11 and 40 C.F.R. § 141.82. If Denver Water's LCR regulatory sampling exceeds the LCR's Action Level as measured at the 90th percentile for two (2) LCR monitoring periods within the duration of the variance, Denver Water has failed to meet the condition in 2.C.i., and either:

a. this variance shall terminate; or

b. CDPHE will require Denver Water to follow the corrosion control treatment steps under § 11.26(3)(c) of 5 CCR 1002-11, in which case the variance will be continued pending the results from corrosion control treatment studies until CDPHE makes a determination under § 11.26(3)(c)(ii). EPA may nevertheless terminate this variance in the interests of public health under paragraph 7.D below.

c. In either case above, CDPHE will issue Denver Water a treatment technique violation and Denver Water must conduct a Tier 2 public notice to all customers under 1.T.i above.

3. Lead Service Line Inventory:

A. *LSL Inventory.* Denver Water must create and maintain on an ongoing basis an inventory of the material used for each service line used for drinking water that is a known, suspected, and possible LSL associated with a customer premise within Denver Water's system, and update the inventory each program year in agreement with CDPHE as LSLs are replaced and the material used for service lines are investigated. The inventory must include private service lines, and must include all LSLs within the system, including in the service areas of all distributors who are a part of the system. Denver Water must complete the initial LSL inventory no later than thirty-five (35) days after the effective date. The total estimated number of known, suspected, and possible LSLs equals (Y) as further described in paragraph 4.A below. Any updates to (Y) will be submitted in Denver Water's annual summary report described in paragraph 6 below.

B. *Investigation of Service Line Materials.* On an ongoing basis Denver Water must investigate known, suspected, and possible LSLs using lead water quality tests, potholing, visual inspections, or other means that supports a determination of the service line material. The number of known, suspected and possible LSLs for the purpose of investigating properties for the first year following the variance approval will be based on the (Y) factor, as adjusted under paragraph 4.A below. Denver Water must incorporate its findings under this subsection into its required LSL inventory annual updates.

C. *Publication of LSL Inventory.* No later than seventy (70) days following the effective date, Denver Water must provide public access to its LSL inventory on its external customer website, which will allow the public to view whether service line materials used for any customer premise in the system is (i.e. lead, copper, or unknown). During the term of this variance, Denver Water must continue to provide public access to its LSL inventory, including access to any updates to its inventory required under this section 3. For owners or residents of a customer premise who call Denver Water by phone, Denver Water must disclose whether its inventory shows that the owner's or resident's service line is a known, suspected and possible LSL, is unlikely to be an LSL or is a non-lead service line.

D. *LSL Inventory Compliance Metrics, Corrective Actions, and Failures.*

i. *Compliance Metric.* Denver Water must investigate a minimum of 1.4% of the total estimated number of suspected and possible LSLs in the LSL inventory each program year until 20% of the total estimated number of suspected and possible LSLs are investigated based upon the inventory at the beginning of the first program year (based on a subset of Y as described in paragraph 4.A below) as adjusted. These investigations are performed independently of the LSL replacements under paragraph 4 below.

ii. *Corrective Action.* If Denver Water does not conduct the minimum 1.4% of investigations by the end of the program year, the denominator (Y) in paragraph 4.A below will revert to the value established at the beginning of the previous program year, less LSL replacements for the previous program year, until Denver Water achieves compliance with this paragraph. Denver Water must also provide public notice that the metric was not met in its annual summary report under paragraph 1.T.iv above.

iii. *Completion of Inventory.* When Denver Water has completed the confirmation of the material for all suspected and possible LSLs under paragraph 3.D.i., Denver Water must provide written notice to CDPHE and this variance metric will terminate.

4. Accelerated Lead Service Line Replacement Program:

A. *LSL Replacement.* By the effective date, Denver Water must begin to implement accelerated LSL replacement in its system and replace all known LSLs within 15 years of the effective date. By the end of program year 1, Denver Water must achieve a 6.0% replacement rate,² and by the end of program year 2, Denver Water must achieve a 6.5% replacement rate based upon the known, suspected and possible LSLs (Y) at the beginning of the program year. By the end of the third program year and every program year thereafter, Denver Water must maintain a minimum cumulative annual average replacement rate of 7.0% per year. At the end of each program year, the cumulative program year average must be calculated using the total number of LSLs replaced during the term of the variance (X) divided by the total estimated number of known, suspected, and possible LSLs (Y), consistent with the most recent update of the LSL inventory. Program year adjustments to (X) and (Y) will be made at the end of each program year with the approval of EPA and CDPHE based upon any changes to the total estimated number of known, suspected and possible LSLs in Denver Water's updated LSL inventory except as otherwise provided in paragraph 3.D.ii above; provided, however, all LSLs must be replaced within 15 years of the effective date. For program year 1, X = 3,838 and Y= 63,955.

B. *LSL Replacement Defined.* For the purpose of calculating the cumulative program year average replacement rate, the following types of LSL replacements will count as credit for an entire LSL replacement:

- i. full LSL replacement of a single service line;
- ii. replacement of an existing partial LSL that results in a non-lead service line from the main to the first fitting inside the structure;
- iii. replacement of a galvanized service line downstream of an existing or previously existing LSL, including any lead that is part of the upstream segment of the service line; and

² If the effective date is after January 1, 2020, the 6.0% replacement rate for the first program year will be prorated through December 31, 2020 by dividing the number of remaining full months from the effective date to the end of the Calendar Year by 12 and multiplying this factor by the 6.0% replacement rate.

iv. LSL replacement completed by other governmental agencies, developers, homeowners, non-profits, etc. and inspected by Denver Water.

C. *Replacement to Fitting.* All LSLs must be replaced from the main up to the first fitting inside the structure excluding any portion of the service line that is copper. If there is no fitting within five feet of the location where the service line enters the structure, Denver Water must install a fitting to allow for connection of the service line at a location convenient for Denver Water.

D. *Partial LSL Replacements.* Denver Water may not make a partial replacement of an LSL during the term of the variance except when i. emergency repairs must be made to a service line or water main to protect the distribution system; or ii. property owner consent cannot be obtained or the property cannot be accessed. A partial replacement that does not result in complete replacement of all portions of the LSL shall not be counted as an LSL replacement for the purposes of the accelerated LSL replacement program until the partial LSL is fully replaced.

E. *Post Replacement Samples.* Denver Water must offer to collect and analyze lead samples at homes where LSLs have been replaced six (6) months post LSL replacement.

F. *Test Out.* The “test out” provision in 40 C.F.R. § 141.84(c) and § 11.26(6)(b)(i)(B) of 5 CCR 1002-11 does not apply while Denver is subject to this variance. Any lines that “test out” do not count toward LSLs that were replaced under the terms of this variance.

G. *Property Owner Consent.* Denver Water must contact property owners at the customer premise before replacement to secure the property owner’s documented consent. Work at the customer premise may commence once consent is documented. If Denver Water has not made contact with a property owner, Denver Water must use reasonable efforts to secure consent. Reasonable efforts must include at least three attempts to contact the property owner including an attempt to send at least two (2) written requests by U.S. mail to the property owner at the most recent mailing address identified through Denver Water records for consent to replace the LSL at the property, and an attempt to obtain permission by making in-person contact with the property owner if necessary. If documented consent to replace the LSL is not granted after reasonable efforts are made to achieve consent, the property will be added to Denver Water’s Service Line Refusal List as described in paragraph 4.H. below.

H. *Customer Refusals and Changes in Customer Accounts.* Denver Water must maintain records of the addresses of all structures at which the property owner does not consent to LSL replacement (Service Line Refusal List). When Denver Water customer account records indicate a change in ownership at the customer premise, Denver Water must determine whether the address is on the Service Line Refusal List, and within ninety-one (91) days of a change in Denver Water account records, undertake reasonable efforts to obtain permission from the new property owner of the customer premise to replace the LSL. Reasonable efforts include the efforts described in paragraph 4.G. above. If permission is granted and conditions allow for

the LSL to be accessed and safely replaced, Denver Water must replace the LSL. By the variance end date, Denver Water must replace all LSLs at properties on the Service Line Refusal List.

I. *LSLs Discovered After Variance Term.* Denver Water must continue to replace any LSL discovered after the variance end date and report any LSL replacements to CDPHE on an annual basis. This condition shall survive the term of the variance.

J. *Accelerated LSL Replacement Compliance Metrics, Corrective Actions, and Failures.*

i. *Compliance Metric.* Denver Water must achieve at least a 6.0% LSL replacement rate by the end of program year 1, 6.5% in program year 2, and beginning the end of program year 3 and thereafter a 7.0% cumulative annual average LSL replacement rate each program year.

ii. *Corrective Action.* If the compliance metric in paragraph 4.J.i. is not achieved after program year 3, Denver Water must increase LSL replacements to achieve a 7.0% cumulative annual average replacement rate by the end of the next program year. In addition, Denver Water shall provide public notice to all customers who have known, suspected, or possible LSLs that correction under this variance metric under 1.T.ii

5. Filter Program:

A. *Filters.* Denver Water must distribute to the occupant of all customer premises with known, suspected and possible LSLs one (1) filter and enough replacement cartridges for the first six months of use. Denver Water shall begin to distribute filters and cartridges within ninety-one (91) days of the effective date and complete distribution one hundred and eighty-two (182) days following the effective date. If Denver Water does not distribute all of the filters and cartridges by the above deadline, then Denver Water must conduct public notice to all customers enrolled in the filter program under paragraph 1.T.ii. All filters and cartridges distributed must be certified NSF/ANSI (53) for lead removal and not remove fluoride. Denver Water need not distribute a filter and replacement cartridge to a customer premises if the occupant confirms that their household uses bottled water, an existing under the sink filter certified NSF/ANSI (53) for lead removal, refrigerator filter certified NSF/ANSI (53) for lead removal, or other lead removal device that is certified NSF/ANSI (53) for lead removal for ingestion purposes.

B. *Filter Replacement Cartridges.* Denver Water must distribute replacement cartridges to customers enrolled in the filter program per the filter manufacturers' recommended replacement rate unless the customer refuses the filter or replacement cartridges. Replacement filters must be provided to each customer premise enrolled in the filter program until six months after replacement of a customer premise's LSL or until the time the service line of the property is confirmed to be non-lead. If Denver Water does not distribute all of the replacement cartridges per the manufacturers' recommended replacement rate, then Denver Water must conduct public notice to all customers enrolled in the filter program under paragraph 1.T.ii.

C. *Changes in Customer Accounts.* If a change in the customer name of the water account associated with a customer enrolled in the filter program occurs at any time, then Denver Water must distribute a new filter within thirty-five (35) days of the change in customer account and replacement cartridges per manufacturers recommended replacement rate to the new customer so long as the customer premise or a residential unit at the customer premise is enrolled in the filter program.

D. *Filters for Infants in '83 to '87 Customer Premises.* If a customer has a formula-fed infant/child up to 24 months of age and resides in a customer premise that is built between 1983-1987 and served by a copper service line with lead solder, upon customer request Denver Water must provide a free lead water quality test kit. If the water quality results in the first draw show lead concentrations above 3 ppb, Denver Water must offer a filter and enough replacement cartridges to last the customer until a child at the customer-premise exceeds the age of 24 months.

E. *Filter Adoption Assessment.*

i. *Surveys.* Denver Water must conduct a survey each program year of randomly selected customers enrolled in the filter program to receive at minimum 1,059 responses. The minimum number of required responses may be reduced upon written approval of CDPHE and EPA as the number of customers enrolled in the filter program decline during the term of this variance. The survey must inquire whether the customer has adopted the filter for water used for infant formula if applicable, cooking and drinking or is using bottled water or a filter device that is certified NSF/ANSI (53) for lead removal not provided by Denver Water for infant formula, cooking and drinking. The filter survey will be provided to and approved by CDPHE before distribution to customers enrolled in the filter program. If Denver Water:

a. Does not conduct the annual survey during any program year, then Denver Water will be issued a treatment technique violation and must conduct public notice to all customers under paragraph 1.T.i.

b. If Denver Water does not collect the minimum number of received survey responses during any program year, then Denver Water must conduct public notice to all customers enrolled in the filter program under paragraph 1.T.v, unless CDPHE determines that Denver Water must conduct public notice under paragraph 1.T.ii.

ii. *Survey of Filter Adoption Rate.* All of the received survey responses will be used to calculate the filter adoption rate based on the number of responses that confirm adoption of the filter, or use of bottled water or alternative filter device not provided by Denver Water that is certified NSF/ANSI (53) for ingestion. All respondents who indicate that they do not use the filter, bottled water, or alternative filter device that is certified NSF/ANSI (53) for cooking but have adopted for drinking water and infant fed formula, if the latter is applicable to the respondent, will be summed and multiplied by 50% and the result may be counted as having adopted a filter for the purposes of determining the average filter adoption rate in paragraph 5.G.i. below.

iii. *Bottled Water and Alternative Filter Devices.* Customers who indicate that they use bottled water or alternative filter device certified NSF/ANSI (53) will continue to be customers enrolled in the filter program unless they refuse a filter or contact Denver Water to opt-out of the filter program. Denver Water will maintain a list of customers who have refused filters or opted-out of the filter program and provide the list to CDPHE upon request.

F. *Filter Performance.*

i. *Confirmation of Filter Performance Before Distribution.* Before distributing filters to customers enrolled in the filter program in program year one, Denver Water will test the lead removal effectiveness of 12 units of each type of filter to be distributed to customers using water from Denver Water's pipe racks as described in the LRPP from at least one Denver Water treatment plant in accordance with a testing protocol approved by CDPHE to confirm that the filters meet their NSF/ANSI (53) certification. All filter testing results will be reported to CDPHE. Denver Water will not distribute a filter model that fails to meet the NSF/ANSI (53) certification based upon the lead samples collected under this paragraph.

ii. *Confirmation of Filter Performance in Field.* To confirm performance of filters in use at customer premise, Denver Water will collect fifty (50) samples from filters in use by customers enrolled in the filter program who are also enrolled in Denver Water's LCR regulatory sampling program in accordance with a testing protocol approved by CDPHE. Samples will be collected from filters used by customers enrolled in the filter program at the same frequency as LCR regulatory sampling and reported to CDPHE and EPA.

iii. If Denver Water does not complete testing of filters under this section 5.F. in accordance with the CDPHE approved protocols, Denver Water must provide public notice in accordance with paragraph 1.T.ii. above.

G. *Filter Adoption Compliance Metrics, Corrective Actions, and Failures.*

i. *Compliance.* Denver Water must achieve a filter adoption rate of 65% at the end of each program year.

ii. *Corrective Action.* If this metric is not achieved at the end of a program year, then Denver Water must achieve a 65% filter adoption rate by the end of the following program year. Denver Water will also provide public notice to customers enrolled in the filter program under paragraph 1.T.ii.

H. *Filter Communication Compliance Metrics, Corrective Actions, and Failures.*

i. *Compliance.* Denver Water must 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.

ii. *Corrective Action.* If Denver water does not achieve compliance with paragraph 5.H.i., then Denver Water must increase outreach efforts to reach 95% of Denver Water customers enrolled in the filter program, and Denver Water must also provide public notice to all customers enrolled in the filter program of its failure to achieve the metric under paragraph 1.T.ii.

6. Recordkeeping and Reporting Requirements:

A. *Reporting.* In the event that Denver Water determines that it will not meet any of the terms and conditions as defined in this document, Denver Water must notify CDPHE and EPA no later than two business days after the determination occurs. CDPHE will provide any resulting requirements (e.g., notification of violation, public notice requirements, etc.) to Denver Water (and copy EPA) in writing.

B. *Recordkeeping.* On an ongoing basis for the term of the variance, Denver Water shall record, maintain records of, and report each year the following information. Denver Water will provide any of the “raw” data to CDPHE or EPA, when requested. Unless otherwise stated, the reporting and recordkeeping requirements under the LCR remain in effect:

i. *CCT.*

- a. all lead and copper regulatory sampling results, as required in § 11.26 of 5 CCR 1002-11;
- b. CCT parameters for pH and alkalinity; and
- c. all water quality sampling results collected as part of Denver Water’s investigation of LSLs and post LSL replacement.

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;
- f. the number of investigations conducted each year to improve the LSL inventory;
- g. an updated distribution system map; and
- h. the rationale for requesting a change in the status of a service line in the inventory (e.g. investigation, replacement, water quality data, etc.).

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 service line refusal list, including addresses 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.

iv. *Filters.*

- a. addresses of customer premises where filters and replacement cartridges have been provided;
- b. the total number of filters and replacement cartridges distributed per program year;
- c. a summary of filter survey responses per program year (i.e., descriptive statistics), the response rate, the percent filter adoption for each year of the variance, and the specific survey questions and responses;
- d. a list of customer accounts 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 customers enrolled in the filter program who have refused a filter or replacement cartridges or have opted out of enrollment in the filter program; and
- f. filter lead sampling results collected under paragraph 5.F above.

v. *Compliance Metrics.* Results achieved under the compliance metrics in sections 2.C, 3.D, 4.J, 5.G, and 5.H above.

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;
- 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, date and time of call.

vii. *Health Equity and Environmental Justice.* A summary of activities conducted and designed to address health equity and environmental justice (HE&EJ) principles set forth in the Lead Reduction Program Plan (LRPP), including:

- a. a description of how the HE&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; and
- c. socioeconomic or demographic data collected from or other 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.

C. *Annual Program Year Reports.* No later than thirty-five (35) days following the end of a program year, Denver Water must submit a program year report to CDPHE and EPA, containing a summary of the information and data required under this section 6 for the previous program year, including an assessment of which metrics were achieved and the status of any corrective actions. This requirement remains in effect for the term of the variance. The annual report will also document any modification requests made by Denver Water to the Lead Reduction Program Plan or deviations from the LRPP during the most recent program year, along with a rationale for the request. If CDPHE or EPA provides any comments or requests related to the annual report, Denver Water must provide a written response within thirty-five (35) calendar days that addresses any identified comments/requests.

7. General Miscellaneous Provisions:

A. *Enforcement.* CDPHE has primary implementation and enforcement authority over the variance, subject to EPA oversight. CDPHE will implement, oversee, and enforce these terms and conditions, and may make recommendations to EPA to terminate or continue this variance, provided that EPA has the authority to ultimately decide whether to continue this variance.

B. *Revisions to the Lead and Copper Rule.* If EPA revises the federal LCR in a manner that affects the provisions and conditions of this variance, then EPA may modify or revoke this variance in a manner that is consistent with federal law.

C. *Lead Reduction Program Plan.* Denver Water will work in good faith to fully implement Section III of the LRPP. If Denver Water deviates from Section III the LRPP during the term of the variance or fails to implement Section III of the LRPP, Denver Water will provide notice to CDPHE within thirty-five (35) days with a description of the deviation from section III of the LRPP and the reason for the deviation. In no case shall a deviation from Section III of the LRPP modify these terms and conditions, except as provided in paragraph 7.J below. In the event of a

conflict between these terms and conditions and Section III of the LRPP, these terms and conditions take precedence.

D. *Enforcement.* Notwithstanding any metric and/or corrective action identified herein, EPA and CDPHE may take enforcement if EPA or CDPHE find, in their sole discretion, that Denver Water has not complied with any requirement of the variance in accordance with 42 U.S.C. §§ 300g-3(a)(1) and 300g-4(b) of the SDWA, including when:

- i. Denver Water does not comply with its terms and conditions;
- ii. A material aspect of Section III of the LRPP has not been implemented in good faith;
- iii. Denver Water requests that EPA terminate the variance; or
- iv. EPA or CDPHE believes that there is a risk to public health.

An enforcement action does not automatically terminate the variance.

E. *Automatic Termination of Variance.* This variance terminates if one or more of the following conditions occur:

- i. Denver Water fails to replace LSLs at the required minimum cumulative program year average rate of 7.0% for a total of three program years; or
- ii. Denver Water fails to achieve a minimum of 65% filter adoption rate in a program year for a total of three program years.

If the variance is terminated Denver Water will provide public notice under 1.T.i

F. *Optimal Corrosion Control Treatment.* If EPA revokes the variance under paragraph 7.D. or the variance automatically terminates under paragraph 7.E, within 182 Days Denver Water shall install and operate orthophosphate as its designated optimal corrosion control treatment, in accordance with CDPHE's March 20, 2018, OCCT determination, and provide public notice to its customers in accordance with paragraph 1.T.i above. The initial dose of orthophosphate must be 2 mg/L. The specific orthophosphate dose may be further modified by CDPHE according to the provisions under 40 C.F.R. § 141.82(h).

G. *Effective Date of Termination or Revocation of the Variance.* Termination or revocation of the variance will be effective within 182 days of automatic termination under paragraph 7.E. above, or EPA's revocation under section 7.D. above, whichever occurs first. Failure to complete installation and operation of orthophosphate by this deadline will be considered a treatment technique violation under § 11.26 of 5 CCR 1002-11.

H. *Notice of Lead Reduction Program Plan.* No later than 14 days following effective date, Denver Water must begin a multi-media public information campaign and customer notification by written letter and pamphlet to notify customers enrolled in the filter program of Denver Water's variance, including the accelerated LSL replacement program and the distribution of the NSF/ANSI (53) certified filters for lead removal.

I. *Term of Variance.* Unless EPA revokes or modifies, the terms, this variance shall extend from the effective date through the variance end date, or until EPA accepts the notice of completion pursuant to section 7.L. below. Additionally, as described in, paragraph 4.I, Denver Water shall replace within six (6) months of discovery, any LSLs discovered after the variance end date. Denver Water must provide an annual summary of these efforts to CDPHE by January 10th of each calendar year for the previous program year.

J. *Modification of Conditions.* EPA may modify the conditions of this variance in consultation with CDPHE. EPA will notify Denver Water thirty-five (35) days prior to the effective date of any modification.

K. *Notices.* All notices, reports, disclosures, or other communications required or related to this variance must be sent via certified U.S. Mail, overnight express delivery service, or electronic means to the recipients and addresses below.

EPA:

Safe Drinking Water Branch Chief
Water Division U.S. Environmental Protection Agency, Region 8
1595 Wynkoop St.
Denver, CO 80202-1129
Current E-mail: **[To be added upon finalization.]**

Denver Water:

James S. Lochhead
CEO/Manager
Denver Water
1600 West 12th Avenue
Denver, Colorado 80204
E-mail: **[To be added upon finalization.]**

Office of General Counsel:
ATTN: Jessica Brody
Denver Water
1600 West 12th Avenue
Denver, Colorado 80204
E-mail: **[To be added upon finalization.]**

CDPHE:

Jill Hunsaker Ryan
Executive Director
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246
E-mail: **[To be added upon finalization.]**

All reports will be sent to Drinking Water Compliance Assurance through its on-line portal at <https://wqcdcompliance.com/login> or through such other means as designated in writing by CDPHE.

Attorney General's Office
ATTN: **[To be added upon finalization.]**

L. *Notice of Completion.* Denver Water may submit a notice of completion of the terms and conditions of this variance to CDPHE, with a copy to EPA, by the variance end date or earlier in accordance with this variance. EPA may either accept or reject Denver Water's notice of completion in writing within thirty-five (35) days of receipt.

APPENDIX VII.A – LEAD REDUCTION PROGRAM COST ESTIMATES

September 2019

Cost Estimate Summary:

Denver Water and the MOU stakeholders developed planning level financial impact estimates for the orthophosphate and variance alternatives.

The "Low" capital costs, annual operating costs, and assumptions are shown in Table VII.A-1. The "High" capital costs, annual operating costs, and assumptions are shown in Table VII.A-2.

Denver Water currently replaces lead service lines at a rate of 700 per year, with an additional 500 per year replaced through redevelopment, for a combined total of 1,200 per year. Denver Water will be required to increase the rate of lead service line replacements to 780 per year to replace all lead services for the orthophosphate alternative within 50 years ($780 \times 50 + 500 \times 50$). Denver Water's cost for replacement of approximately 780 lead services lines per year is included in the cost estimates. The developers cost for replacement of 500 lead service lines per year is not included in the cost estimates.

A Net Present Value summary for the 50-year period using the capital and operating costs is shown in Table VII.A-3. The low and high cost estimate range reflects different assumptions for the timing and need of various capital projects and associated operating costs. The assumptions are incorporated into the life-cycle costs for both scenarios; specifically 50 years for orthophosphate and 15 years for the variance. The NPV summary reflects a discount rate of 1.5% and an inflation rate of 0%. The discount rate is based on the US Office of Management and Budget memorandum titled *2019 Discount Rates for OMB Circular No. A-94* of December 18, 2018. Assumptions regarding timing for the low and high operating capital and operating costs are shown in Tables VII.A-1 and VII.A-2, respectively.

A total investment summary for the Low and High capital and operating costs for the 50-year and 15-year period is shown in Table VII.A-3. The total investment summary includes the capital and operating costs for the life of the program.

Table VII.A-1: Regional Estimated Financial Impacts For OCCT and LSL Removal Alternatives -Low Cost Estimates in Today's Dollars

Cost Category and Subcategory	Incremental Capital or Total Item Costs					Operating Costs					Assumptions and Notes for the NPV
	Orthophosphate @ 3 mg/L and LSLR in 50 years	Orthophosphate @ 2 mg/L and LSLR in 50-Years	Orthophosphate @ 1 mg/L and LSLR in 50-years	Orthophosphate @ 0.5 mg/L and LSLR in 50-years	Variance Option: pH 8.8 w/ 15-Yr ALSLR Program	Orthophosphate @ 3 mg/L	Orthophosphate @ 2 mg/L	Orthophosphate @ 1 mg/L	Orthophosphate @ 0.5 mg/L	Variance Option: pH 8.8 w/ 15-Yr ALSLR Program	
A - Wastewater Treatment Plant Expenses											
Metro Wastewater Reclamation District (MWRD)	\$129,000,000	\$129,000,000	\$129,000,000	\$0	\$0	\$4,590,000	\$3,170,000	\$1,790,000	\$30,000	\$0	Capital cost starting in 2036. O&M start in 2036 through end of 50 year period. Starting in 2023 Starting in 2025 Starting in 2020. Capital costs as referenced in CDPHE July 2019 memo Not in WISE group but in Cherry Creek Basin. Starting in 2020. Capital costs as referenced in CDPHE July 2019 memo
South Platte Water Renewal Partners (SPWRP)	\$0	\$0	\$0	\$0	\$0	\$250,000	\$200,000	\$80,000	\$40,000	\$0	
South Adams County Water and Sanitation District (SACWSD)	\$0	\$0	\$0	\$0	\$0	\$91,200	\$60,000	\$30,000	\$0	\$0	
Broomfield	\$0	\$0	\$0	\$0	\$0	\$256,000	\$171,000	\$86,000	\$43,000	\$0	
ACWWA (Inverness Supply)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
WISE Participants (Centennial, etc.)	\$4,500,000	\$3,000,000	\$1,500,000	\$700,000	\$0	\$18,800	\$12,500	\$6,300	\$3,100	\$0	
Subtotal A - Wastewater Treatment Plant	\$133,500,000	\$132,000,000	\$130,500,000	\$700,000	\$0	\$5,206,000	\$3,613,500	\$1,992,300	\$116,100	\$0	
B - Stormwater & Non-Point Irrigation Treatment											
Phosphorus Removal - City and County of Denver Stormwater	\$14,080,000	\$9,400,000	\$4,680,000	\$2,360,000	\$0	\$2,462,000	\$1,641,000	\$821,000	\$410,000	\$0	Capital and operating costs starting in 2030. Included with Above
Phosphorus Removal - Service Areas Outside City and County of Denver Stormwater	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Subtotal B - Stormwater & Non-Point	\$14,080,000	\$9,400,000	\$4,680,000	\$2,360,000	\$0	\$2,462,000	\$1,641,000	\$821,000	\$410,000	\$0	
C - Watershed Non-Point Treatment											
Recreational Impacts @ Barr Lake and Milton Reservoir	\$0	\$0	\$0	\$0	\$0	\$364,000	\$281,500	\$199,000	\$116,500	\$0	Operating cost start in 2020 and extend through 2029. Operating costs start in 2020 and extend for 50-years. Costs vary over time. Operating costs start in 2020 and extend through 2035.
Barr/Milton In Canal Treatment	\$0	\$0	\$0	\$0	\$0	\$723,500	\$343,900	\$147,000	\$1,650	\$0	
DW Gravel Lakes Treatment	\$0	\$0	\$0	\$0	\$0	\$290,000	\$290,000	\$290,000	\$290,000	\$0	
Subtotal C - Watershed Non-Point Treatment	\$0	\$0	\$0	\$0	\$0	\$1,377,500	\$915,400	\$636,000	\$408,150	\$0	
D - Non-Denver Water WTP Improvements											
Thornton	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Capital and operating cost start in 2020 (amount for first 15-years then 15% for remainder) Capital and O&M Starting in 2020. Reduce by 25%. No cost anticipated. ECCV will reduce purchase of DW to maintain low phosphorus levels in their watershed basin.
Aurora	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$0	\$157,000	\$157,000	\$157,000	\$157,000	\$0	
Broomfield OCCT	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$0	\$60,000	\$40,000	\$20,000	\$10,000	\$30,000	
South Adams County Water and Sanitation District (SACWSD)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
East Cherry Creek Valley (ECCV)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Subtotal D - Non-Denver Water WTP	\$11,000,000	\$11,000,000	\$11,000,000	\$11,000,000	\$0	\$217,000	\$197,000	\$177,000	\$167,000	\$30,000	
E - Denver Water WTP & Distribution Expenses											
Foothills WTP Upgrade	\$2,900,000	\$2,900,000	\$2,900,000	\$2,900,000	\$2,900,000	\$1,000,000	\$670,000	\$330,000	\$170,000	\$500,000	Starting in 2020 Starting in 2020 Starting in 2020 Starting in 2020
Marston WTP Upgrade	\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$250,000	\$167,500	\$82,500	\$42,500	\$100,000	
Moffat WTP Upgrade	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$250,000	\$167,500	\$82,500	\$42,500	\$100,000	
Denver Water - Marston Washwater Recycling	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$0	\$196,000	\$196,000	\$196,000	\$196,000	\$0	
Increased Nitrification Control	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Subtotal E - Denver Water WTP Expenses	\$17,100,000	\$17,100,000	\$17,100,000	\$17,100,000	\$7,100,000	\$1,696,000	\$1,201,000	\$691,000	\$451,000	\$700,000	
F - Filter Program											
Distribution and Management	\$0	\$0	\$0	\$0	\$33,406,000	\$0	\$0	\$0	\$0	\$0	Starting in 2020 and end in 2034, ~93,200 filters distributed in year 2020
Subtotal F - Filter Program	\$0	\$0	\$0	\$0	\$33,406,000	\$0	\$0	\$0	\$0	\$0	
G - ALSLR Program											
ALSLR Program	\$0	\$0	\$0	\$0	\$254,250,000	\$0	\$0	\$0	\$0	\$0	Starting in 2020 and end in 2034, ~64,000 LSL at \$4,500/each + 7,500 LSL replaced by developers at no cost. Starting in 2020, 9,700 potholes and 39,000 WQ Samples
Potholing and WQ Sampling Program	\$0	\$0	\$0	\$0	\$5,932,500	\$0	\$0	\$0	\$0	\$0	
Subtotal G - ALSLR Program	\$0	\$0	\$0	\$0	\$260,182,500	\$0	\$0	\$0	\$0	\$0	
H - Current LSLR Process											
Current LSLR Process	\$184,275,000	\$184,275,000	\$184,275,000	\$184,275,000	\$0	\$0	\$0	\$0	\$0	\$0	Starting in 2020, 64,000 LSL at \$4,500/each + 25,000 LSL replaced by developers at no cost (5% internal management cost) Starting in 2020, 10,600 potholes and 42,300 WQ Samples (rely on physical identification versus predictive model, 5% internal management cost)
Potholing and WQ Sampling Program	\$5,733,000	\$5,733,000	\$5,733,000	\$5,733,000	\$0	\$0	\$0	\$0	\$0	\$0	
Subtotal H - Current LSLR Process	\$190,008,000	\$190,008,000	\$190,008,000	\$190,008,000	\$0	\$0	\$0	\$0	\$0	\$0	
Total Estimated Fiscal Impact	\$365,700,000	\$359,500,000	\$353,300,000	\$221,200,000	\$300,700,000	\$11,000,000	\$7,600,000	\$4,300,000	\$1,600,000	\$730,000	

Notes:
1. No, unanticipated, and unknown costs are represented as \$0.

Table VII.A-2: Regional Estimated Financial Impacts For OCCT and LSL Removal Alternatives - High Cost Estimates in Today's Dollars

Cost Category and Subcategory	Incremental Capital or Total Item Costs					Operating Costs					Assumptions and Notes for the NPV
	Orthophosphate @ 3 mg/L and LSLR in 50 years	Orthophosphate @ 2 mg/L and LSLR in 50-Years	Orthophosphate @ 1 mg/L and LSLR in 50-years	Orthophosphate @ 0.5 mg/L and LSLR in 50-years	Variance Option: pH 8.8 w/ 15-Yr ALSLR Program	Orthophosphate @ 3 mg/L and LSLR in 50 years	Orthophosphate @ 2 mg/L and LSLR in 50-Years	Orthophosphate @ 1 mg/L and LSLR in 50-years	Orthophosphate @ 0.5 mg/L and LSLR in 50-years	Variance Option: pH 8.8 w/ 15-Yr ALSLR Program	
A - Wastewater Treatment Plant Expenses											
Metro Wastewater Reclamation District (MWRD)	\$129,000,000	\$129,000,000	\$129,000,000	\$0	\$0	\$4,590,000	\$3,170,000	\$1,790,000	\$30,000	\$0	Capital cost starting in 2036. O&M start in 2036 through end of 50 year period.
South Platte Water Renewal Partners (SPWRP)	\$0	\$0	\$0	\$0	\$0	\$250,000	\$200,000	\$80,000	\$40,000	\$0	Starting in 2023
South Adams County Water and Sanitation District (SACWSD)	\$0	\$0	\$0	\$0	\$0	\$91,200	\$60,000	\$30,000	\$0	\$0	Starting in 2025
Broomfield	\$0	\$0	\$0	\$0	\$0	\$256,000	\$171,000	\$86,000	\$43,000	\$0	Starting in 2020. Capital costs as referenced in CDPHE July 2019 memo
ACWWA (Inverness Supply)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Not in WISE group but in Cherry Creek Basin.
WISE Participants (Centennial, etc.)	\$4,500,000	\$3,000,000	\$1,500,000	\$700,000	\$0	\$18,800	\$12,500	\$6,300	\$3,100	\$0	Starting in 2020. Capital costs as referenced in CDPHE July 2019 memo
Subtotal A - Wastewater Treatment Plant	\$133,500,000	\$132,000,000	\$130,500,000	\$700,000	\$0	\$5,206,000	\$3,613,500	\$1,992,300	\$116,100	\$0	
B - Stormwater & Non-Point Irrigation Treatment											
Phosphorus Removal - City and County of Denver Stormwater	\$177,960,000	\$133,800,000	\$13,360,000	\$6,680,000	\$0	\$7,623,000	\$5,278,000	\$2,336,000	\$1,168,000	\$0	Capital and operating costs starting in 2030.
Phosphorus Removal - Service Areas Outside City and County of Denver Stormwater	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Included with Above
Subtotal B - Stormwater & Non-Point Irrigation	\$177,960,000	\$133,800,000	\$13,360,000	\$6,680,000	\$0	\$7,623,000	\$5,278,000	\$2,336,000	\$1,168,000	\$0	
C - Watershed Non-Point Treatment											
Recreational Impacts @ Barr Lake and Milton Reservoir	\$0	\$0	\$0	\$0	\$0	\$364,000	\$281,500	\$199,000	\$116,500	\$0	Operating cost start in 2020 and extend through 2029.
Barr/Milton in Canal Treatment	\$0	\$0	\$0	\$0	\$0	\$723,500	\$343,900	\$146,600	\$1,650	\$0	Operating costs start in 2020 and extend for 50-years. Costs vary over time.
DW Gravel Lakes Treatment	\$0	\$0	\$0	\$0	\$0	\$290,000	\$290,000	\$290,000	\$290,000	\$0	Operating costs start in 2020 and extend through 2035.
Subtotal C - Watershed Non-Point Treatment	\$0	\$0	\$0	\$0	\$0	\$1,377,500	\$915,400	\$635,600	\$408,150	\$0	
D - Non-Denver Water WTP Improvements											
Thornton	\$20,000,000	\$20,000,000	\$20,000,000	\$20,000,000	\$0	\$200,000	\$134,000	\$66,000	\$33,000	\$0	Capital and operating cost start in 2020 (amount for first 15-years then 15% for remainder)
Aurora	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$0	\$157,000	\$157,000	\$157,000	\$157,000	\$0	Capital and operating cost start in 2020 (amount for first 15-years then 15% for remainder)
Broomfield OCCT	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$0	\$60,000	\$40,000	\$20,000	\$10,000	\$30,000	Capital and O&M Starting in 2020. Reduce by 25%.
South Adams County Water and Sanitation District (SACWSD)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	No cost anticipated.
East Cherry Creek Valley (ECCV)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	ECCV will reduce purchase of DW to maintain low phosphorus levels in their watershed basin.
Subtotal D - Non-Denver Water WTP	\$31,000,000	\$31,000,000	\$31,000,000	\$31,000,000	\$0	\$417,000	\$331,000	\$243,000	\$200,000	\$30,000	
E - Denver Water WTP & Distribution Expenses											
Foothills WTP Upgrade	\$2,900,000	\$2,900,000	\$2,900,000	\$2,900,000	\$2,900,000	\$1,000,000	\$670,000	\$330,000	\$170,000	\$500,000	Starting in 2020
Marston WTP Upgrade	\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$250,000	\$167,500	\$82,500	\$42,500	\$100,000	Starting in 2020
Moffat WTP Upgrade	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$250,000	\$167,500	\$82,500	\$42,500	\$100,000	Starting in 2020
Denver Water - Marston Washwater Recycling	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$0	\$196,000	\$196,000	\$196,000	\$196,000	\$0	Starting in 2020
Increased Nitrification Control	\$0	\$0	\$0	\$0	\$0	\$100,000	\$100,000	\$100,000	\$100,000	\$0	Starting in 2020
Subtotal E - Denver Water WTP Expenses	\$17,100,000	\$17,100,000	\$17,100,000	\$17,100,000	\$7,100,000	\$1,796,000	\$1,301,000	\$791,000	\$551,000	\$700,000	
F - Filter Program											
Distribution and Management	\$0	\$0	\$0	\$0	\$48,501,200	\$0	\$0	\$0	\$0	\$0	Starting in 2020 and end in 2034, ~119,250 filters distributed in year 2020
Subtotal F - Filter Program	\$0	\$0	\$0	\$0	\$48,501,200	\$0	\$0	\$0	\$0	\$0	
G - ALSLR Program											
ALSLR Program	\$0	\$0	\$0	\$0	\$403,975,000	\$0	\$0	\$0	\$0	\$0	Starting in 2020 and end in 2034, ~64,000 LSL at \$6,500/each + 7,500 LSL replaced by developers at no cost.
Potholing and WQ Sampling Program	\$0	\$0	\$0	\$0	\$6,525,750	\$0	\$0	\$0	\$0	\$0	Starting in 2020, 9,700 potholes and 39,000 WQ Samples
Subtotal G - ALSLR Program	\$0	\$0	\$0	\$0	\$410,500,750	\$0	\$0	\$0	\$0	\$0	
H - Current LSLR Process											
Current LSLR Process	\$266,175,000	\$266,175,000	\$266,175,000	\$266,175,000	\$0	\$0	\$0	\$0	\$0	\$0	Starting in 2020, 64,000 LSL at \$6,500/each + 25,000 LSL replaced by developers at no cost (5% internal management cost)
Potholing and WQ Sampling Program	\$5,733,000	\$5,733,000	\$5,733,000	\$5,733,000	\$0	\$0	\$0	\$0	\$0	\$0	Starting in 2020, 10,600 potholes and 42,300 WQ Samples (rely on physical identification versus predictive model, 5% internal management cost)
Subtotal H - Current LSLR Process	\$271,908,000	\$271,908,000	\$271,908,000	\$271,908,000	\$0	\$0	\$0	\$0	\$0	\$0	
Total Estimated Fiscal Impact	\$631,500,000	\$585,800,000	\$463,900,000	\$327,400,000	\$466,100,000	\$16,400,000	\$11,400,000	\$6,000,000	\$2,400,000	\$730,000	

Notes:
1. No, unanticipated, and unknown costs are represented as \$0.

Denver Water - Lead Reduction Program
Cost Estimates

Table VII.A-3: NPV and Total Investment Summary Information

NPV Summary					Total Investment				
1. Ortho Option – Item A, B, C, D, and E (ie. Cost of ortho addition without LSLR)					Ortho Option – Item A, B, C, D, and E (ie. Cost of ortho addition without LSLR)				
	Capital					Capital			
	3mg/L	2mg/L	1mg/L	0.5mg/L		3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/o LSLR - HIGH	\$ 244,042,455	\$ 219,718,821	\$ 155,932,376	\$ 52,744,424	Ortho w/o LSLR - HIGH	\$ 315,070,000	\$ 280,450,000	\$ 188,620,000	\$ 56,348,400
Ortho w/o LSLR - LOW	\$ 141,345,606	\$ 136,851,806	\$ 132,332,228	\$ 29,895,257	Ortho w/o LSLR - LOW	\$ 175,680,000	\$ 169,500,000	\$ 163,280,000	\$ 31,160,000
	Operation					Operation			
	3mg/L	2mg/L	1mg/L	0.5mg/L		3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/o LSLR - HIGH	\$ 407,708,994	\$ 286,059,824	\$ 148,434,030	\$ 64,720,974	Ortho w/o LSLR - HIGH	\$ 620,209,917	\$ 434,470,231	\$ 223,496,899	\$ 93,400,077
Ortho w/o LSLR - LOW	\$ 266,279,775	\$ 185,573,545	\$ 104,640,372	\$ 41,270,955	Ortho w/o LSLR - LOW	\$ 402,817,113	\$ 280,104,859	\$ 156,583,063	\$ 57,803,607
	Combined					Combined			
	3mg/L	2mg/L	1mg/L	0.5mg/L		3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/o LSLR - HIGH	\$ 651,751,449	\$ 505,778,645	\$ 304,366,407	\$ 117,465,399	Ortho w/o LSLR - HIGH	\$ 935,279,917	\$ 714,920,231	\$ 412,116,899	\$ 149,748,477
Ortho w/o LSLR - LOW	\$ 407,625,381	\$ 322,425,351	\$ 236,972,600	\$ 71,166,212	Ortho w/o LSLR - LOW	\$ 578,497,113	\$ 449,604,859	\$ 319,863,063	\$ 88,963,607
2. Variance Option = E + F + G - H (Cost of Variance without LSLR)					Variance Option = E + F + G - H (Cost of Variance without LSLR)				
	Capital					Capital			
Variance w/o LSLR - High	\$ 336,700,000				Variance w/o LSLR - High	\$ 194,200,000			
Variance w/o LSLR - Low	\$ 239,200,000				Variance w/o LSLR - Low	\$ 136,700,000			
	Operation					Operation			
Variance w/o LSLR - High	\$ 25,700,000				Variance w/o LSLR - High	\$ 36,500,000			
Variance w/o LSLR - Low	\$ 26,000,000				Variance w/o LSLR - Low	\$ 37,200,000			
	Combined					Combined			
Variance w/o LSLR - High	\$ 362,400,000				Variance w/o LSLR - High	\$ 230,700,000			
Variance w/o LSLR - Low	\$ 265,200,000				Variance w/o LSLR - Low	\$ 173,900,000			

Comment: Higher than Total Investment because subtracting a 50-year LSLR NPV from a 15-year variance NPV (NOT A COMPARABLE NPV NUMBER)

Denver Water - Lead Reduction Program
Cost Estimates

Table VII.A-3: NPV and Total Investment Summary Information

NPV Summary

3. Ortho Option – Item A, B, C, D, E, and H (with Current LSLR)

	Capital			
	3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/ LSLR - HIGH	\$ 320,900,000	\$ 296,600,000	\$ 232,800,000	\$ 129,600,000
Ortho w/ LSLR - LOW	\$ 195,000,000	\$ 190,600,000	\$ 186,000,000	\$ 83,600,000

	Operation			
	3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/ LSLR - HIGH	\$ 407,700,000	\$ 286,100,000	\$ 148,400,000	\$ 64,700,000
Ortho w/ LSLR - LOW	\$ 266,300,000	\$ 185,600,000	\$ 104,600,000	\$ 41,300,000

	Combined			
	3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/ LSLR - HIGH	\$ 728,600,000	\$ 582,700,000	\$ 381,200,000	\$ 194,300,000
Ortho w/ LSLR - LOW	\$ 461,300,000	\$ 376,200,000	\$ 290,600,000	\$ 124,900,000

NPV Summary

4. Variance Option = E + F + G (with Current LSLR)

Capital	
Variance - High	\$ 413,500,000
Variance - Low	\$ 292,900,000

Operation	
Variance - High	\$ 25,700,000
Variance - Low	\$ 26,000,000

Combined	
Variance - High	\$ 439,200,000
Variance - Low	\$ 318,900,000

NPV Summary

5. Delta Between Orthophosphate Option at 2 mg/L and Variance (without Current LSLR)

Combined	
Variance - High	\$ 66,600,000
Variance - Low	\$ 3,500,000

NPV Summary

6. Delta Between Orthophosphate Option at 2 mg/L and Variance (with Current LSLR)

Combined	
Variance - High	\$ 143,500,000
Variance - Low	\$ 57,300,000

Total Investment

Ortho Option – Item A, B, C, D, E, and H (with Current LSLR)

	Capital			
	3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/ LSLR - HIGH	\$ 587,000,000	\$ 552,400,000	\$ 460,500,000	\$ 328,300,000
Ortho w/ LSLR - LOW	\$ 365,700,000	\$ 359,500,000	\$ 353,300,000	\$ 221,200,000

	Operation			
	3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/ LSLR - HIGH	\$ 620,200,000	\$ 434,500,000	\$ 223,500,000	\$ 93,400,000
Ortho w/ LSLR - LOW	\$ 402,800,000	\$ 280,100,000	\$ 156,600,000	\$ 57,800,000

	Combined			
	3mg/L	2mg/L	1mg/L	0.5mg/L
Ortho w/ LSLR - HIGH	\$ 1,207,200,000	\$ 986,900,000	\$ 684,000,000	\$ 421,700,000
Ortho w/ LSLR - LOW	\$ 768,500,000	\$ 639,600,000	\$ 509,900,000	\$ 279,000,000

Total Investment

Variance Option = E + F + G (with Current LSLR)

Capital	
Variance - High	\$ 466,100,000
Variance - Low	\$ 326,700,000

Operation	
Variance - High	\$ 36,500,000
Variance - Low	\$ 37,200,000

Combined	
Variance - High	\$ 502,600,000
Variance - Low	\$ 363,900,000

Total Investment

Delta Between Orthophosphate Option at 2 mg/L and Variance (without Current LSLR)

Combined	
Variance - High	\$ 212,300,000
Variance - Low	\$ 85,700,000

Total Investment

Delta Between Orthophosphate Option at 2 mg/L and Variance (with Current LSLR)

Combined	
Variance - High	\$ 484,300,000
Variance - Low	\$ 275,700,000