

Director Creagh:

The following package includes documents relating to the Flint Water issue.

- **Flint Water Advisory Task Force.** Governor Snyder announced this independent Flint Water Advisory Task Force on October 21, 2015. Its members include the following:

Ken Sikkema, Co-Chair – Senior Policy Fellow, Public Sector Consultants  
Chris Kolb, Co-Chair – President, Michigan Environmental Council  
Matthew Davis, M.D., M.A.P.P - University of Michigan  
Lawrence Reynolds, M.D. - President, Mott Children's Health Center  
Eric Rothstein – Principal, Galardi Rothstein Group

The Flint Water Advisory Task Force has corresponded with the Governor as follows:

- **December 29, 2015** – indicating that the DEQ failed in its responsibility to ensure safe drinking water for Flint residents.
- December 15, 2015 – the Governor responded to a December 7, 2015 request and appointed Harvey Hollins as the Flint coordinator for the administration, and also retained Chris DeWitt for communication purposes.
- A On **December 23, 2015**, the **Michigan Auditor General** responded to specific questions regarding data and the sampling and data collection protocols raised by State Senator Ananich.
- **Timeline of the Flint Water Events** chronicles the activities and documents relating to the various issues of concern. There are specific resources attached to each entry which can be provided.

Also enclosed are additional background materials:

- Flint water FY 2016 Supplemental Budget Request
- DEQ's 18 Point Partnering Plan
- A set of EPA memoranda/communications addressing the federal Lead and Copper Rule
- Listing of the FOIAs requested relating to the Flint water issue.

Madhu R. Anderson

1 January 2105

**FLINT WATER ADVISORY TASK FORCE  
CORRESPONDENCE**

December 29, 2015

Dear Governor Snyder:

The Flint Water Advisory Task Force, which you appointed on October 21, 2015, has devoted considerable effort and countless hours to our review of the contamination of the Flint water supply: what happened, why it occurred, and what is needed to prevent a recurrence in Flint or elsewhere in the state. We have also been assessing ongoing mitigation efforts to help assure that short- and long-term public health issues and water management concerns will be properly addressed to safeguard the health and well being of the Flint community.

Shortly after we began our work, we recognized the immediate need for better coordination of the state's response to the ongoing public health issues in Flint, and for assignment of a single person to provide this coordination. We addressed these concerns in a letter to you on December 7, 2015, and you responded with immediate adoption of these recommendations. We thank you for the commitment your response demonstrates.

In our continuing efforts, we have now interviewed numerous individuals at state and local levels; reviewed many documents, articles, and emails; and deliberated repeatedly as a group. Both individually and as a group, we have visited Flint several times during the past several weeks to meet with citizens, public health officials and healthcare providers, individuals who have water management responsibilities at the city and county levels, and other public officials.

It is clear to us, particularly as we listen to the people of Flint, that it is both critical and urgent to establish responsibility for what happened in their community and to ensure accountability. This is a first step in a long process to re-establish the trust they no longer have in their government and the agencies whose responsibility it is to protect their health. It is urgent because this deep distrust of government continues to compromise the effective delivery of protective services designed to address ongoing public health issues. It is for these reasons that we are sending this letter at this time.

We believe the primary responsibility for what happened in Flint rests with the Michigan Department of Environmental Quality (MDEQ). Although many individuals and entities at state and local levels contributed to creating and prolonging the problem, MDEQ is the government agency that has responsibility to ensure safe drinking water in Michigan. It failed in that responsibility and must be held accountable for that failure.

The Safe Drinking Water Act (SDWA) places responsibility for compliance with its requirements on the public water system. In this instance, the City of Flint had the responsibility to operate its water system within SDWA requirements, under the jurisdiction of the MDEQ. The role of the MDEQ is to ensure compliance with the SDWA through its regulatory oversight as the primary agency having enforcement responsibility for the Flint water system.

The MDEQ failed in three fundamental ways.

#### Regulatory Failure

We believe that in the Office of Drinking Water and Municipal Assistance (ODWMA) at MDEQ, a culture exists in which "technical compliance" is considered sufficient to ensure safe drinking water in Michigan.

This minimalist approach to regulatory and oversight responsibility is unacceptable and simply insufficient to the task of public protection. It led to MDEQ's failure to recognize a number of indications that switching the water source in Flint would—and did—compromise both water safety and water quality. The MDEQ made a number of decisions that were, and continue to be, justified on the basis that federal rules "allowed" those decisions to be made. ODWMA must adopt a posture that is driven not by this minimalist technical compliance approach, but rather by one that is founded on *what needs to be done to assure drinking water safety*.

A culture change must occur within ODWMA. It must be driven by a mission that is aspirational regarding the role of the MDEQ in ensuring the safety and the quality of Michigan's drinking water. We believe, and have expressed to MDEQ Director Dan Wyant, that as a Great Lakes State, Michigan should aspire to have the safest drinking water in the nation, rather than merely aiming for technical compliance with regulatory requirements.

#### Failure in Substance and Tone of MDEQ Response to the Public

Throughout 2015, as the public raised concerns and as independent studies and testing were conducted and brought to the attention of MDEQ, the agency's response was often one of aggressive dismissal, belittlement, and attempts to discredit these efforts and the individuals involved. We find both the tone and substance of many MDEQ public statements to be completely unacceptable. In a real way, the MDEQ represents the public, including the very individuals it treated dismissively and disrespectfully in public statements. We recognize that the agency might disagree with the opinions of others on a variety of issues, including testing protocol, interpretation of testing results, the requirements of federal law and rules, and other matters. What is disturbing about MDEQ's responses, however, is their persistent tone of scorn and derision. In fact, the MDEQ seems to have been more determined to discredit the work of others—who ultimately proved to be right—than to pursue its own oversight responsibility.

#### Failure in MDEQ Interpretation of the Lead and Copper Rule

The federal Lead and Copper Rule (LCR) is central to what happened in Flint, because that rule, at least theoretically, is designed to prevent lead and copper contamination of drinking water. The federal LCR calls for "optimized corrosion control treatment," which the MDEQ did not require in the switch to the Flint River. Prior to the switch, MDEQ staff instructed City of Flint water treatment staff that corrosion control treatment (CCT) was not necessary until two six-month monitoring periods had been conducted. The need for CCT would be evaluated after the results from those two monitoring periods were reviewed. The decision not to require CCT, made at the direction of the MDEQ, led directly to the contamination of the Flint water system.

The MDEQ seems to have taken different positions on whether it faithfully followed the LCR in the Flint situation. It first maintained that it followed the LCR, then stated that it did not follow the rule properly, and most recently claimed that a federal memorandum issued by the US EPA in early November 2015 suggests that the original MDEQ interpretation was possibly correct.

We are not convinced. Even the MDEQ's latest interpretation of the US EPA's November memorandum is overly legalistic and misunderstands the intent of the LCR, which is to minimize risks of lead and copper exposure for human health.

We believe ODWMA's single-minded legalistic focus is the heart of the problem, and it is part of the "technical compliance" culture described above. ODWMA should not be basing its actions solely on a

legally possible interpretation of the LCR. It should be focusing on how to protect Michigan's citizens from lead in drinking water.

We met with MDEQ Director Wyant on December 16, 2015, to discuss these issues, as well as many others. We note his substantial agreement with many of our conclusions, particularly as it relates to the regulatory failure and the abysmal public response of his agency. It is our understanding that he has drawn similar conclusions in his own evaluation of the MDEQ's role in the Flint water crisis. At the same time, it was disappointing to hear his weak defense of the CCT decision based on the EPA's November 2015 memorandum.

We are not finished with our work. Other individuals and entities made poor decisions, contributing to and prolonging the contamination of the drinking water supply in Flint. As an example, we are particularly concerned by recent revelations of MDHHS's apparent early knowledge of, yet silence about, elevated blood lead levels detected among Flint's children. We also feel it important to further review local government decision processes under emergency management. Our final report will highlight and discuss those concerns, among many others, to provide some context to a comprehensive series of recommendations. As stated earlier in this letter, however, we believe that establishing responsibility is a critical and urgent need, and one that should not wait for our final report in 2016. Individuals and agencies responsible must be held accountable in a timely fashion.

It is our hope that the heightened awareness of the dangers of lead poisoning can be an opportunity to make Michigan safer, particularly for its children. Drinking water must be recognized as a potential source of health risk exposure when water lines and fixtures containing lead are disturbed or compromised. Proper testing, not only in high-risk areas but also in facilities serving children (e.g., schools), must be considered. Facilitating long-term financing of a model public health program, and also replacement of lead-containing water service lines and fixtures, would enable Michigan to realize a positive lasting legacy from the tragedy of the Flint water crisis. Our final report will address some of these issues.

The City of Flint's water customers—fellow Michigan citizens—were needlessly and tragically exposed to toxic levels of lead through their drinking water supply. They deserve a commitment to properly assess responsibility and ensure accountability. They also deserve a commitment to needed mitigation in both the short and long term. The Flint water crisis never should have happened. Having failed to prevent it, state government should coordinate a sustained, public-health-focused response to remedy, to the fullest extent possible, the impacts on the Flint community.

Respectfully yours,

Flint Water Advisory Task Force:

Matt Davis  
Chris Kolb  
Larry Reynolds  
Eric Rothstein  
Ken Sikkema



STATE OF MICHIGAN  
EXECUTIVE OFFICE  
LANSING

RICK SNYDER  
GOVERNOR

BRIAN CALLEY  
LT. GOVERNOR

December 15, 2015

Dear Flint Water Advisory Task Force Members:

Thank you for your correspondence on Dec. 7, and, most importantly, for your hard work to promote public health and protect our residents as we move forward. Your efforts are both respected and appreciated.

As acknowledged in your letter, we have taken many steps to address the challenges in Flint as they relate to reducing lead exposure. I am pleased to see the progress since October, and recognize there is more work that must be done to ensure that this progress continues.

At the state level, there has been a confluence of efforts between Departments of Environmental Quality and the Department of Health and Human Services to coordinate with the Genesee County Health Department, local schools, and our partners in the non-profit community.

These partners are making progress, and we know we must always strive to improve practices and communication for continual improvement.

You make a solid recommendation to establish a person who is independent of any one of the involved state agencies to serve as the point person to coordinate the ongoing work. I am recommending that Harvey Hollins, director of the Office of Urban Initiatives, carry out this effort. Harvey is well-versed in the issues and the challenges faced by our cities and will be effective in this role. Senior members of our executive team will continue to engage with your task force and provide direction and support to Harvey to ensure you will have continued support and cooperation. We also have retained Chris DeWitt, a veteran communications specialist, to strengthen community outreach efforts to make sure residents have access to the information they need.

I also support your suggestion of a dashboard to make information about our work and progress more accessible to the Flint community. These are critical measures that can be used as we look the challenges and progress in Flint, but also can be a part of efforts moving forward in other areas of our state. It's important that people have confidence that we are working to address any problems and will take the necessary actions to improve interaction among city, state and federal agencies. We also will continue to work with the medical community to consider how we can work together on wraparound needs of children who might experience health problems.

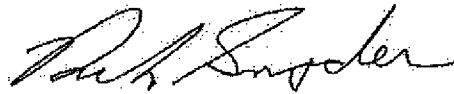
December 15, 2015

Page 2:

People in Flint and across our state deserve safe, clean water. I want them to be confident that the water coming out of their tap is safe for their families. And I want them to trust that their government – at all levels – is working effectively to protect them.

I thank you again for investing your time and expertise in this vitally important effort.

Sincerely,

A handwritten signature in black ink, appearing to read "Rick Snyder", written in a cursive style.

Rick Snyder  
Governor

Dec. 7. 2015 4:06PM

No. 0027 P. 2

December 7, 2015

Dear Governor Snyder:

On Wednesday, November 18, 2015, the Flint Water Advisory Task Force met with representatives of the Michigan Department of Environmental Quality (MDEQ) and the Michigan Department of Health and Human Services (MDHHS) to discuss elements of the 10-point Action Plan designed to address various issues related to the ongoing public health protection challenges precipitated by lead in the Flint water supply. These discussions were held at our request as part of our task to make recommendations to prevent a similar occurrence in Flint or elsewhere, and also to monitor ongoing mitigation efforts.

Subsequent to those meetings, on Tuesday, November 24, 2015, members of the Task Force participated in a conference call with yourself, members of the Administration, and representatives of these agencies to discuss the progress to date on the 10-point Action Plan, as well as several other related issues.

We want to acknowledge the steps that have already been taken to implement the action plan, specifically in the areas of outreach efforts to facilitate blood lead testing for children, communication with health care providers in the Flint community about the importance of testing children for lead, and the training of additional public health nurses in the Genesee County Health Department. We do believe, however, that additional steps need to be taken to reach additional children for blood lead testing, assure proper follow-up with children found to have elevated blood lead levels, and to continue water testing. We will continue to assess state and local efforts and make recommendations regarding specific steps that we believe are warranted.

One primary concern we have at this point is that the current efforts appear to be taking place in the absence of a larger project coordination framework that measures results and clearly delineates responsibilities for continuing actions to protect public health. We believe the state is best positioned to facilitate this larger framework, which should address the following:

1. The need for MDHHS and MDEQ—and, possibly, other state agencies—to set goals for actions in collaboration with local and federal agencies and organizations.
2. The need for a set of corresponding timelines for the goals.
3. The need to establish responsibility for meeting the goals in a timely fashion and for contingency plans for the state if the goals are not being met.
4. The need for clear, regular communication with the Flint community and stakeholder groups regarding action steps and updates.

We also believe it important that a single person or entity—potentially independent of any one particular state agency and mutually agreeable to this Task Force and you, Governor—be established to provide effective coordination of ongoing activities and reporting on the status of mitigation measures. For this, we also believe a readily understood “dashboard” should be developed that reports on the goals, timelines and assignments. This will enable members of the Flint community, public health providers, and state agencies to know about the status of the Flint water crisis mitigation program, as

Dec. 7. 2015 4:06PM

No. 0027 P. 3

well as promote coordination and accountability. The Task Force is prepared to assist in the development of that dashboard.

We believe it is vitally important that trusted members of the Flint community be engaged in communication on this issue, as well as the distribution of information conveyed by our suggested dashboard reporting. Accordingly, in advance of our final report, we would like to ensure the independent coordinator suggested above engage trusted community groups to begin rebuilding community trust in state actions.

We appreciate your personal interest in this issue, commitment to assisting the Task Force in our review, and—most importantly—commitment to ensuring that the full measure of state resources are brought forward to protect the public health in Flint and throughout the state.

Respectfully yours,

Flint Water Advisory Task Force:

Dr. Matt Davis

Chris Kolb

Dr. Larry Reynolds

Eric Rothstein

Ken Sikkema

**FLINT WATER ADVISORY TASK FORCE  
BACKGROUND**

## Contact Information

Friday, October 16, 2015  
10:01 AM

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*Final*

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**FOR IMMEDIATE RELEASE**

Wednesday, Oct. 21, 2015

**Gov. Rick Snyder announces Flint Water Task Force to review state, federal and municipal actions, offer recommendations**

*Experts in public health, water management, environmental protection to focus on steps to protect residents*

LANSING, Mich. – Gov. Rick Snyder today announced the creation of an independent advisory task force charged with reviewing actions regarding water use and testing in Flint and offer recommendations for future guidelines to protect the health and safety of all state residents.

Task force members include experts in public health and medicine, water management, and environmental protection from both sides of the aisle, and will be co-chaired by Ken Sikkema of Public Sector Consultants and Chris Kolb, of the Michigan Environmental Council. Also serving will be Dr. Matthew Davis of the University of Michigan Health System, Eric Rothstein, of the Galardi Rothstein Group and Dr. Lawrence Reynolds of Mott Children's Health Center in Flint.

"Transitioning back to the Detroit Water and Sewerage Department-Great Lakes Water Authority is a good first step to protecting public health in Flint, but it's not the last step," Snyder said. "Bringing in outside experts to evaluate our actions and help monitor and advise on potential changes to law, procedures and practices will be key to continuing work on the comprehensive action plan and ensuring safe drinking water for all the residents in Flint and all of Michigan."

Snyder said the administration will fully cooperate with task force members, saying he wants an unbiased report focusing on steps taken in the past and recommendations that could improve practices to ensure all residents have access to safe, clean water.

**Ken Sikkema** is a senior policy fellow at Public Sector Consultants, where he specializes in public finance, environment, and energy policy. Prior to joining the firm, Sikkema served in both the Michigan House and Senate, culminating with four years as Senate majority leader. He has also served as both an adjunct and visiting professor at Grand Valley State University.

**Chris Kolb** is president of the Michigan Environmental Council, a statewide coalition of 70 environmental, public health and faith-based nonprofit groups. Before joining the MEC, Kolb represented Ann Arbor in the state House for six years and served six years on the Ann Arbor City Council. He has been president of the MEC for six years.

**Matthew Davis, M.D., M.A.P.P.**, is professor of pediatrics and internal medicine at the University of Michigan Health System and professor of public policy at the Gerald R. Ford School at the University of Michigan, having joined the faculty in 2000. Davis also is a professor of health management and policy at the School of Public Health. He previously served as the chief medical executive of the Michigan Department of Community Health/Department of Health and Human Services.

**Eric Rothstein** is a national water issues consultant and principal at the Galardi Rothstein Group. He served as an independent advisor on the creation of the Great Lakes Water Authority. Rothstein also has served as Jefferson County, Alabama's rate consultant and municipal adviser for litigation related to the county's bankruptcy and issuance of \$1.7 billion in sewer warrants and led strategic financial planning for the City of Atlanta's Department of Watershed Management. He has more than 30 years of experience in water, wastewater and stormwater utility finance and rate-making assessments.

**Lawrence Reynolds, M.D.**, is a pediatrician in Flint who serves as president of the Mott Children's Health Center. He received his medical degree from Howard University College of Medicine and has been in practice for 36 years. He has served as president of the Genesee County Medical Society and the Michigan Chapter of the American Academy of Pediatrics. He has been honored for his humanitarian and advocacy efforts on behalf of children from the Community Foundation of Greater Flint.

Snyder has said reconnecting with the authority is a critical step to resolving water quality issues and addressing related health concerns. It will not immediately resolve the city's problem with lead service lines or aging infrastructure. It will take time for pipes in Flint to become coated with the phosphate corrosion control.

To best protect public health, state and local authorities will continue to carry out steps outlined on Oct. 2 in a comprehensive action plan, including continued testing, the use of faucet filters and providing residents with accurate information about steps to eliminate lead exposure. The Michigan Departments of Environmental Quality and Health and Human Services are continuing to provide free water filters, free lead testing through the state laboratory for Flint water customers, and hiring additional staff to conduct health exposure monitoring for lead in drinking water.

####

## After-Action Review Q&A

**Is the After-Action Review Panel independent? They were appointed by the Governor.**

None of the panel members are city, state or federal employees, and none have been previously involved in the drinking water situation in Flint. They bring diverse expertise in pediatrics and internal medicine, environmental protection, water and wastewater asset management, and environmental policy. We are pleased to have their participation.

**What will the panel look at?**

The After-Action Review Panel will look at the procedures and protocols used by the City of Flint, the Michigan DEQ and the U.S. EPA during and after its switch to using the Flint River as its source of drinking water. The group will also review whether the present procedures, protocols, statutes, policies and rules that govern drinking water systems are enough to protect the public health of Michigan residents.

**Will the After-Action Review Panel look at corrosion control and the Lead and Copper Rule?**

Yes. If necessary, the After-Action Review Panel could include proposed amendments to the Lead and Copper Rule in its final report to the Governor.

**What types of information are you going to look at to make your determinations?**

The After-Action Review Panel will have any and all information at its disposal, including reports, emails, permits and any other documents needed.

**Will the panel be empowered to fire anyone, or is that a recommendation they can make?**

The after-action review is focused on making proactive recommendations to prevent future problems with lead in drinking water and to better protect public health statewide.

**Is the panel made up of drinking water or lead experts?**

The panel includes four members with diverse expertise in water and medicine. Their areas of specialty include pediatrics and internal medicine, environmental protection, water and wastewater asset management, and environmental policy, and we are pleased to bring their experience to the issue.

**How long is the after-action review going to take?**

The After-Action Review Panel will summarize its work in a report to be presented to the Governor within 90 days.

**So will the results and the report to the Governor be made public?**

The full report will be made public.

**How does this help the people of Flint?**

The after-action review is designed specifically to ensure the state learns from the experience in Flint and can better protect public health going forward. In the meantime, the city has reconnected to the Great Lakes Water Authority, and residents are encouraged to continue to use water filters and other protective measures to ensure safe drinking water while the long-term fixes of connecting to the Karegnondi Water Authority and replacing outdated local lead infrastructure is completed.

**Volume #54, Report #209, Article #3--Wednesday, October 21, 2015**

Senate Activity Report | House Activity Report

**Snyder Names Flint Water Task Force**

With controversy growing over how the state handled the water crisis in Flint, Governor Rick Snyder on Wednesday named a five-member independent advisory task force to investigate actions by the state involving water use and testing in the city.

As Mr. Snyder made the announcement, U.S. Rep. Dan Kildee (D-Flint) and Senate Minority Leader Jim Ananich (D-Flint) called for the federal Environmental Protection Agency to investigate the controversy and its handling by the Department of Environmental Quality.

Mr. Snyder's announcement and the separate calls by Mr. Kildee and Mr. Ananich come as revelations of some internal emails from the DEQ brought into question how seriously some officials viewed the problem.

When the state announced earlier this month it would push for Flint to be reconnected to the Detroit Water and Sewerage System - the city's emergency manager decided in 2014 to draw water from the Flint River while the city prepared to join a pipeline drawing water from Lake Huron after no agreement could be reached on a short-term contract with the Detroit system - Mr. Snyder said he would create the independent body.

Along with looking into how the state handled the crisis, which after more than a year of complaints about water taste and smell broke wide open this past summer when tests showed elevated levels of lead in the water, the task force is to make recommendations to the state for "future guidelines to protect the health and safety of all state residents."

Co-chairing the task force will be former Senate Majority Leader Ken Sikkema, now with Public Sector Consultants, and former Democratic Rep. Chris Kolb, now with the Michigan Environmental Council.

Also named to the task force is Matthew Davis of the University of Michigan Health System, Eric Rothstein of the Galardi Rothstein Group and Lawrence Reynolds of Mott Children's Health Center of Flint.

Mr. Snyder said he wanted an "unbiased report" that looked at past actions affecting the Flint water situation and recommendations to help ensure that all state residents have access to safe drinking water. He said administration officials would cooperate fully with the task force.

There was no time frame set on when the task force would issue a report.

Mr. Ananich on Wednesday, meanwhile, released a letter to the U.S. EPA asking for a formal review of the DEQ's handling of the Flint water situation, emphasizing that the public needed to know if "the misapplication of federal water testing rules was intentional or due to negligence.

"Our citizens deserve answers," Mr. Ananich said.

And Mr. Kildee also wrote to the EPA, saying to ensure failures like that with the Flint system does not occur again, an investigation into how the crisis occurred is necessary.

"Unfortunately, the citizens of Flint are the victims in this situation. They deserve a thorough investigation and answers to these questions," Mr. Kildee said in his letter.

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(DRAFT)  
**FLINT WATER ADVISORY TASK FORCE  
AFTER-ACTION REVIEW**

The Flint Water Task Force is an independent advisory panel appointed by Governor Rick Snyder charged with reviewing actions regarding water use and testing in Flint and with offering recommendations for future guidelines to protect the health and safety of all state residents.

The task force expects to summarize its work in a report to be presented to Governor Rick Snyder within ninety (90) days.

**GOALS**

The Flint River Task Force's goals are as follows:

- Complete a thorough review of all steps taken by state and local officials regarding the decision to switch the city of Flint's water source to the Flint River from the Detroit Water and Sewerage Department's system (DWSD).
  - Produce a timeline of actions
  - Establish why each action was taken
- Review the roles of the federal, state, and local officials in the decision-making process.
  - Identify best practices for federal, state, and local officials to work together in future similar situations
  - Evaluate where coordination between these entities could have been better, and how it could be improved
- Review federal, state, and local actions and protocols
  - Determine whether the proper procedures were followed
  - Identify which procedures should be changed
- Monitor and review the process, procedures, and protocols being followed as the City of Flint returns to the DWSD system
  - Ensure that proper corrosion controls and testing are in place
  - Highlight the appropriate actions that the City of Flint should follow when the switch is made to the Karegnondi Water Authority's system
- Assess future practices
  - Highlight practices that should change for communities in similar situations
  - Recommend changes in law, procedure, or practice to ensure all Michiganders are drinking safe water

**AUDITOR GENERAL LETTER TO SENATOR ANANICH**  
**DECEMBER 23, 2015**



# OAG

Office of the Auditor General

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**Doug A. Ringler, CPA, CIA**  
Auditor General

December 23, 2015

The Honorable Jim Ananich  
Senate Minority Leader  
State Capitol, Room S-105  
Lansing, Michigan

Dear Senator Ananich:

Enclosed are answers to the questions you posed in your October 20, 2015 letter to our office regarding the audit we are conducting of the Office of Drinking Water and Municipal Assistance (ODWMA), Department of Environmental Quality (DEQ), specific to lead contamination in the City of Flint's drinking water. Also enclosed are additional questions we developed that are relevant to these issues, along with five exhibits:

- A map showing Flint water samples by zip code.
- A map showing lead counts of 5 parts per billion or higher.
- Two charts showing the number of samples by time period and zip code.
- A time line of the Flint water review.

We appreciate the opportunity to assist you in answering questions regarding this topic. If you have further questions or a request for other services, please do not hesitate to contact our office.

Sincerely,

A handwritten signature in cursive script that reads "Doug Ringler".

Doug Ringler  
Auditor General

Enclosures



## Questions and Answers

**Q1: How does ODWMA ensure the data it receives is accurate?**

**A:** With regard to the United States Environmental Protection Agency (EPA) Lead and Copper Rule (LCR) monitoring requirements, DEQ relies on the following key controls to ensure the accuracy of test results:

- State-owned laboratories test water samples.
- State-owned laboratories send test results directly to DEQ.
- The City of Flint Water Treatment Plant (Flint WTP) certifies whether sample sites are classified as tier 1\*.

The current Flint WTP LCR sampling process includes:

1. DEQ informs the Flint WTP of the required water lead and copper sample size.
2. The Flint WTP determines the pool of tier 1 sites for sampling.
3. The Flint WTP selects the sample.
4. The Flint WTP sends out sample kits and instructions to residents for collecting water samples.
5. Residents leave samples and signed sampling forms outside their front doors.
6. The Flint WTP employee picks up samples and forms from residents.
7. The Flint WTP employee reviews sample forms for completeness.
8. The Flint WTP employee sends samples to the State-owned laboratories.
9. State-owned laboratories test samples and provide results directly to DEQ.
10. DEQ receives water lead and copper sample results, which include the following information: date collected, date received, address where collected, type of residence (e.g., single family or apartment), and sample point (e.g., kitchen sink or bathroom sink).
11. DEQ tracks, and follows up if necessary, the number of samples collected by the Flint WTP to help ensure that the required minimum number of samples are collected by the monitoring period deadline.

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\* Single-family or multiple-family residence with lead service line, lead solder copper piping constructed after 1982, or lead plumbing.

12. The Flint WTP submits lead and copper report to DEQ that certifies whether sample sites meet tier 1 criteria.
13. DEQ prepares the LCR 90th percentile calculation report.

During our review, we noted two potential improvements for the Flint WTP sampling process (see Question 5 of the additional questions answered by the OAG regarding tier 1 sample validity):

- DEQ could verify that the sampling pool was limited to only tier 1 sample sites to ensure that the Flint WTP is in compliance with the LCR (Title 40, Part 141, section 86(a)(3) of the *Code of Federal Regulations [CFR]*).
- DEQ could independently verify the validity of sample site certifications.

**Q2: What accountability measures are in place for ODWMA staff who fail to follow data verification protocols?**

A: DEQ does not provide any direct oversight over the Flint WTP and, therefore, does not have any accountability measures over the Flint WTP's LCR data verification protocols. DEQ's data verification protocol for lead and copper water sampling is limited to verification that the WTP certifies samples submitted to the State-owned laboratories for analysis (see steps 7 and 12 in the Flint WTP LCR sampling process noted in Question 1 above). We did not identify any instances in which ODWMA staff failed to verify that submitted samples were certified by the Flint WTP.

**Q3: What accountability measures are in place for ODWMA staff who lie or misrepresent information to the EPA?**

A: As with all classified employees, ODWMA staff must adhere to the rules and regulations established by the Michigan Civil Service Commission. If any ODWMA staff were determined to misrepresent information to the EPA, they would be subject to Civil Service Rule 2-6, Discipline, which allows an appointing authority to discipline an employee for just cause up to and including dismissal. We are not aware of any DEQ-established measures that are in addition to the Civil Service Rules.

We gained access to the e-mail accounts of key DEQ management (DEQ Director, Deputy Director, ODWMA Chief, and other key ODWMA staff) extending back to January 1, 2013. We did so to identify the key decision points and conversations that occurred leading up to and through the situation in Flint. Our review was also intended to determine whether State, Flint, or other officials attempted to conceal key test results or other information.

We noted one e-mail exchange between DEQ and the EPA that appears to be a significant contributor to the concern that DEQ misrepresented information to the EPA. The EPA requested clarification on February 26, 2015 regarding the type of optimized corrosion control **treatment** the Flint WTP was using. DEQ responded on February 27, 2015 that the city had an optimized corrosion control **program** in place, but DEQ did not provide any program details. DEQ informed us that the Flint WTP corrosion control **program** included performing

lead and copper monitoring for two consecutive six-month periods to determine whether corrosion control treatment would be necessary in the future. However, it appears the EPA interpreted corrosion control program to mean that corrosion control treatment was being performed.

On April 23, 2015, the EPA again inquired as to what the Flint WTP was doing for corrosion control treatment. DEQ responded on April 24, 2015 that the Flint WTP was not practicing corrosion control treatment.

Based on our review of this and other e-mails, we have no specific reason to believe that DEQ willfully misrepresented the information to the EPA.

**Q4: What policies do DEQ and ODWMA have in place to escalate major infractions up the chain of command?**

**A:** We did not note any instances of major infractions (i.e., intentional disregard of policies, laws, regulations or specific directions) committed by DEQ staff during the course of our review. DEQ does not have a formal policy or procedure in place to escalate major infractions performed by ODWMA employees; however, our review of DEQ correspondence confirmed the escalation of key issues up the chain of command related to the Flint situation. DEQ stated that its informal policy is for staff to notify the proper level of management of infractions to determine necessary action.



# OAG

Office of the Auditor General

## Additional Questions Answered by the OAG

### Application of the LCR

**Q1: How did the Flint WTP become the primary water supplier for the City of Flint?**

**A:** Upon notification of the City of Flint's plans to switch to the Karegnondi Water Authority (KWA) in April 2013, the Detroit Water and Sewerage Department (DWSD) submitted a letter to the City of Flint stating that it would terminate its agreement to provide water services on April 17, 2014.

According to DEQ management, the Flint WTP attempted to negotiate with the DWSD to maintain it as the City of Flint water supplier; however, after negotiations were unsuccessful, the City of Flint notified DEQ through a permit request of its intent to operate the Flint WTP full time using the Flint River. Although the Flint City Council voted in March 2013 in support of moving to the KWA pipeline, the vote was silent on the use of the Flint River as a temporary drinking water source.

DEQ informed us that in the 1990s, the City of Flint upgraded the Flint WTP to serve as a backup source of water for emergencies. In 2006, the Flint WTP began quarterly testing of the treated Flint River water at the Flint WTP to ensure water quality standards were met; however, the Flint WTP did not test the water's effect on the distribution system at consumer tap locations.

**Q2. Did DEQ consult with the EPA prior to determining how to apply the LCR?**

**A:** DEQ did not consult with the EPA on how to apply the LCR prior to implementing two consecutive six-month monitoring periods of the Flint WTP beginning July 1, 2014. Based on past experiences applying the LCR monitoring requirements, DEQ believed that it had appropriately applied the LCR requirements of a large water system.

**Q3: When Flint switched to the Flint River water source, should corrosion control treatment have been maintained?**

**A:** We believe that corrosion control treatment should have been maintained.

According to the LCR, a water system can achieve optimized corrosion control if it submits results of tap water monitoring for two consecutive six-month monitoring periods with acceptable lead levels. However, a water system that has optimized corrosion control, and which has treatment in place, should continue to operate and maintain optimal corrosion control treatment.

DEQ staff explained that they did not treat the switch to Flint River water as a new system, but as a new source. DEQ further stated that because the Flint River was a new water source and there was a change in chemicals needed to treat the new source, a corrosion control study was needed to determine the impact on the water distribution system. Therefore, it was DEQ's interpretation that two rounds of six-month monitoring were still needed to evaluate the water quality and determine optimal corrosion control treatment.

The Flint water system had optimal corrosion control treatment when the DWSD WTP was the water supplier. Based on our review of notes from a July 21, 2015 EPA and DEQ conference call on DEQ's implementation of the LCR regarding whether the Flint WTP should have continued to maintain corrosion control treatment, it appeared that the EPA did not agree with DEQ's interpretation of the LCR. Region 5 EPA staff explained that they would talk to the EPA headquarters about the interpretation of regulations and believes that systems that have been deemed optimized need to "maintain" corrosion control. The Region agreed to provide supporting regulatory citations for the language about maintaining corrosion control.

On November 3, 2015, the EPA issued a memorandum stating that the LCR had differing possible interpretations; however, the EPA concluded that it is important for large water systems to take the steps necessary to ensure that appropriate corrosion control treatment is maintained at all times, thus ensuring that public health is protected. Based on this clarification, it appears that corrosion control treatment should have been maintained.

**Q4: Should DEQ have required the Flint WTP to start pursuing optimized corrosion control treatment after the first round of six-month sampling results were above the lead action level of 5 parts per billion (ppb)?**

**A:** Yes. According to DEQ's application of the LCR, within six months after the end of the monitoring period in which the water sample results exceeded the acceptable lead level, DEQ should have required the Flint WTP to start pursuing optimized corrosion control treatment.

The LCR states that the lead action level is exceeded if the lead level, as determined by the 90th percentile calculation, is greater than 15 ppb. If the lead action level is exceeded, water systems are required to take additional actions including educating the public about lead in drinking water as well as commencing lead service line replacement if the water system has already installed corrosion control and/or source water treatment. However, for water systems that have not yet implemented corrosion control treatment, they can be deemed to have optimized corrosion control without installing treatment if they can demonstrate lead levels below 5 ppb for two consecutive six-month periods.

The first round of six-month sampling results was received in late March 2015. Because the results were 1 ppb over the lead action level of 5 ppb, DEQ would not be able to achieve two consecutive six-month periods below 5 ppb. Therefore, DEQ should have notified the Flint WTP to start pursuing optimized corrosion control treatment. However, DEQ waited until the second round of sampling was completed (June 30, 2015) to assess whether water sample results improved.

#### Water Samples

**Q5: Did DEQ verify that only tier 1 sample sites were selected by the Flint WTP in the two rounds of six-month samples?**

**A:** DEQ did not verify that only tier 1 sample sites were selected. DEQ relies on the Flint WTP's certification of sample sites and does not perform any independent verification of those certifications.

In a November 19, 2015 *Flint Journal* article, the Flint WTP indicated that it did not have the ability to ensure that all sites were tier 1. In fact, water samples came from the random distribution of 175 testing bottles without regard for whether the homes were at risk for high lead levels. DEQ issued a formal memorandum on November 9, 2015 requesting that the Flint WTP verify the classification of all prior sample items. The results are due back from the Flint WTP on December 30, 2015.

**Q6: DEQ dropped two water sampling sites from its second six-month sample (January 1, 2015 through June 30, 2015). Was this appropriate?**

**A:** Yes, it was appropriate for DEQ to drop these two water sampling sites. Federal regulation 40 *CFR* 141.86(a) states:

" . . . each water system shall complete a materials evaluation of its distribution system in order to identify a pool of targeted sampling sites that meets the requirements of this section . . . All sites from which first draw samples are collected shall be selected from this pool . . . Sampling sites may not include faucets that have point-of-use or point-of-entry treatment devices designed to remove inorganic contaminants."

This regulation also requires that a water system's targeted sampling pool consist of only tier 1 sampling sites if an adequate number is available to meet monitoring requirements.

According to federal regulation 40 *CFR* 141.86(f), the State may invalidate a water sample if it determines that the sample was taken from a site that did not meet the site selection criteria. A sample invalidated per this regulation does not count toward determining lead or copper 90th percentile levels or toward meeting the minimum monitoring requirements.

DEQ dropped one water sample site from its 90th percentile calculations because the site was from a business that does not meet the tier 1 requirements of being a single-family or multiple-family residence. The second sample site was dropped because the home had a point-of-entry treatment device to filter contaminants. Based on the criteria specified above, it appears that DEQ's rationale for dropping the samples from these two sites appropriately met the requirements for invalidating samples per federal regulation 40 *CFR* 141.86.

**Q7: Was flushing of the taps the night before drawing a sample an appropriate sample methodology?**

**A:** Yes. The LCR requires that samples be a first draw of water after six hours of stagnation. The LCR does not indicate whether or not the water line should be flushed prior to collecting the sample. In the sample instructions, DEQ required preflushing to ensure that sampled faucets were not stagnant for an excessive period of time beyond the targeted six hours (e.g., rarely used faucets or when a homeowner has been gone for an extended period of time.)

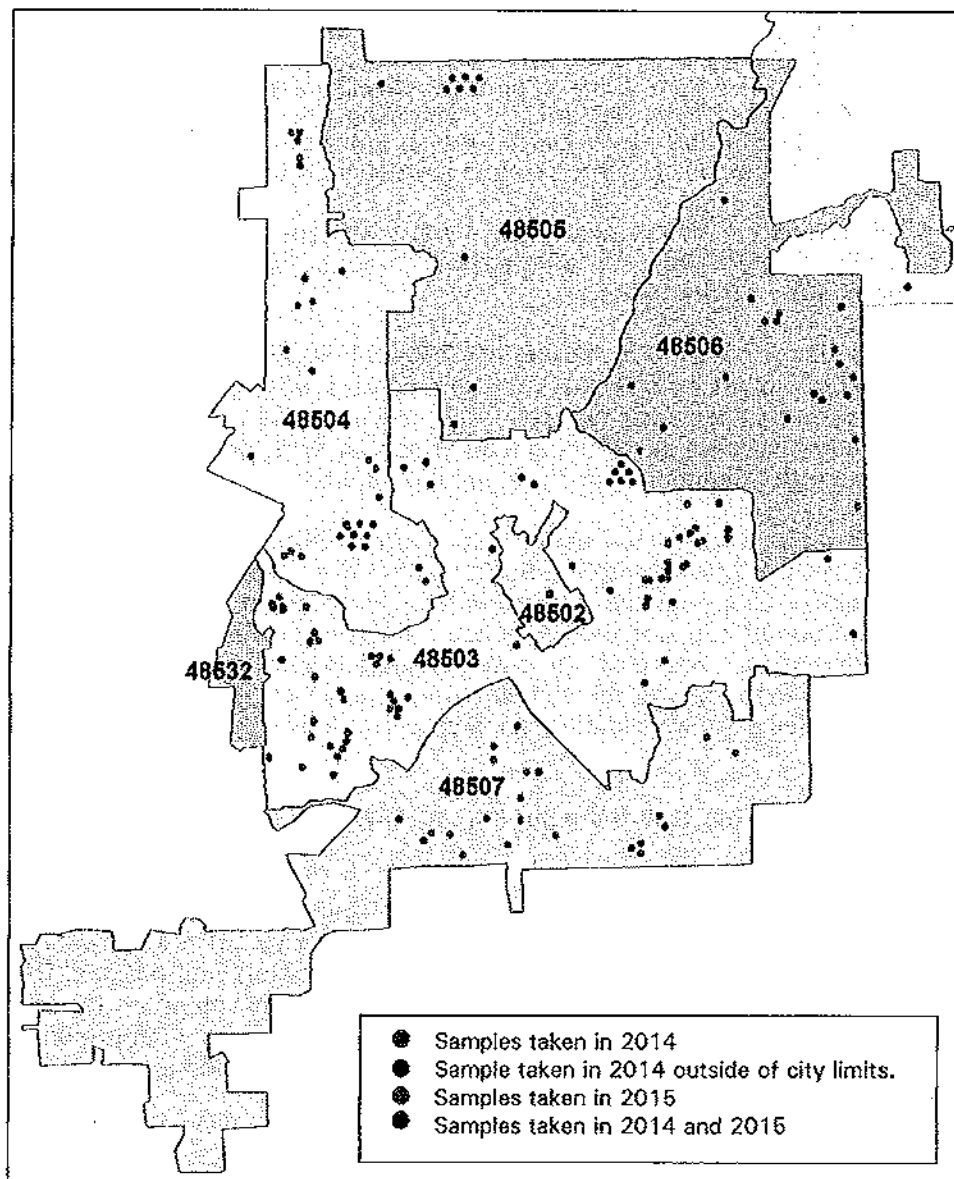
The LCR requires six hours of stagnation; however, it does not preclude DEQ from instructing residents to flush prior to stagnation.



## Flint WTP 2014 and 2015 Sample Locations (Exhibit #1)

In calendar year 1992, the Flint WTP established a tier 1 sample site pool for LCR monitoring. With the change to the Flint River water, the Flint WTP needed to increase the pool of sample locations because of additional sampling requirements. The following exhibit documents the 2014 and 2015 sample locations for LCR monitoring. Based on the data obtained during our review, we could not determine how the locations were selected or whether they were properly classified as tier 1 sample sites.

As noted in Question 5 of the additional questions answered by the OAG, DEQ has requested the Flint WTP to verify the tier 1 classification of all prior sample items.

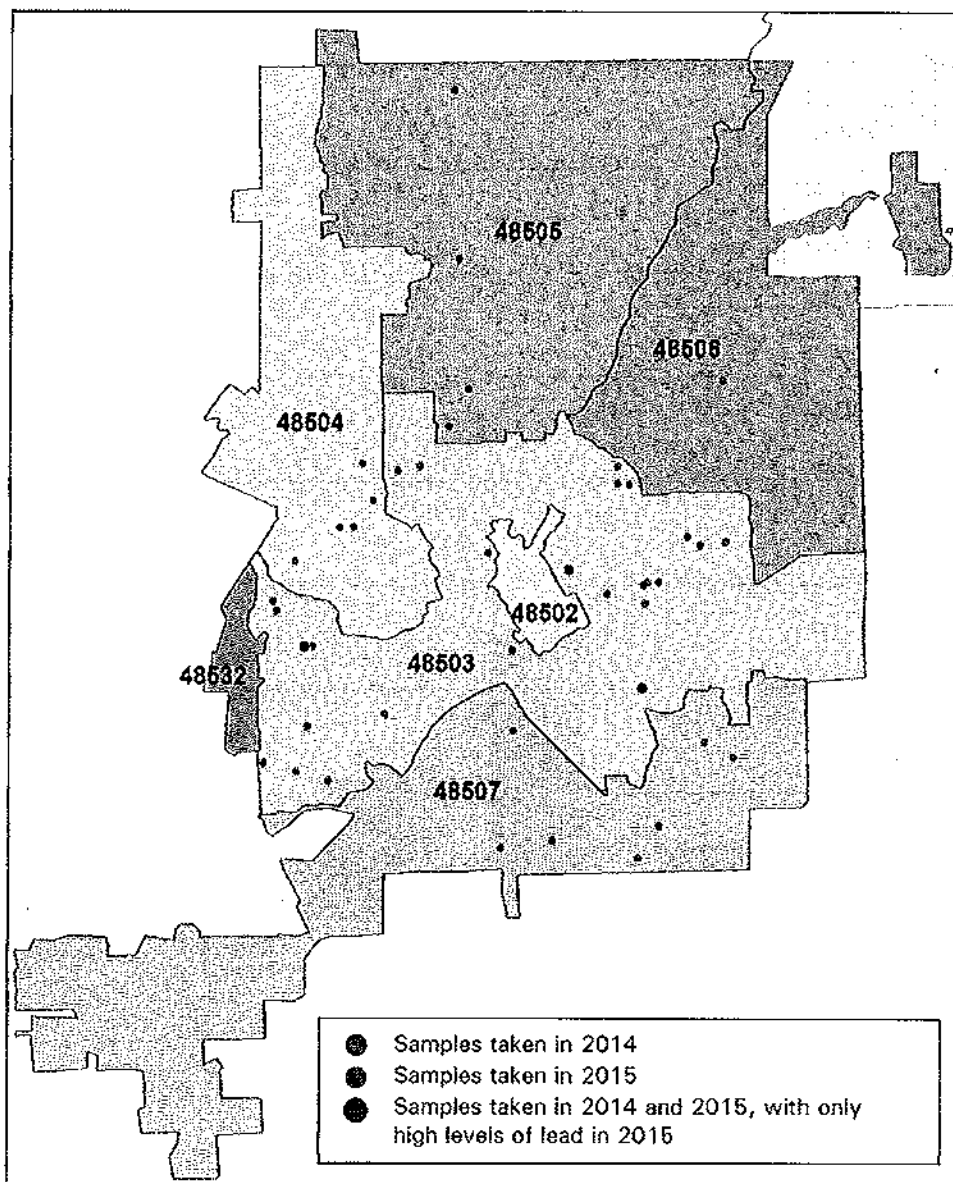


Source: The OAG prepared this map using data obtained from DEQ and ©OpenStreetMap contributors (opendatacommons.org). The sample locations are approximate.



**Flint WTP 2014 and 2015  
Sample Locations With Lead Counts of  
5 Parts Per Billion or Higher (Exhibit #2)**

This exhibit documents the 2014 and 2015 sample locations with lead counts of 5 ppb or higher. This information is used in aggregate by DEQ to determine if the city has optimized lead levels.

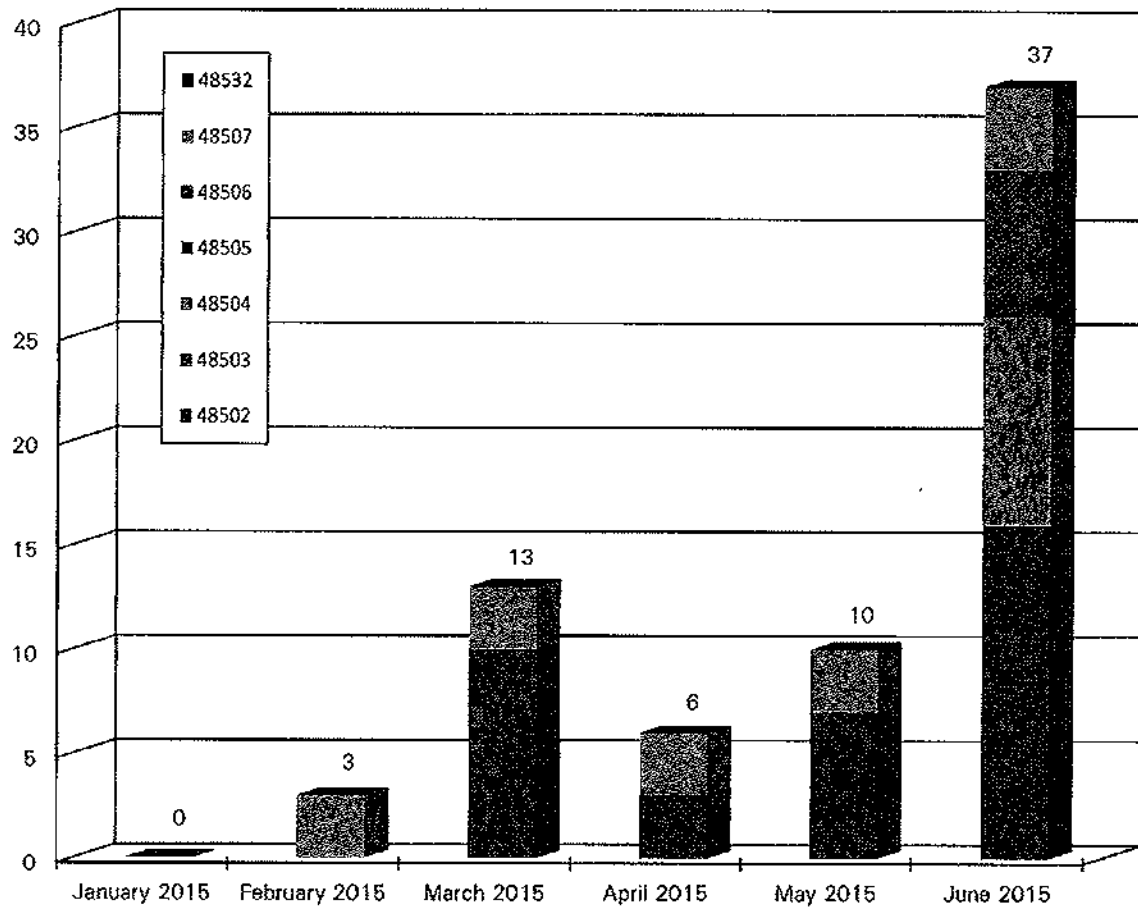


Source: The OAG prepared this map using data obtained from DEQ and ©OpenStreetMap contributors (opendatacommons.org). The sample locations are approximate.



**Flint WTP 2015**  
**Number of Samples by**  
**Time Period and Zip Code (Exhibit #3)**

This chart expands on Exhibit #1 to show a summary by zip code and time of selection within the sampling period. Based on the data obtained during our review, we could not determine if the lateness of selection within the monitoring period affected the appropriateness of the sample items.



Source: The OAG prepared this chart using data obtained from DEQ.

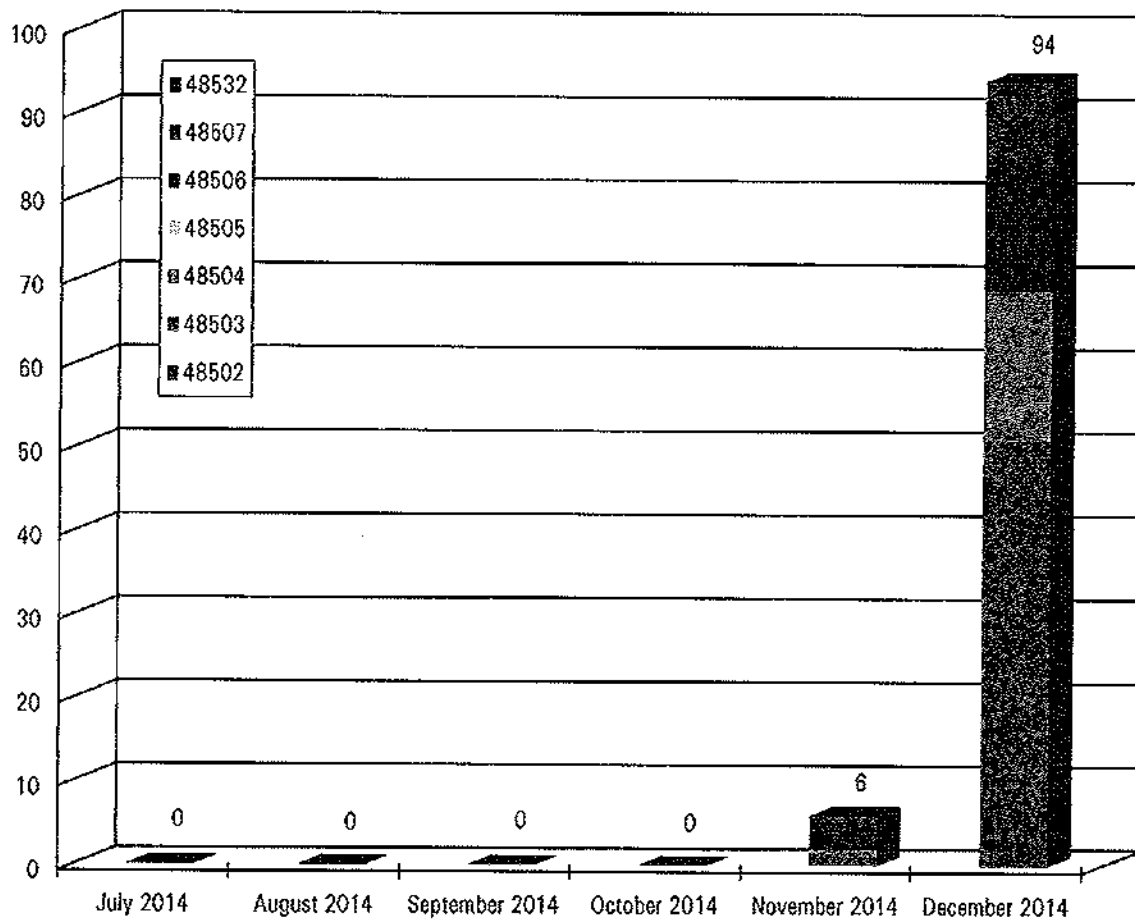


# OAG

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## Flint WTP 2014 Number of Samples by Time Period and Zip Code (Exhibit #4)

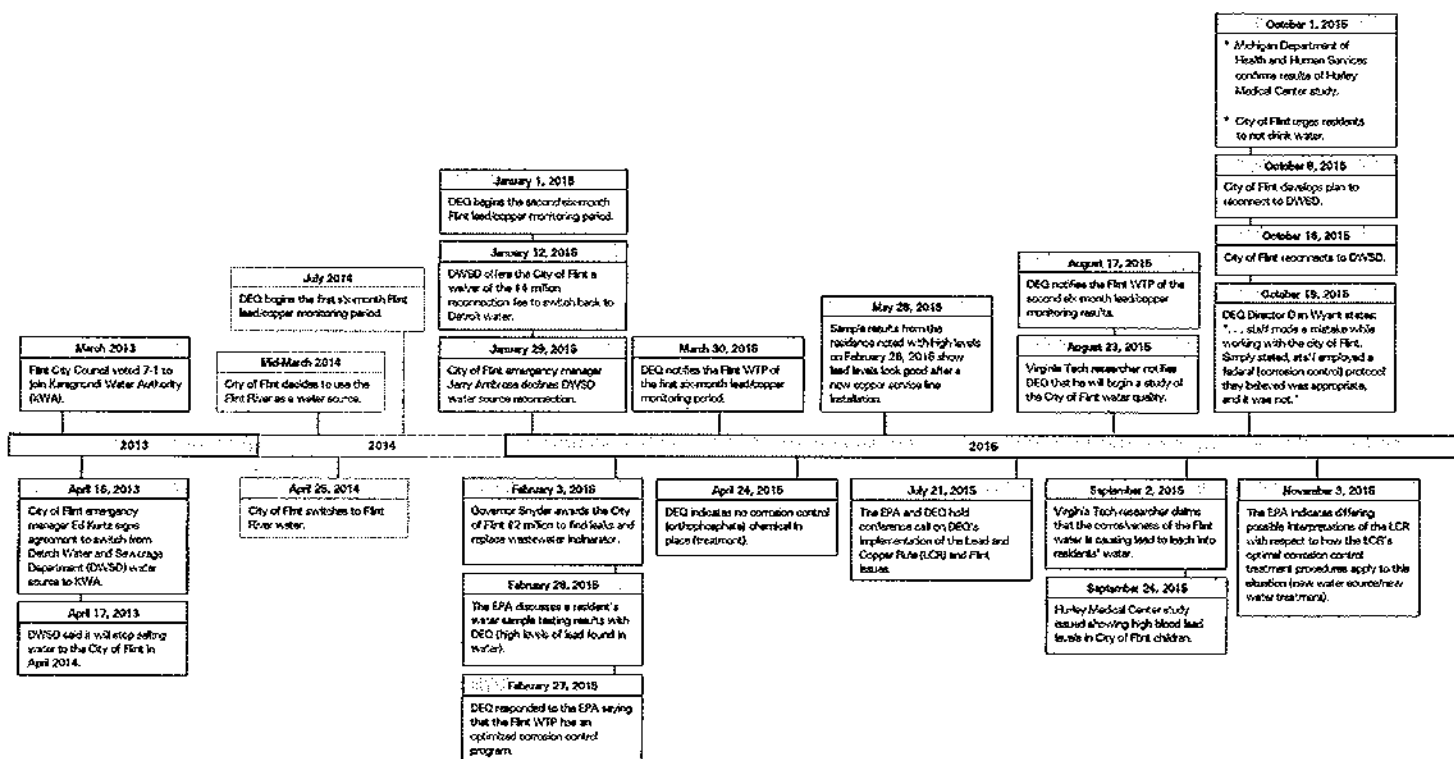
This chart expands on Exhibit #1 to show a summary by zip code and time of selection within the sampling period. Based on the data obtained during our review, we could not determine if the lateness of selection within the monitoring period affected the appropriateness of the sample items.



Source: The OAG prepared this chart using data obtained from DEQ.



## Flint Water Review Time Line (Exhibit #5)



Source: The OAG prepared this time line using data (e-mails, meeting notes, and letters) obtained from DEQ, newspaper and press release articles, the Flintwaterstudy.org, and the Hurley Medical Center survey results.

## FLINT WATER EVENTS TIMELINE

## MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY FLINT DRINKING WATER EVENTS TIMELINE

| Date                            | Event                                                                                                                                                             | Attachment |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Pre-1967                        | Flint Water Treatment Plant in operation using Flint River for drinking water                                                                                     | 1          |
| Post-1967                       | Flint switched to Detroit Water and Sewerage Department for drinking water                                                                                        | None       |
| January 2006                    | Discussions regarding Karegnondi Water Authority, <i>Preliminary Long-Term Water Supply for Genesee County</i>                                                    | 2          |
| June 25, 2009<br>September 2009 | <i>Lake Huron Water Supply Study Karegnondi Water Authority Executive Summary and Preliminary Engineering Report</i>                                              | 3          |
| March 2013                      | <i>Analysis of the Flint River as a Permanent Water Supply for the City of Flint</i> ; Prepared for: City of Flint dated July 2011                                | 4          |
| April 2013                      | Flint notifies Detroit Water and Sewerage Department of contract discontinuation and joins the Karegnondi Water Authority                                         | 5          |
| April 2013                      | Detroit Water and Sewerage Department sets termination of Flint water service contract to April 17, 2014                                                          | 6          |
| June 2013                       | Flint notifies the Department of Environmental Quality of intent to operate Flint Water Treatment Plant full time using Flint River for drinking water            | 7          |
| April 2014                      | The Michigan Department of Environmental Quality issues Flint Water Treatment Plant construction permits for full time operation enhancements W141025 and W141026 | 9          |
| May 2014                        | Flint stops purchasing Detroit Water and Sewerage Department water. Starts using the City of Flint Water Treatment Plant and Flint River for drinking water       | 10         |
| August 2014                     | Flint <i>E. coli</i> bacteria violation, Localized System Boil Water Advisory                                                                                     | 11         |
| September 2014                  | Disinfection Byproducts compliance communication; the Michigan Department of Environmental Quality requests preemptive Operational Evaluation                     | 12         |
| September 2014                  | Flint Total Coliform Bacteria violation, Localized System Boil Water Advisory                                                                                     | 13         |

## MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY FLINT DRINKING WATER EVENTS TIMELINE

| Date                          | Event                                                                                                                                                                     | Attachment |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| October 2014                  | General Motors announces decision to stop using Flint River as source for production water                                                                                | 14         |
| December 2014                 | Disinfection Byproducts quarterly violation begins                                                                                                                        | 15         |
| December 31, 2015<br>14       | 1st 6-month round of lead and copper monitoring ends. Results due from Flint to Michigan Department of Environmental Quality on January 10, 2015                          | None       |
| January 21, 2015              | City of Flint Public Meeting regarding disinfection byproducts and bacteria                                                                                               | 17         |
| February 26, 2015             | E-mail from United States Environmental Protection Agency to Michigan Department of Environmental Quality regarding elevated lead sample                                  | 18         |
| February 27, 2015             | E-mail from United States Environmental Protection Agency to Michigan Department of Environmental Quality inquiring about Optimized Corrosion Control Treatment           | 19         |
| February 27, 2015             | Michigan Department of Environmental Quality response to United States Environmental Protection Agency email with statement regarding optimized corrosion control program | 20         |
| March 5, 2015                 | 2nd Disinfection Byproducts quarterly violation notice                                                                                                                    | 21         |
| March 30, 2015                | Michigan Department of Environmental Quality notifies Flint of Lead/Copper Monitoring Results.                                                                            | 16         |
| April 3, 2015                 | Long Term 2 Enhanced Surface Water Treatment Rule Letter                                                                                                                  | 22         |
| April 6, 2015                 | Flint proposes installation of Granular Activated Carbon Filter media to reduce disinfection byproducts                                                                   | 23         |
| April 23, 2015                | United States Environmental Protection Agency e-mail to Michigan Department of Environmental Quality regarding corrosion control treatment                                | 24         |
| April 24, 2015<br>May 1, 2015 | Michigan Department of Environmental Quality responds to United States Environmental Protection Agency regarding corrosion control treatment                              | 25         |

## MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY FLINT DRINKING WATER EVENTS TIMELINE

| Date           | Event                                                                                                                                                                                                                              | Attachment |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| April 27, 2015 | United States Environmental Protection Agency provided bottles to 212 Browning for lead/copper analyses                                                                                                                            | 26         |
| May 6, 2015    | Lead service line replaced at 212 Browning. United States Environmental Protection Agency on-site                                                                                                                                  | 27         |
| May 28, 2015   | Internal United States Environmental Protection Agency e-mail regarding results at 212 Browning                                                                                                                                    | 29         |
| June 9, 2015   | 3rd Disinfection Byproducts quarterly violation notice                                                                                                                                                                             | 30         |
| June 10, 2015  | Semi-Annual Conference call with United States Environmental Protection Agency                                                                                                                                                     | 31         |
| June 30, 2015  | E-mail from United States Environmental Protection Agency scheduling conference call on July 21, 2015 regarding elevated lead result and concerns regarding corrosion control                                                      | 32         |
| June 30, 2015  | 2nd 6-month round of lead and copper monitoring ends. Results due from Flint to Michigan Department of Environmental Quality on July 10, 2015                                                                                      | None       |
| July 9, 2015   | Michigan Department of Environmental Quality informed that United States Environmental Protection Agency draft internal memo is on ACLU website                                                                                    | 33         |
| July 14, 2015  | Michigan Department of Environmental Quality issues construction permit to Flint for Granular Activated Carbon filter media W151055                                                                                                | 34         |
| July 21, 2015  | Conference call with United States Environmental Protection Agency (Lead and Copper Rule implementation and Flint) during which it informs Michigan Department of Environmental Quality its interpretation of Lead and Copper Rule | 35         |
| July 24, 2015  | Michigan Department of Environmental Quality e-mail and draft letter 90th percentile lead determination = 11 parts per billion and City of Flint requirement to add corrosion control treatment                                    | 36         |

## MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY FLINT DRINKING WATER EVENTS TIMELINE

| Date               | Event                                                                                                                                                                                                                                                   | Attachment |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| July 28, 2015      | Michigan Department of Environmental Quality received blood lead level information from Michigan Department of Health and Human Services indicating that results since the switch to the Flint River are consistent with past years seasonal variations | 37         |
| August 4, 2015     | Meeting with city representatives at Governor's office                                                                                                                                                                                                  | 38         |
| August 17, 2015    | Michigan Department of Environmental Quality notifies Flint of lead/copper monitoring results and requires City to install corrosion control treatment                                                                                                  | 39         |
| August 23, 2015    | Michigan Department of Environmental Quality notified by an external party that a water quality study was about to begin in Flint                                                                                                                       | 40         |
| September 2, 2015  | Disinfection Byproducts return to compliance                                                                                                                                                                                                            | 43         |
| September 11, 2015 | United States Environmental Protection Agency e-mail confirming that Michigan Department of Environmental Quality was never sent the draft June 24, 2015 memo                                                                                           | 44         |
| September 21, 2015 | Meeting with Congressional representatives, legislators, United States Environmental Protection Agency and Michigan Department of Environmental Quality to discuss issues with water quality in Flint                                                   | 45         |
| September 22, 2015 | Meeting/Conference call with Michigan Department of Health and Human Services, Genesee County Health Department, and Michigan Department of Environmental Quality to discuss lead education/outreach                                                    | 46         |
| September 24, 2015 | Hurley Children's Hospital data reveals elevated blood lead levels in Flint children                                                                                                                                                                    | 47         |
| September 24, 2015 | Michigan Department of Health and Human Services response affirms State blood lead level data is more comprehensive than Hurley Hospital data                                                                                                           | None       |

## MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY FLINT DRINKING WATER EVENTS TIMELINE

| Date               | Event                                                                                                                                                                        | Attachment |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| September 25, 2015 | Flint issues Lead Advisory regarding drinking water                                                                                                                          | 48         |
| October 1, 2015    | State Chief Medical Officer confirms Hurley blood lead level data                                                                                                            | None       |
| October 1, 2015    | Genesee County Health Department issues "Do Not Drink" Advisory                                                                                                              | 49         |
| October 2, 2015    | Michigan Department of Environmental Quality and Michigan Department of Health and Human Services press conference. Governor's Flint Action Plan announced.                  | 50         |
| October 2, 2015    | Genesee County Health Department school screening water samples collected for lead analysis                                                                                  | 51         |
| October 8, 2015    | Governor Press Conference: Flint to reconnect to Great Lakes Water Authority/Detroit Water and Sewerage Department                                                           | 52         |
| October 15, 2015   | State Legislature authorizes a \$9 million to assist the City of Flint to pay for the return to the Detroit water system and to fund staff at schools to gauge lead exposure | None       |
| October 16, 2015   | First weekly coordination meeting held between the City of Flint and state agencies                                                                                          | None       |
| October 16, 2015   | Michigan Department of Environmental Quality meets with Flint Schools Superintendent and Genesee County Health Department                                                    | None       |
| October 16, 2015   | Flint switches back to Detroit Water and Sewerage Department for water                                                                                                       | 53         |
| October 21, 2015   | Governor Snyder announces formation of Flint Water Task Force to complete an After-Action Review                                                                             | None       |
| October 28, 2015   | Michigan Department of Environmental Quality issues construction permit for additional corrosion control treatment W151104                                                   | 54         |
| October 30, 2015   | Michigan Department of Environmental Quality letter to Flint regarding corrosion control treatment operation                                                                 | 55         |

## MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY FLINT DRINKING WATER EVENTS TIMELINE

| Date             | Event                                                                                                                                                                           | Attachment |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| November 3, 2015 | United States Environmental Protection Agency Memorandum regarding "Lead and Copper Rule Requirements for Optimal Corrosion Control Treatment for Large Drinking Water Systems" | 56         |
| November 4, 2015 | United States Environmental Protection Agency Memorandum regarding "Transmittal of Final Report – High Lead at Three Residences in Flint, Michigan"                             | 57         |
| Mid-Late 2016    | Planned connection to Karegnondi Water Authority (Lake Huron water to Flint Water Treatment Plant)                                                                              | None       |

## **FY 2016 SUPPLEMENTAL BUDGET REQUEST**

## **Flint Water FY 2016 Supplemental Budget Request**

### **1. \$1 Million for Filters**

The \$1 million for filters will be used to purchase filters for households in Flint that do not qualify for assistance under any of the DHHS assistance programs. Filters for those residents will be paid for out of funding already in place in DHHS' budget. Each filter is \$20 and they were ordered in bulk through Home Depot. Filters are being distributed through local public health departments, with documentation filed for each filter handed out.

### **2. \$6 Million for switch from Flint River to DWSD**

The City of Flint estimates it will cost the City an additional \$1.3 million per month to use DWSD instead of the Flint River. The State and the City agreed to split the cost through June 2016, when the new Karegnondi Water Authority will be completed and Flint will switch to that water source. (\$1.3 million for 9 months)

### **3. \$1.35 Million for resources to do community Lead Exposure Testing**

DEQ, DHHS and LARA are assembling a team to go into schools, childcare facilities, and other high lead exposure health risk locations to test and follow up on lead exposure.

### **4. \$1 Million for evaluating sample results at the State Lab**

The new testing protocols for schools will require each faucet in the school to be tested and evaluated at the State lab. In addition, lead exposure testing in homes will result in tens of thousands more samples that will be need to processed. Each sample costs \$26 to process.

**Total Ask: \$9.35 Million, \$7.15 GF**

## **DEQ'S 18 POINT PARTNERING PLAN**

## **DEQ's 18 Point Partnering Plan**

### **1. After Action Plan (FAQ) will be ready by noon November 16, 2015**

- First version complete – updated as needed

### **2. School Test Data**

- School reports to be expedited
- Steve Busch creates summary reports
- George Krisztian creates summary spreadsheet

### **3. Blood exposure**

- DHHS is lead on providing data

### **4. Meeting with Mayor Karen Weaver**

- Harvey Hollins lead – Dan Wyant, Jim Sygo and George Krisztian to attend

### **5. Messaging our Partnering Plan**

- Provide ongoing public updates regarding Governor's 10 point plan
- Continue emphasis on the availability of free testing for Flint residents
- OEA to direct the Public to the "Flintwater" website

### **6. Sampling Protocol**

- Establish alignment with EPA Region 5 on sampling protocol

### **7. Lead service line replacement**

- Expand RLF directed at lead service line replacement
- Amy Epkey, Maggie Pallone and Sonya Butler

### **8. Partner with EPA**

- Jim Sygo → Bob Kaplan
- Dan Wyant → Susan Hedman
- Mike Prysby and Steve Busch → Darren Lytle and Mike Schock
- George Krisztian → Tom Burke
- ODWMA Staff → EPA Region 5 Staff (Jennifer Crooks and Tom Poy)

### **9. Meet with Mott Foundation to discuss Lead Service Line Identification Study**

### **10. Lead Education Program**

- DHHS is the lead on Lead Education Program

**11. Moving KWA forward**

- Proactive meetings with KWA

**12. Participate actively with Technical Advisory Council****13. Utilize Joan Rose and MSU water expertise****14. Public Outreach**

- Mayor Karen Weaver
- Genesee County Health Department
- Drs. Lawrence Reynolds, Eden Wells and Matthew Davis
- Ministers
- Land Bank
- Legislators
- Citizens

**15. Outreach to schools**

- EPA guidance on testing
- Work with state superintendent
- ODWMA Staff to work on Literature

**16. Make recommendations to EPA about LCR****17. Compliance Communication letter sent November 9, 2015**

- Wait until after Dec 30<sup>th</sup>

**18. Enhance Coordination with Health Officials regarding personal health notifications of drinking water issues.**

## **EPA COMMUNICATION ON LEAD AND COPPER RULE**

**Thelen, Mary Beth (DEQ)**

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**From:** Wyant, Dan (DEQ)  
**To:** Hedman, Susan  
**Subject:** RE: talking points

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**From:** Hedman, Susan [mailto:[hedman.susan@epa.gov](mailto:hedman.susan@epa.gov)]  
**Sent:** Thursday, October 01, 2015 7:27 PM  
**To:** Wyant, Dan (DEQ)  
**Subject:** RE: talking points

Further to our conversation, please note that lead and copper monitoring is used to determine:

- 1) Whether corrosion control is optimized. Under 141.81(b)(3), a water system is deemed to have optimum corrosion control if it submits results of tap water monitoring that demonstrates for 2 consecutive six-month periods that the 90<sup>th</sup> percentile level is below 5 ug/L (ppb). Because Flint exceeded this level, the City is required to implement corrosion control – as noted in MDEQ's August 17<sup>th</sup> letter to the City of Flint which states: "Since the City did not meet these criteria in both the July–December 2014, and January–June 2015, sampling periods, the City must now recommend a treatment to fully optimize corrosion control treatment . . . ."
- 2) Whether the lead action level (15ug/L) has been exceeded. Under 141.84(a), systems that fail to meet the lead action level in tap samples after installing corrosion control treatment must replace lead service lines – 7% of the lead service lines in its distribution system.

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**From:** Wyant, Dan (DEQ) [mailto:[WyantD@michigan.gov](mailto:WyantD@michigan.gov)]  
**Sent:** Thursday, October 01, 2015 5:02 PM  
**To:** Hedman, Susan  
**Subject:** Fwd: talking points

Talking points. I will make the adjustment you and I talked about. Thanks for your help.

Sent from my iPhone

Begin forwarded message:

**From:** "Tommasulo, Karen (DEQ)" <[TommasuloK@michigan.gov](mailto:TommasuloK@michigan.gov)>  
**Date:** October 1, 2015 at 4:27:53 PM EDT  
**To:** "Pallone, Maggie (DEQ)" <[PalloneM@michigan.gov](mailto:PalloneM@michigan.gov)>, "Minicuci, Angela (DHHS)" <[MinicuciA@michigan.gov](mailto:MinicuciA@michigan.gov)>, "Eisner, Jennifer (DHHS)" <[EisnerJ@michigan.gov](mailto:EisnerJ@michigan.gov)>, "Hertel, Elizabeth (DHHS)" <[HertelE@michigan.gov](mailto:HertelE@michigan.gov)>, "Wurfel, Brad (DEQ)" <[WurfelB@michigan.gov](mailto:WurfelB@michigan.gov)>, "Wurfel, Sara (GOV)" <[Wurfels@michigan.gov](mailto:Wurfels@michigan.gov)>, "Murray, David (GOV)" <[MurrayD1@michigan.gov](mailto:MurrayD1@michigan.gov)>, "Thelen, Mary Beth (DEQ)" <[THELENM2@michigan.gov](mailto:THELENM2@michigan.gov)>, "Wyant, Dan (DEQ)" <[WyantD@michigan.gov](mailto:WyantD@michigan.gov)>, "Paciorek, Josh (GOV)" <[PaciorekJ@michigan.gov](mailto:PaciorekJ@michigan.gov)>, "Lasher, GERALYN (DHHS)" <[lasherg@michigan.gov](mailto:lasherg@michigan.gov)>  
**Subject:** talking points



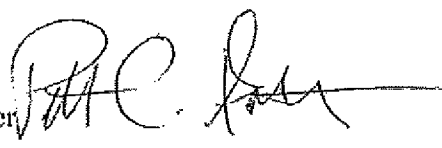
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OFFICE OF WATER

NOV 03 2015

MEMORANDUM

**SUBJECT:** Lead and Copper Rule Requirements for Optimal Corrosion Control Treatment for Large Drinking Water Systems

**FROM:** Peter C. Grevatt, Director  
Office of Ground Water and Drinking Water 

**TO:** EPA Regional Water Division Directors, Regions I-X

This memorandum addresses certain concerns raised about the application of the 1991 Lead and Copper Rule, specifically the requirements pertaining to maintenance of optimal corrosion control treatment, in situations in which a large water system ceases to purchase treated water and switches to a new drinking water source. These concerns have been raised most recently in regard to the drinking water system in Flint, Michigan, where the water system was disconnected from the Detroit Water and Sewerage Department, which provided corrosion control treatment for Lake Huron source waters, and instead began distributing water from the Flint River. This type of situation rarely arises and the language of the LCR does not specifically discuss such circumstances. After reviewing the rule with our Office of General Counsel, it appears that there are differing possible interpretations of the LCR with respect to how the rule's optimal corrosion control treatment procedures apply to this situation, which may have led to some uncertainty with respect to the Flint water system. This memorandum clarifies how the LCR applies to this situation and eliminates the uncertainty for water systems and primacy agencies that may face these circumstances in the future.

It is important for large systems and primacy agencies<sup>1</sup> to take the steps necessary to ensure that appropriate corrosion control treatment is maintained at all times, thus ensuring that public health is protected. This memorandum focuses on those steps and clarifies, on a prospective basis, how EPA interprets the LCR corrosion control requirements and how primacy agencies should apply these requirements to large public water systems before, during and after making a significant change in source water, including switching from purchased water to a new source.

Under the LCR, all large systems (those serving more than 50,000 persons), whether purchasing water or not, must have completed a series of steps to either optimize the corrosion control treatment or be deemed to have optimal corrosion control treatment (OCC<sup>1</sup>) by 1998. 40 CFR 141.81. Key steps for

<sup>1</sup> The term "primacy agency" refers to the State, tribe or U.S. Environmental Protection Agency regional office having jurisdiction over, and primary enforcement responsibility for, a given public water system.

optimizing corrosion control include monitoring, corrosion control studies, installation of treatment, follow-up sampling and specification by the primacy agency of water quality parameters (WQPs) for monitoring corrosion control. The LCR requires any large system that has met the OCCT requirements through the installation of corrosion control treatment to continue operating and maintaining the treatment and to continue meeting the WQPs established by the primacy agency. 40 CFR 141.81(b) and 141.82(g). Systems deemed to have OCCT without the installation of corrosion control treatment are not subject to this requirement. However, they are required to notify the primacy agency in writing of any upcoming changes in treatment or source and request that the primacy agency modify its determination of the OCCT and WQPs applicable to the system. The primacy agency must then review and approve the change and designate OCCT and WQPs prior to its implementation by the system. 141.81(b)(3). Similarly, systems subject to reduced monitoring or monitoring waivers must notify the primacy agency of any upcoming changes in treatment or source and the primacy agency must subsequently review and approve it. EPA recommends that systems that are not subject to a notification requirement also notify the primacy agency prior to the addition of a new source or treatment and request the primacy agency to modify its determination of the optimal corrosion control and WQPs applicable to the system.

Due to the unique characteristics of each PWS (e.g., source water, existing treatment processes, distribution system materials) it is critical that public water systems, in conjunction with their primacy agencies and, if necessary, outside technical consultants, evaluate and address potential impacts resulting from treatment and/or source water changes. It is also critical for public water systems to conduct ongoing monitoring to ensure compliance with OCCT prior to, during and after a source or treatment change. The rearrangement of a system's existing configuration may trigger the need for OCCT adjustments and establishment of appropriate WQPs. Primacy agencies should work with systems that plan to disconnect from a supplier that had installed corrosion control treatment to determine the OCCT for the new source and establish WQPs for that treatment instead of using the OCCT and WQPs established for the previous source. This will allow a system that ceases to purchase treated water to stay in compliance with any applicable requirements pertaining to OCCT and ensure protection of public health during and after the change in source. EPA has developed a guidance manual<sup>2</sup> specifically focusing on evaluation of corrosion control treatment options and optimization of full-scale treatment to assist water systems and primacy agencies with these efforts. EPA is currently preparing an updated version of the manual, which we anticipate will be released in February 2016.

The key to identifying and mitigating potential problems is to ensure effective collaboration between the public water system and the primacy agency. Corrosion control treatment can come in many forms. For this reason, it is important to conduct a system-wide assessment prior to any source water and/or treatment modifications and to identify existing or anticipated water quality, treatment or operational issues that may interfere with or limit the effectiveness of corrosion control treatment optimization or re-optimization.

If you have additional questions or concerns, please contact me or have your staff contact Maria Lopez Carbo, Chief of the Protection Branch, in the Office of Ground Water and Drinking Water, at [lopez-carbo.maria@epa.gov](mailto:lopez-carbo.maria@epa.gov).

<sup>2</sup> U.S. Environmental Protection Agency, *Lead and Copper Rule Guidance Manual, Volume II: Corrosion Control Treatment*, Office of Water, EPA 811-B-92-002, 1992. Available at: <http://nepis.epa.gov/1/xef/ZyPDF.cgi?Dockey=91019DM4.txt>.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
 REGIONAL ADMINISTRATOR  
 77 WEST JACKSON BOULEVARD  
 CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

**MEMORANDUM**

**DATE:** November 4, 2015

**SUBJECT:** Transmittal of Final Report - High Lead at Three Residences in Flint, Michigan

**FROM:** Tinka G. Hyde *Tinka G. Hyde*  
 Water Division Director

**TO:** Jim Sygo  
 Deputy Director  
 Michigan Department of Environmental Quality

Howard Croft  
 Director of Flint Public Works

Enclosed please find for your file a final redacted version of a report prepared by EPA Scientist, Miguel Del Toral, regarding lead in drinking water at three residences in Flint, Michigan. The redactions remove personally identifiable and medical information. This report has been finalized and is also being provided to the National Drinking Water Advisory Council (NDWAC) for discussion during their upcoming meeting on November 17-19, 2015. We understand you saw an earlier version of this document; and note that most of the recommendations in that interim report are already being implemented (e.g., the City of Flint has switched back to Detroit water; filters have been provided to residents; and additional corrosion control treatment will be implemented).

The final report contains important new information indicating that physical disturbances of lead service lines can dislodge the protective coating that prevents lead from leaching into drinking water. The final report recommends notifying residents about the potential risks of increased lead levels in drinking water when work is undertaken that may disturb lead service lines.

cc: Natasha L. Henderson, City of Flint Administrator

## High Lead Levels in Flint, Michigan

The purpose of this report is to present the findings of activities conducted in response to high lead levels in drinking water reported to the United States Environmental Protection Agency Region 5 Office (EPA) by a resident in the City of Flint, Michigan.

### *Background Information*

Prior to April 30, 2014, the City of Flint purchased water from the City of Detroit. On April 30, 2014, the City of Flint switched from utilizing purchased water from Detroit to a new water source, the Flint River. Subsequent to the change in source water, the City of Flint experienced a number of water quality issues resulting in violations of National Primary Drinking Water Regulations (NPDWR) including acute and non-acute Coliform Maximum Contaminant Level (MCL) violations and Total Trihalomethanes (TTHM) MCL violations (see Appendix A).

Beginning in January 2015, [REDACTED], a resident of Flint, called the Flint Water Department (FWD) regarding the water quality in her home. In response to the initial and subsequent calls, the FWD visited the [REDACTED] home on a number of occasions and also collected tap water samples. [REDACTED] also contacted EPA regarding these same water quality issues and medical issues she believes are associated with the water quality in Flint.

Following initial calls on the general water quality, on February 26, 2015, [REDACTED] contacted EPA regarding high lead levels found in her drinking water by the City of Flint. The result of the initial lead in water sample collected by the City of Flint on February 18, 2015 from the [REDACTED] home was 104 µg/L and the level of iron in the water exceeded the capability of the instrument to measure (>3.3 mg/L). On February 26, 2015, upon receiving the lead results from [REDACTED], the EPA contacted the Michigan Department of Environmental Quality (MDEQ) regarding the high lead result. The MDEQ advised that the City of Flint collect a follow-up sample for lead at the [REDACTED] home.

On March 3, 2015, the City of Flint collected a follow-up sample for lead at the [REDACTED] residence and the result of this second sample was 397 µg/L<sup>1</sup>. Subsequent to receiving her second result, EPA spoke to [REDACTED] via phone on March 19, 2015, and the following information was provided by [REDACTED]:

- The [REDACTED] home is a HUD home which was gutted and renovated in 2011. All existing plumbing had been removed and the [REDACTED] installed plastic plumbing.
- Due to high iron levels in the tap water, the [REDACTED] installed an iron filter downstream of the service line inlet into the home.
- [REDACTED] indicated that at this time they are not drinking the water or using it for cooking. She stated that her child's blood lead level (BLL) was originally at [REDACTED] in 2012 and that a more recent test showed it had increased to [REDACTED], but she noted that

<sup>1</sup> Note: A third water sample had been collected on April 2, 2015, but the results had not been provided to the [REDACTED] at the time the interim report was written. The third lead in water sample result was 707 µg/L.

*Final Report, October 21, 2015*

the BLL testing was done well after the child had stopped drinking the water and may have been higher during the time the child was consuming the water.

- Water samples collected by the City of Flint from her home were collected from the kitchen tap after the iron filter was physically removed.
- The Flint Water Department (FWD) informed [REDACTED] that her service line does not connect to the water main in front of her home as is typically the case for most homes.
- On March 18, 2015, City of Flint personnel went to the [REDACTED] home to locate the external shut-off valve in conjunction with the planned replacement of the [REDACTED] service line and were unsuccessful. Eventually it was discovered that the external shut-off valve was located at the corner of [REDACTED] and Bryant Street, two houses down from the [REDACTED] home.

As part of EPA's effort to respond to [REDACTED] concerns regarding her water results, EPA contacted the FWD. The following information was provided to EPA by the FWD:

- [REDACTED] home is one of the first homes built on the block and the service line runs for approximately 50-60 yards, connecting to the water main on Bryant Street which runs perpendicular to [REDACTED] (see Appendix A).
- Flint has a large number of lead service lines, so it would not be surprising to find that this is a very long lead line.
- The first sample from the [REDACTED] home was collected with the iron filter in place, and the second was with the iron filter physically removed. The iron filter was located just after the water meter.
- [REDACTED] showed FWD a video of her son 10 minutes after taking a bath, and that he had a full body rash in the video.

It was a common practice in the early 1900s to purchase large parcels of land and later subdivide them. Since service lines are typically run from the water main to the nearest location on a property and it is possible that the [REDACTED] home may have originally been part of a larger parcel of land that encompassed the two homes that now exist adjacent to the [REDACTED] home and was subsequently divided, leaving the original home connected to the same service connection and water main, while the newer homes were connected to a more recent water main installed along [REDACTED].

Based on a suspected conflict of interest at the healthcare facility that originally tested her son's BLL, [REDACTED] took her son to a different healthcare facility to have his blood lead tested again. On April 1, 2015, [REDACTED] provided EPA with a copy of her child's blood lead testing performed on March 27, 2015, showing a higher BLL ([REDACTED]) than the original test.

Due to the persistently high lead results, the FWD shut off the water service to the [REDACTED] home on April 3, 2015. Per agreement between the FWD and [REDACTED], her home was then connected to her neighbor's home via a garden hose, from one hose bib to another. This was understood to be a temporary measure until the [REDACTED] service line could be replaced. The [REDACTED] used this water connection only for bathing, washing dishes and washing clothes.

At the invitation of [REDACTED], EPA visited the [REDACTED] home on April 27, 2015, and reviewed the internal plumbing and information provided by [REDACTED], including water samples and spent filter cartridges. During this visit, EPA observed that the internal pipes, valves and connectors at the [REDACTED] residence were made of CPVC plastic, approved by NSF for potable drinking water applications, with a few minor metal connectors. A review of the treatment units in the home by EPA found that there was no iron filter in the home as had previously been thought. The only active treatment device in the home was a whole-home sediment filter which utilizes NSF certified Whirlpool WHKF-WHWC cartridge filters for sediment removal and taste/odor. There was also a non-functioning 'Water Resources International Hydro-Quad Commercial Water Processor' which was bypassed (see Appendix A).

At the request of [REDACTED], Dr. Marc Edwards at Virginia Tech provided sampling instructions to [REDACTED] for collecting a series of samples from her home. As part of the instructions, on the night of April 27, 2015, the water at the [REDACTED] residence was turned back on temporarily and the kitchen tap was flushed for 25 minutes at low flow prior to letting the water sit overnight. A series of sequential samples were collected the following morning (April 28, 2015) and sent to Dr. Edwards for analysis.

Dr. Edwards provided [REDACTED] with the results of the analyses and also shared the results with EPA on May 5, 2015, along with information regarding other chemical parameters tested (see Appendix B). In addition to very high lead levels in all sample results, the analytical data shows a correlation between lead and phosphate as well as lead and aluminum in all samples. On April 24, 2015, EPA had learned that Flint did not have corrosion control treatment in place and also learned that Flint was using ferric chloride as a coagulant. Consequently, as the City of Flint is not utilizing phosphate or alum as treatment chemicals since the source switch, the results indicate that it is likely that the phosphate and aluminum were being released from the scale within the distribution system network. This scale would have formed on the inside of the pipes in Flint during the time when the City was purchasing water from Detroit, as Detroit utilizes orthophosphate for corrosion control and alum as a coagulant in their water filtration process.

Research conducted by EPA on lead content in pipe scales has shown that scales which form on the inside of lead pipes can be released or dislodged into the water and may contain a high percentage of lead (Appendix C). Although the results received from Virginia Tech were indicative of the presence of a lead service line, the FWD indicated that no records existed to confirm whether any portion of the service line connecting to the [REDACTED] home was made of lead. However, given the high lead levels found, it was presumed that at least a portion of the service line was likely made of lead. In the course of following up on the high lead at the [REDACTED] home, additional sample results provided to EPA from other residences in Flint also showed high lead levels.

Primarily from a public health standpoint, but also from a research standpoint, it was important to try to find out what the cause of these very high lead levels might be. EPA Region 5, EPA's Office of Research and Development and others have been working

together collaboratively to better understand lead release mechanisms from lead service lines in anticipation of upcoming revisions to the Lead and Copper Rule (LCR) and as part of a collaborative effort in EPA Region 5 to study potential options for optimizing phosphate treatment to control lead in water and the need to reduce phosphorus discharges into the environment. Since the [REDACTED] service line was scheduled for replacement on May 6, 2015 and the presumption was that at least a portion of the service line was lead, EPA visited the [REDACTED] home on the day of the service line replacement to gather information and service line pipe samples that could provide additional information as to how lead levels could get as high as they did in this case.

The original service line to the [REDACTED] home was disconnected and two service line pipe segments from this service line were extracted on May 6, 2015. Additional tap water samples were collected also from two homes on Bryant Street that were connected to the same water main as the [REDACTED] home (Appendix A). The samples were collected from these homes as they had more typical service line lengths as compared with the [REDACTED] home. During the same visit, patches of asphalt were also noted along the curb on Browning Avenue, indicating that excavation had occurred. These patches, which were in proximity of the [REDACTED] service line in the parkway (see Appendix C) may be one of the potential factors contributing to the high lead at the [REDACTED] home, as it has been shown that physical disturbances to pipes can dislodge the scales within those pipes.

The two service line segments that were extracted were subsequently identified as galvanized iron pipe. Analyses conducted by Virginia Tech on the extracted portions of the pipe indicate that the galvanized iron pipe was fairly typical in terms of composition (see Appendix C). The galvanized iron portion ran from inside the [REDACTED] home to the external shut-off valve at the corner of [REDACTED] and Bryant Street. The remainder of the [REDACTED] original service line from the shut-off valve to the water was made of lead.

Although the service line had been disconnected from the [REDACTED] home, it was not possible to retrieve a segment of the lead portion of the service line as it was beyond the shut-off valve which had been closed and left in place. Following the disconnection of the original service line, a new service line made of copper was installed from the [REDACTED] home to the water main in front of the home on [REDACTED]. Subsequent to the replacement of the service line at the [REDACTED] home, water samples were also collected from the [REDACTED] home and sent to the EPA Chicago Regional Laboratory for analysis. In all three homes, the sequential samples were collected using standard protocols used in prior sequential sampling efforts to capture water samples reflecting lead levels from the kitchen tap to the water main. Two additional samples were collected from the water heater drain valve at the [REDACTED] home to determine if lead deposits had accumulated in the water heater, and a final sample was collected from the bathroom tap. The sequential sampling results indicate that the service line replacement eliminated the high lead levels and that no residual lead had accumulated within the plastic plumbing of the [REDACTED] residence, which was a potential concern and possibility based on prior research. One of the two samples collected from the [REDACTED] hot water heater had high lead (32 µg/L), likely from lead particulate that had accumulated in the tank, and the sample collected from the bathroom was 5.5 µg/L.

The sequential samples collected from the two homes on Bryant Street had differing results. At the first home (Site 2), a series of 15 sequential one-liter samples were collected and the results are indicative of a service line that does not contain any portion that is made of lead. Consequently the lead results were low overall for samples representative of the service line. The first sample in the sequential sampling series was the highest, which potentially indicates the presence of leaded brass in the faucet or underlying sink fixtures. Some leaded brasses manufactured prior to the 2011 lead-free law have been shown to release high levels of lead in certain water qualities. Leaded-solder was ruled out as the home plumbing consisted of galvanized iron pipe, and it is presumed that if the galvanized iron pipe were contributing the higher lead, the lead levels would be more consistent in all 15 samples.

At the second home (Site 3), a series of 15 sequential one-liter samples were collected from the kitchen tap and the results indicated that there were no significant sources of lead within the home plumbing but that a portion of the service line is likely made of lead, as indicated by the characteristic peaking of lead levels in the liters capturing water from the service line between the property and the water main, where the portions of many service lines in Flint are made of lead.

All three sets of sequential samples were analyzed for lead, copper, iron, phosphorus and cadmium. In contrast to the samples analyzed by Virginia Tech from the [REDACTED] home prior to the removal of the original service line, no phosphorus was present in the sequential samples at the [REDACTED] home following the replacement of the service line. In addition, no phosphorus was detected in the sequential samples from the two homes on Bryant Street. These results indicate that the source of high lead, aluminum and phosphorus in the analyses conducted by Virginia Tech was likely dislodged or disintegrated scale from within the [REDACTED] original service line.

The sequential sampling results from the [REDACTED] home before and after service line replacement, as well as the results from the two homes on Bryant Street are included in Appendix B.

Although relative contributions cannot be determined, there are a number of factors that could have contributed to the high lead levels found at the [REDACTED] home as follows:

1) Corrosiveness of water and lack of mitigating (corrosion control) treatment

The corrosiveness of the water and the absence of mitigative treatment to control lead release are well known factors that can contribute to high lead release.

2) Presence of a lead service line

Lead service lines are the largest source of lead, when present, and can contribute up to 75 percent of the total mass of lead released into the water. The portion of the original service line from the water main to the external shut-off valve at the corner of [REDACTED] and Bryant Street, estimated to be approximately 25 feet in length, was found to be a lead

pipe. In addition, studies have also shown that the scales within galvanized iron pipe downstream of lead pipe segments can be 'seeded' with lead from the lead portion of the service line. The [REDACTED] service line was much longer than most typical service lines which would allow accumulation of a greater total mass of scale within the pipe.

### 3) Physical disturbances

A recent EPA study indicates that physical disturbances in proximity to lead service lines can cause the dislodging of the protective scales from within the service lines. The photograph in Appendix C shows the scale that was dislodged from inside a lead service line during routine maintenance work in another city due to a physical disturbance of the line. The dislodged scale and sediment contained a very high concentration of lead. At the time of the EPA visit to the [REDACTED] home, there were two patches of new asphalt visible on [REDACTED] along the parkway where the [REDACTED] original service line was located, indicating recent excavation and possible recent physical disturbances to the [REDACTED] service line (Appendix C). These potential disturbances were along the galvanized iron section of the service line and as noted above, research has shown that the presence of lead pipe upstream can 'seed' the galvanized iron pipe downstream with lead, which results in an accumulation of lead-bearing scales within the galvanized pipe downstream of the lead portion of the service line. It is reasonable to assume that these physical disturbances to the galvanized iron portion of the service line could therefore result in the same dislodging of scale and sediment as studies have shown can happen with lead service lines.

The street disturbances on [REDACTED] occurred after the [REDACTED] moved into the home along the portion of the service line made of galvanized iron pipe. There were no visible signs of disturbance on Bryant Street where the lead portion of the [REDACTED] service line was situated (see Appendix C). It is likely, given the extremely high lead levels found and the co-occurrence of aluminum, phosphorus and lead, that the long segment of galvanized iron pipe was seeded with lead over the entire length of the pipe and the physical disturbances and other factors such as the water chemistry resulted in the release of large amounts of the high-lead bearing scale and sediment into the water. Virginia Tech also found nearly perfect correlations between the lead in water and markers for galvanized pipe scales including zinc.

### Recommendations

As indicated by the results from the [REDACTED] home and previous EPA work, the presence of lead pipes over many years has likely resulted in the accumulation of lead in the scales within non-lead pipes downstream of the lead pipe and physical disturbances to the lead or non-leaded portions of the service lines have the potential to release large amounts of scale and sediment that could pose an immediate and acute health hazard to the residents. Consequently, even with corrosion control treatment in place in the future, physical disturbances will be capable of dislodging the high lead-bearing scale and sediment from non-lead pipes as well as lead pipes, as was the case in the earlier EPA study.

Obtaining information on the lead reservoirs in the scales within the lead and non-leaded portions of intact service lines is essential for determining the potential risk to residents

from lead-bearing scale released as lead lines are replaced as well as the risk that may remain following removal of the lead lines, where the non-lead portions of service lines are left in place.

As the [REDACTED] service line was very long compared to the length of most typical service lines, it is important to assess the potential risk posed by the scale reservoirs in more typical lengths of service lines by extracting both the leaded and non-lead portions of service lines which have not been physically disturbed. The service lines chosen for extraction and analysis should be representative of the materials commonly used downstream of the lead pipe (e.g., galvanized iron, copper, plastic). Extraction/handling procedures should be developed by EPA to ensure that damage to the scales from the excavation, extraction and delivery of the service line segments is minimized. Sequential sampling should also be conducted on a representative group of homes with common plumbing materials (e.g., galvanized iron, copper, plastic) to determine the extent to which the lead from the service line has seeded the interior plumbing in homes.

It is also critically important to develop and incorporate ongoing training and public education on the potential for high lead release from the scales as a result of any future physical disturbances to service lines and mitigative actions that residents can take to lower their exposure risk. The training and educational material should be assessed for clarity, meaningfulness, and accessibility by a group of residents and health experts to ensure the effectiveness of the communications.

At a minimum, immediate training and public education on the potential risks posed by physical disturbances to service lines should be developed by communications experts and provided to residents, community groups, elected officials, health departments, pediatricians and gynecologists, water and non-water utilities (gas, electric, cable, etc.), plumbing organizations and contractors. Residents should be notified of scheduled work by water and non-water utilities and informed of the potential risk of increased lead levels due to these disturbances.

## Appendix A – Background Information

### *National Primary Drinking Water Regulations (NPDWR) Violations – City of Flint*

Following the switch to the Flint River, the City of Flint experienced a series of NPDWR violations as follows:

- Acute Coliform MCL violation in August 2014
- Monthly Coliform MCL violation in August 2014
- Monthly Coliform MCL violation in September 2014
- Average TTHM MCL violation in December 2014
- Average TTHM MCL violation in March 2015
- Average TTHM MCL violation in June 2015

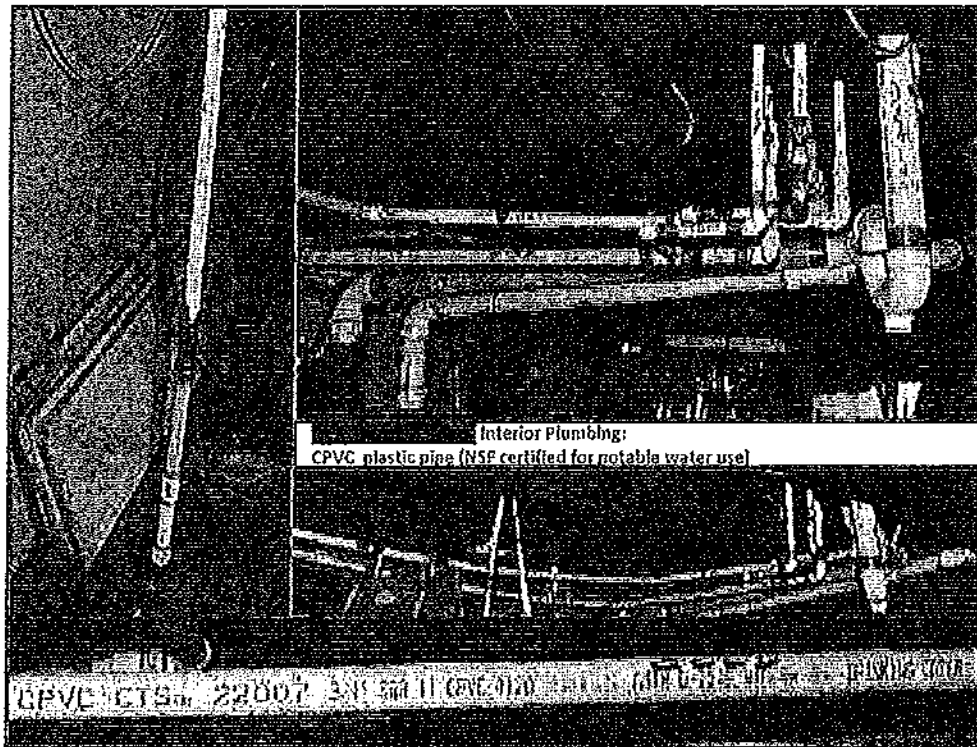
### *Sampling Sites*

The map below shows the three homes that were sampled as provides information on the length of the service lines and the plumbing material. Two portions of the original service line were extracted and analyzed and a third portion was collected from the entry point into the home, but not analyzed.

[map redacted because it shows Personally Identifiable Information]

*Final Report, October 21, 2015****Internal Plumbing –*** [REDACTED]

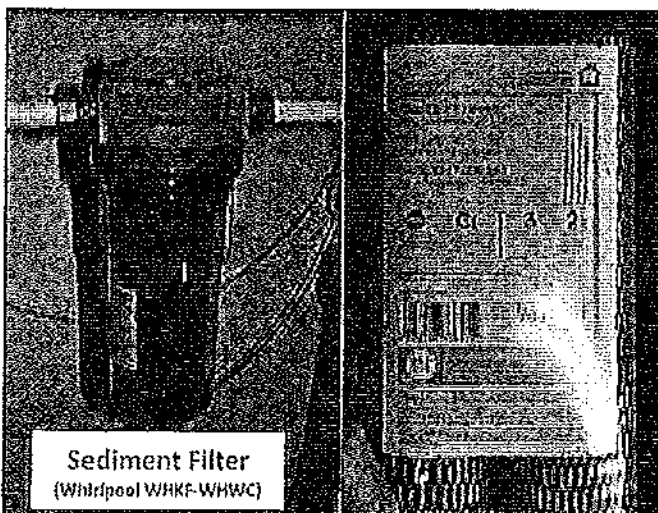
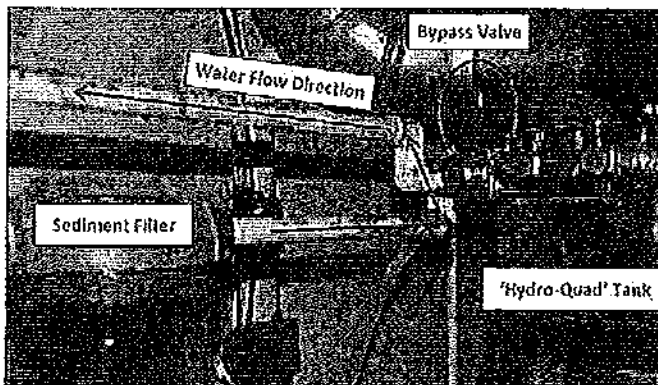
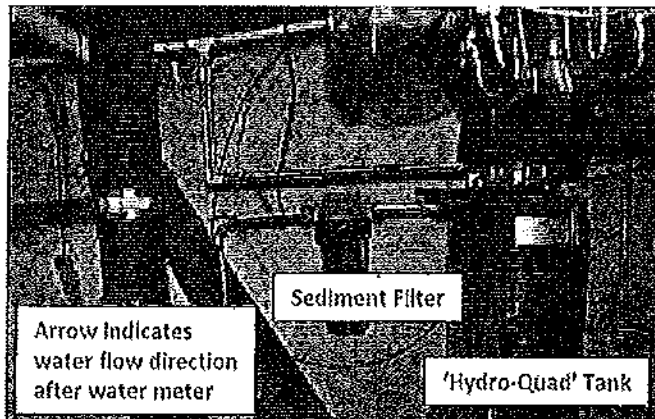
The following pictures were taken at the [REDACTED] home located at [REDACTED]. With the exception of a few minor metallic connectors, all potable water plumbing in the home was found to be CPVC plastic pipe which is NSF-certified for drinking water use.



*Final Report, October 21, 2015*

### *Treatment Units – [REDACTED]*

The [REDACTED] home has a whole-home sediment filter, as well a non-functioning 'Hydro-Quad Commercial Water Processor' which is bypassed. There was no iron filter in the home as had been previously reported.



## Appendix B – Analytical Results

Lead in water sampling results from the [REDACTED] residence ([REDACTED])

### City of Flint Samples

The City of Flint collected water samples from the [REDACTED] residence and analyzed them for lead. The results for each date are listed below.

February 18, 2015: 104 µg/L

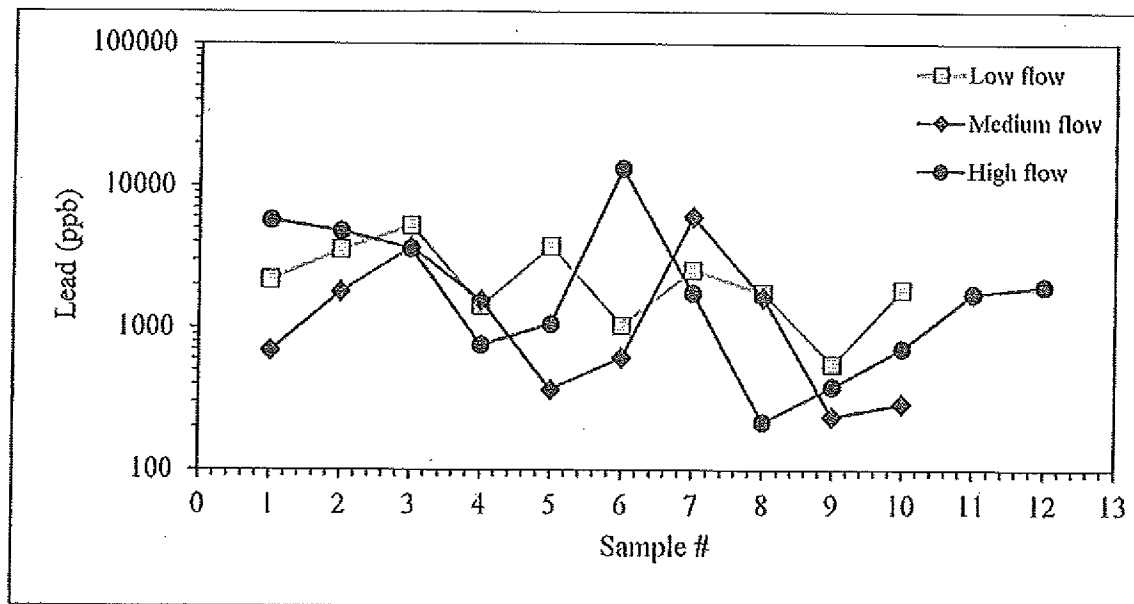
March 3, 2015: 397 µg/L

April 2, 2015: 707 µg/L\*

\*This sample result had not been provided to the [REDACTED] at the time the interim report was written.

### Virginia Tech Sampling Results (provided courtesy of Virginia Tech)

Samples were collected from the [REDACTED] home following an extended stagnation period (April 3, 2015 to April 27, 2014) after the water at the [REDACTED] residence had been shut off. The water was turned back on and three sets of sequential samples were collected on April 28, 2015, at different flow rates (low, medium and high).



Final Report, October 21, 2015

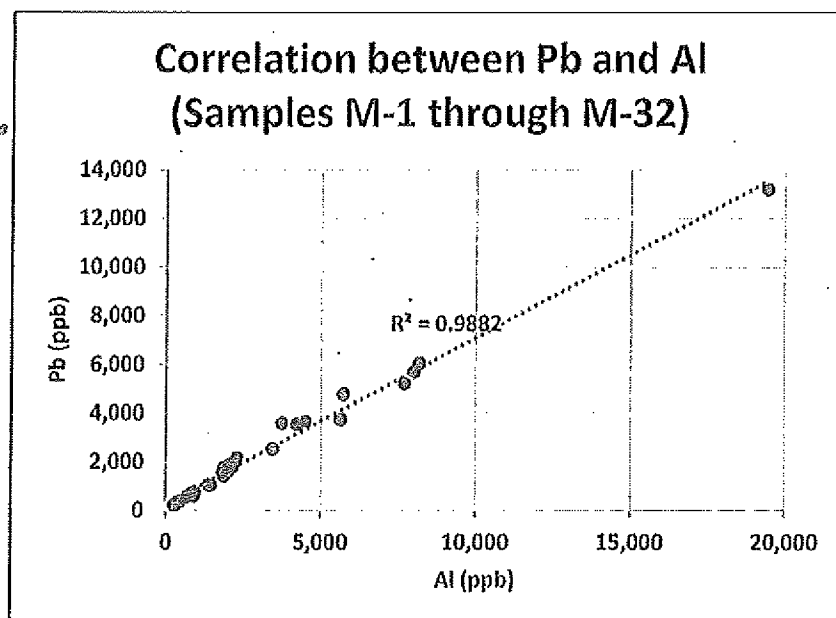
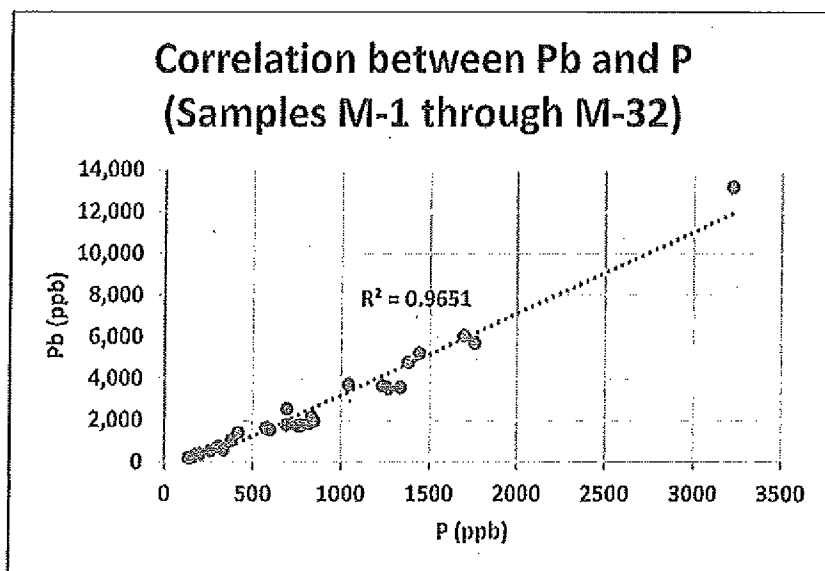
| Element<br>(units) | Low Flow          |        |        |        |        |        |        |                      |        |        |
|--------------------|-------------------|--------|--------|--------|--------|--------|--------|----------------------|--------|--------|
|                    | 1 L Sample Bottle |        |        |        |        |        |        | 125 mL Sample Bottle |        |        |
|                    | M-1               | M-2    | M-3    | M-4    | M-5    | M-6    | M-7    | M-21                 | M-22   | M-23   |
| Ag (ppb)           | 0                 | 0      | 0      | 0      | 0      | 0      | 0      | 0                    | 0      | 0      |
| Al (ppb)           | 2,285             | 4,199  | 7,683  | 1,856  | 5,623  | 1,422  | 3,413  | 1,865                | 666    | 2,015  |
| As (ppb)           | 3.3               | 3.9    | 4      | 2      | 3.2    | 2      | 2.6    | 3.6                  | 1.9    | 3.1    |
| Ba (ppb)           | 31.3              | 39.8   | 27.7   | 21.2   | 24.2   | 20.9   | 22.8   | 31.3                 | 21.3   | 32.6   |
| Ca (ppb)           | 43,150            | 43,620 | 43,580 | 42,590 | 43,030 | 42,030 | 42,440 | 40,790               | 41,050 | 41,460 |
| Cd (ppb)           | 2.5               | 4.2    | 5.7    | 1.9    | 3.9    | 2      | 2.5    | 2.2                  | 1.4    | 2.4    |
| Cl (ppm)           | 1,206             | 1,148  | 1,272  | 1,178  | 1,187  | 1,214  | 1,218  | 1,641                | 1,076  | 1,044  |
| Co (ppb)           | 1.1               | 1.7    | 0.9    | 0.4    | 0.7    | 0.4    | 0.5    | 0.9                  | 0.3    | 1      |
| Cr (ppb)           | 2.1               | 2.5    | 2.6    | 1.3    | 1.9    | 1.6    | 1.5    | 1.8                  | 1.3    | 1.7    |
| Cu (ppb)           | 235               | 355    | 294    | 94     | 146    | 101    | 112    | 180                  | 82     | 178    |
| Fe (ppb)           | 3,598             | 4,928  | 3,419  | 1,446  | 3,029  | 2,142  | 1,780  | 3,096                | 1,344  | 3,241  |
| K (ppb)            | 3,480             | 3,508  | 3,445  | 3,435  | 3,430  | 3,391  | 3,409  | 3,256                | 3,319  | 3,341  |
| Mg (ppb)           | 10,310            | 11,910 | 17,990 | 11,290 | 15,470 | 10,610 | 12,720 | 8,861                | 9,396  | 9,098  |
| Mn (ppb)           | 1,734             | 2,790  | 1,093  | 462    | 703    | 429    | 652    | 1,382                | 442    | 1,509  |
| Mo (ppb)           | 2.3               | 2.3    | 1.9    | 1.9    | 1.9    | 1.8    | 1.8    | 1.7                  | 1.7    | 1.8    |
| Na (ppb)           | 17,790            | 17,860 | 17,810 | 17,620 | 17,650 | 17,410 | 17,610 | 16,960               | 17,100 | 17,280 |
| Ni (ppb)           | 9.8               | 16     | 30.7   | 8.1    | 23.2   | 6.2    | 15.3   | 6.6                  | 3.7    | 6.8    |
| P (ppb)            | 835               | 1,267  | 1,441  | 416    | 1,040  | 379    | 691    | 773                  | 261    | 819    |
| Pb (ppb)           | 2,171             | 3,550  | 5,224  | 1,412  | 3,735  | 1,038  | 2,542  | 1,759                | 552    | 1,857  |
| S (ppm)            | 28.5              | 28.7   | 28.5   | 28.4   | 28.5   | 28     | 28     | 26                   | 27     | 27.1   |
| Se (ppb)           | 0.2               | 0      | -0.1   | 0.1    | 0.2    | 0      | 0.3    | 0                    | 0      | 0.2    |
| Si (ppb)           | 3,212             | 5,281  | 12,320 | 4,474  | 9,401  | 3,770  | 6,231  | 2,619                | 2,582  | 2,775  |
| Sn (ppb)           | 4.6               | 4.9    | 6.1    | 2.2    | 4.5    | 2.3    | 3      | 2.3                  | 1.5    | 2.3    |
| Sr (ppb)           | 129.4             | 132.3  | 128.5  | 125    | 127.7  | 125.3  | 126.1  | 126.3                | 125.5  | 128    |
| Ti (ppb)           | 3.4               | 5.8    | 8.3    | 2.1    | 5.8    | 1.9    | 3.1    | 3                    | 1.4    | 3.1    |
| U (ppb)            | 1                 | 1.6    | 2.6    | 0.8    | 1.9    | 0.7    | 1.2    | 0.9                  | 0.4    | 0.9    |
| V (ppb)            | 13.9              | 17.5   | 23.9   | 9.8    | 17.6   | 8.9    | 13.8   | 12.2                 | 6      | 10.8   |
| Zn (ppb)           | 1,055             | 1,848  | 2,731  | 777    | 1,890  | 839    | 979    | 746                  | 513    | 808    |

| Element<br>(units) | Medium Flow       |        |        |        |        |        |        |                      |        |        |
|--------------------|-------------------|--------|--------|--------|--------|--------|--------|----------------------|--------|--------|
|                    | 1 L Sample Bottle |        |        |        |        |        |        | 125 mL Sample Bottle |        |        |
|                    | M-8               | M-9    | M-10   | M-11   | M-12   | M-13   | M-14   | M-24                 | M-25   | M-26   |
| Ag (ppb)           | 0                 | 0      | 0      | 0      | 0      | 0      | 0      | 0                    | 0      | 0      |
| Al (ppb)           | 891               | 2,142  | 4,493  | 1,810  | 431    | 877    | 8,159  | 2,005                | 286    | 347    |
| As (ppb)           | 2.2               | 2.9    | 3.9    | 2.5    | 2      | 2.3    | 4.6    | 2.7                  | 1.8    | 2      |
| Ba (ppb)           | 22                | 29.1   | 36.3   | 28     | 18.9   | 22.6   | 37.1   | 26.2                 | 18.9   | 19.4   |
| Ca (ppb)           | 41,520            | 41,580 | 42,080 | 41,490 | 41,020 | 40,850 | 42,010 | 40,940               | 41,110 | 40,550 |
| Cd (ppb)           | 1.5               | 2.4    | 4      | 2.1    | 1      | 1.5    | 4.9    | 2.9                  | 0.9    | 1      |
| Cl (ppm)           | 1,329             | 1,211  | 1,252  | 1,225  | 1,507  | 1,321  | 1,324  | 1,179                | 1,258  | 1,318  |
| Co (ppb)           | 0.4               | 0.8    | 1.3    | 0.7    | 0.2    | 0.4    | 1.4    | 0.7                  | 0.2    | 0.2    |
| Cr (ppb)           | 1.1               | 1.5    | 2.2    | 1.4    | 1.2    | 1.1    | 3.5    | 2.1                  | 1.1    | 1.1    |
| Cu (ppb)           | 104               | 151    | 257    | 144    | 65     | 119    | 267    | 166                  | 52     | 59     |
| Fe (ppb)           | 1,510             | 2,476  | 4,254  | 2,258  | 912    | 1,471  | 4,563  | 3,450                | 711    | 820    |
| K (ppb)            | 3,363             | 3,391  | 3,370  | 3,352  | 3,344  | 3,311  | 3,360  | 3,308                | 3,356  | 3,311  |
| Mg (ppb)           | 9,769             | 9,960  | 12,360 | 9,703  | 9,331  | 9,513  | 16,430 | 10,820               | 9,237  | 9,166  |
| Mn (ppb)           | 498               | 1,185  | 1,878  | 1,052  | 231    | 536    | 1,947  | 967                  | 167    | 220    |
| Mo (ppb)           | 1.8               | 1.8    | 1.8    | 1.9    | 1.8    | 1.8    | 2.2    | 2                    | 1.7    | 1.7    |
| Na (ppb)           | 17,240            | 17,370 | 17,370 | 17,310 | 17,190 | 17,010 | 17,320 | 17,020               | 17,140 | 16,950 |
| Ni (ppb)           | 4.1               | 7.7    | 16.2   | 6.8    | 2.7    | 3.8    | 33     | 7.7                  | 2.1    | 2.4    |
| P (ppb)            | 321               | 690    | 1,233  | 595    | 178    | 332    | 1,697  | 573                  | 144    | 163    |
| Pb (ppb)           | 688               | 1,791  | 3,655  | 1,549  | 366    | 616    | 6,048  | 1,631                | 237    | 292    |
| S (ppm)            | 27.6              | 27.5   | 27.3   | 27.3   | 27.1   | 26.9   | 27     | 26.4                 | 27     | 26.6   |
| Se (ppb)           | 0                 | 0      | 0.2    | 0.1    | 0.1    | 0.2    | 0.2    | 0.3                  | 0.1    | 0      |
| Si (ppb)           | 2,892             | 3,591  | 6,180  | 3,307  | 2,445  | 2,756  | 11,280 | 4,184                | 2,274  | 2,303  |
| Sn (ppb)           | 2.2               | 2.6    | 4.4    | 2.5    | 1.4    | 1.8    | 4.9    | 3                    | 1      | 1.1    |
| Sr (ppb)           | 124               | 128    | 128    | 126    | 124    | 124    | 128    | 126                  | 125    | 124    |
| Ti (ppb)           | 1.6               | 2.9    | 5.5    | 2.5    | 1      | 1.2    | 7.7    | 2.7                  | 0.4    | 0.6    |
| U (ppb)            | 0.5               | 0.9    | 1.7    | 0.9    | 0.4    | 0.5    | 2.7    | 0.9                  | 0.3    | 0.3    |
| V (ppb)            | 8.4               | 11.9   | 17.5   | 10.4   | 8.2    | 8.4    | 25.1   | 9.7                  | 6      | 7.4    |
| Zn (ppb)           | 657               | 933    | 1,669  | 836    | 366    | 592    | 1,934  | 1,304                | 305    | 337    |

| Element<br>(units) | High Flow         |        |        |        |        |        |                      |        |        |        |        |        |
|--------------------|-------------------|--------|--------|--------|--------|--------|----------------------|--------|--------|--------|--------|--------|
|                    | 1 L Sample Bottle |        |        |        |        |        | 125 mL Sample Bottle |        |        |        |        |        |
|                    | M-15              | M-16   | M-17   | M-18   | M-19   | M-20   | M-27                 | M-28   | M-29   | M-30   | M-31   | M-32   |
| Ag (ppb)           | 0                 | 0      | 0      | 0      | 0      | 0      | 0                    | 0      | 0      | 0      | 0      | 0      |
| Al (ppb)           | 7,984             | 5,713  | 3,714  | 912    | 1,354  | 19,440 | 1,893                | 248    | 455    | 822    | 1,859  | 2,176  |
| As (ppb)           | 5                 | 4.1    | 4.3    | 1.9    | 2.1    | 7.4    | 2.9                  | 2      | 2.2    | 2.3    | 3.2    | 3.4    |
| Ba (ppb)           | 40                | 37     | 45     | 21     | 22     | 41     | 32                   | 19     | 20     | 22     | 31     | 34     |
| Ca (ppb)           | 42,200            | 41,870 | 41,760 | 41,120 | 41,110 | 43,860 | 41,410               | 40,730 | 40,990 | 40,550 | 41,000 | 41,050 |
| Cd (ppb)           | 5.6               | 4.1    | 3.7    | 1.4    | 1.9    | 9.3    | 2.2                  | 0.9    | 1.2    | 1.6    | 2.1    | 2.5    |
| Cl (ppm)           | 1,347             | 1,261  | 1,088  | 1,150  | 1,138  | 1,285  | 891                  | 1,261  | 1,309  | 1,215  | 1,121  | 1,226  |
| Co (ppb)           | 1.6               | 1.4    | 1.7    | 0.4    | 0.4    | 1.9    | 0.9                  | 0.2    | 0.3    | 0.4    | 0.9    | 1      |
| Cr (ppb)           | 2.8               | 2.4    | 2.6    | 1.3    | 1.3    | 4.8    | 1.7                  | 1.1    | 1.5    | 1.5    | 1.6    | 1.8    |
| Cu (ppb)           | 541               | 24     | 276    | 89     | 105    | 351    | 165                  | 52     | 70     | 96     | 167    | 192    |
| Fe (ppb)           | 4,926             | 4,288  | 5,323  | 1,509  | 1,705  | 6,491  | 3,074                | 667    | 1,215  | 1,591  | 3,026  | 3,349  |
| K (ppb)            | 3,363             | 3,350  | 3,343  | 3,327  | 3,305  | 3,410  | 3,361                | 3,320  | 3,348  | 3,287  | 3,333  | 3,331  |
| Mg (ppb)           | 15,910            | 13,430 | 9,758  | 9,633  | 10,240 | 29,890 | 9,110                | 9,158  | 9,305  | 9,462  | 9,051  | 9,157  |
| Mn (ppb)           | 2,067             | 2,058  | 2,818  | 498    | 503    | 1,975  | 1,401                | 149    | 301    | 534    | 1,369  | 1,638  |
| Mo (ppb)           | 2                 | 2      | 2      | 1.9    | 1.9    | 2.2    | 1.8                  | 1.8    | 1.8    | 1.8    | 1.8    | 1.8    |
| Na (ppb)           | 17,340            | 17,310 | 17,280 | 17,110 | 16,980 | 17,540 | 17,370               | 17,040 | 17,210 | 16,840 | 17,250 | 17,230 |
| Ni (ppb)           | 30.6              | 21.7   | 11.8   | 4.6    | 5.8    | 80     | 7.5                  | 3      | 2.8    | 3.9    | 6.3    | 7.2    |
| P (ppb)            | 1,758             | 1,378  | 1,336  | 308    | 378    | 3,224  | 771                  | 134    | 199    | 299    | 756    | 847    |
| Pb (ppb)           | 5,702             | 4,781  | 3,585  | 755    | 1,055  | 13,200 | 1,752                | 217    | 384    | 715    | 1,742  | 1,962  |
| S (ppm)            | 27.2              | 26.9   | 26.8   | 26.7   | 26.6   | 27.1   | 27                   | 26.6   | 26.9   | 26.2   | 26.8   | 26.4   |
| Se (ppb)           | 0.2               | 0.2    | 0.2    | 0      | 0      | 0.1    | 0                    | 0.2    | 0.1    | 0.2    | 0.1    | 0.1    |
| Si (ppb)           | 10,530            | 7,660  | 3,636  | 2,830  | 3,573  | 26,740 | 2,680                | 2,258  | 2,422  | 2,687  | 2,661  | 2,826  |
| Sn (ppb)           | 5.6               | 4.2    | 3.8    | 1.8    | 2      | 8.9    | 2.2                  | 1      | 1.3    | 1.6    | 2.2    | 2.5    |
| Sr (ppb)           | 129               | 128    | 129    | 125    | 125    | 131    | 128                  | 125    | 125    | 125    | 127    | 127    |
| Ti (ppb)           | 8.2               | 6.1    | 6.2    | 1.1    | 2.2    | 16.9   | 3.7                  | 0.5    | 0.8    | 1.3    | 3      | 3.1    |
| U (ppb)            | 2.7               | 2      | 1.6    | 0.5    | 0.6    | 5.6    | 0.9                  | 0.3    | 0.4    | 0.5    | 0.9    | 1      |
| V (ppb)            | 24.3              | 19.8   | 16.3   | 6.8    | 8.3    | 51.3   | 10.2                 | 6.5    | 7.8    | 8      | 10.9   | 11.7   |
| Zn (ppb)           | 2,520             | 1,622  | 1,305  | 593    | 796    | 3,652  | 752                  | 293    | 395    | 603    | 739    | 856    |

### Correlation between lead, phosphorus and aluminum

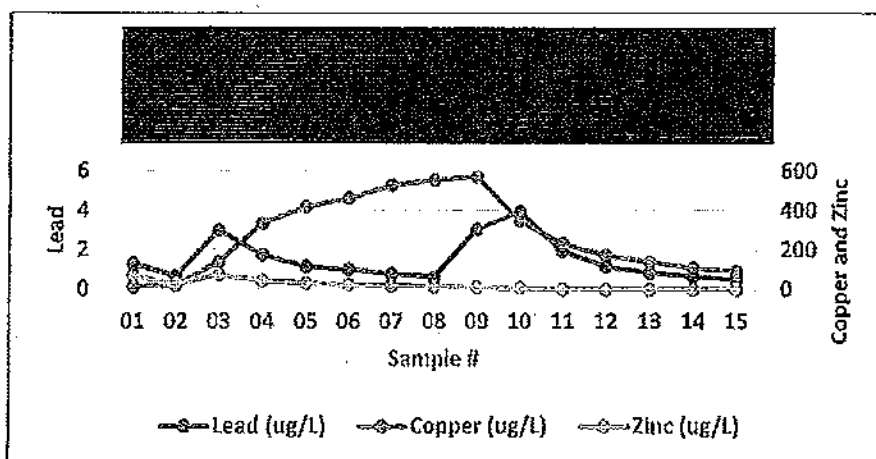
The correlation of lead and phosphate, as well as lead and aluminum, indicate that the samples were captured scale and sediment that had formed inside the pipes while the City of Flint was purchasing water from Detroit. The absence of these chemicals in the current treatment provided by Flint indicate that these elements were not in the water passing through the pipes, but came from the scales inside the service line which had disintegrated into the water or were dislodged into the water.



### U.S. EPA Region 5 sampling

██████████ residence (following replacement of service line)

Following the replacement of the ██████████ original service line, a series of 15 sequential samples were collected from the kitchen tap to measure the lead levels and other parameters to ensure that the high lead from the original service line had not contaminated the interior plumbing at the ██████████ home. With the exception of two areas, lead levels were low throughout the ██████████ plumbing following the service line replacement. The two sources of lead that were still detected in the plumbing are likely the water meter (Sample 3) and the new external service shut-off valve (Samples 9-11). Although new brass plumbing components must be lead-free, there can still be some lead that is released from these components.



██████████ (██████████ home)

#### After Service Line Replacement

| Sample # | Site Description | Copper (ug/L) | Lead (ug/L) | Zinc (ug/L) | Cadmium (ng/L) | Iron (mg/L) | Phosphorus (mg/L) |
|----------|------------------|---------------|-------------|-------------|----------------|-------------|-------------------|
| 01       | Kitchen          | 13.1          | 1.3         | 70.9        | U              | 0.171       | U                 |
| 02       | Kitchen          | 20.1          | 0.687       | 23.2        | U              | 0.117       | U                 |
| 03       | Kitchen          | 141           | 3.01        | 76.8        | U              | 0.144       | U                 |
| 04       | Kitchen          | 336           | 1.76        | 45.4        | U              | 0.151       | U                 |
| 05       | Kitchen          | 419           | 1.17        | 32.2        | U              | 0.149       | U                 |
| 06       | Kitchen          | 463           | 1.03        | 24.8        | U              | 0.149       | U                 |
| 07       | Kitchen          | 529           | 0.8         | 19.6        | U              | 0.146       | U                 |
| 08       | Kitchen          | 554           | 0.666       | 14.9        | U              | 0.147       | U                 |
| 09       | Kitchen          | 571           | 3.07        | 11.6        | U              | 0.195       | U                 |
| 10       | Kitchen          | 345           | 3.93        | 10.3        | U              | 0.282       | U                 |
| 11       | Kitchen          | 233           | 1.94        | 0           | U              | 0.283       | U                 |

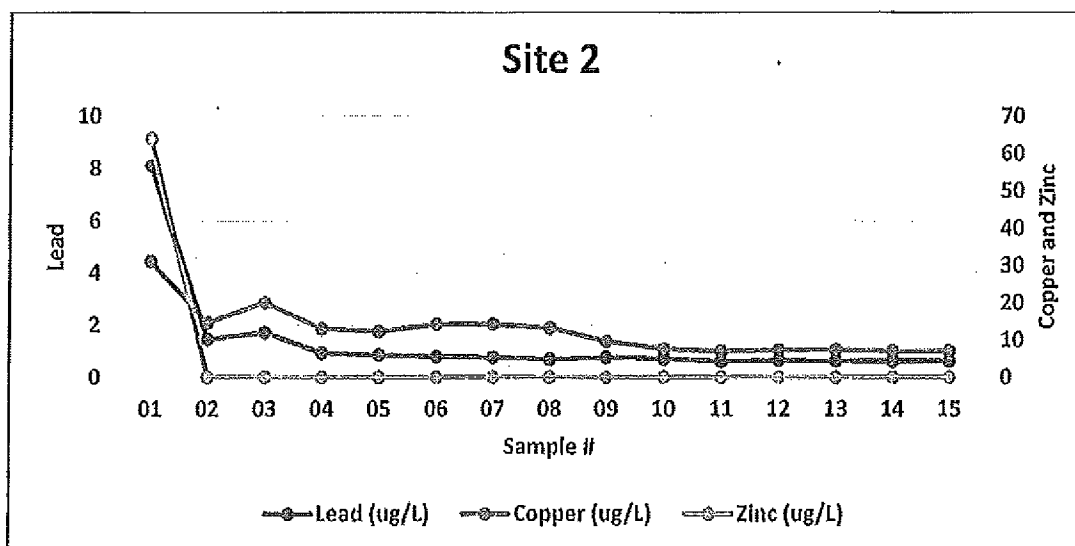
██████████ (██████████ home)

### After Service Line Replacement

| Sample # | Site Description | Copper (ug/L) | Lead (ug/L) | Zinc (ug/L) | Cadmium (mg/L) | Iron (mg/L) | Phosphorus (mg/L) |
|----------|------------------|---------------|-------------|-------------|----------------|-------------|-------------------|
| 12       | Kitchen          | 171           | 1.17        | 0           | U              | 0.290       | U                 |
| 13       | Kitchen          | 139           | 0.864       | 0           | U              | 0.292       | U                 |
| 14       | Kitchen          | 110           | 0.67        | 0           | U              | 0.294       | U                 |
| 15       | Kitchen          | 91.5          | 0.505       | 0           | U              | 0.297       | U                 |
| 16       | Bathroom         | 29.7          | 5.52        | 71.3        | U              | 0.259       | U                 |
| 17       | Water Heater     | 70.4          | 31.7        | 883         | U              | 0.540       | 0.0877            |
| 18       | Water Heater     | 35            | 9.74        | 346         | U              | 0.0870      | U                 |

### Site #2 (Bryant Street)

Based on the results found at this home, it does not appear that any portion of the service line is made of lead, and as a result, the lead levels are low in most samples. The exception is in Sample 1 which reflects water within approximately 15 feet of the kitchen tap and is likely due to brass components in the faucet, underlying valves and fixtures.



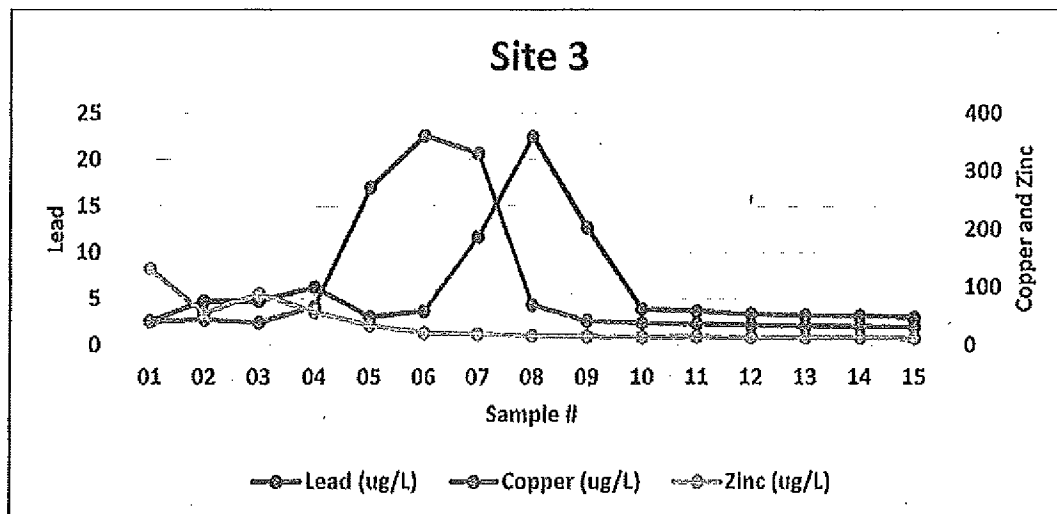
## Site 2

(Note: U for Zinc replaced with 0 to show on graph)

| Sample # | Copper (ug/L) | Lead (ug/L) | Zinc (ug/L) | Cadmium (mg/L) | Iron (mg/L) | Phosphorus (mg/L) |
|----------|---------------|-------------|-------------|----------------|-------------|-------------------|
| 01       | 31.1          | 8.11        | 64          | U              | 0.0307      | U                 |
| 02       | 14.7          | 1.46        | U           | U              | 0.0302      | U                 |
| 03       | 20            | 1.72        | U           | U              | 0.0302      | U                 |
| 04       | 13            | 0.933       | U           | U              | 0.0301      | U                 |
| 05       | 12.3          | 0.862       | U           | U              | 0.0311      | U                 |
| 06       | 14.2          | 0.795       | U           | U              | 0.0298      | U                 |
| 07       | 14.2          | 0.769       | U           | U              | 0.0311      | U                 |
| 08       | 13.3          | 0.691       | U           | U              | 0.0317      | U                 |
| 09       | 9.6           | 0.774       | U           | U              | 0.0319      | U                 |
| 10       | 7.57          | 0.715       | U           | U              | 0.0313      | U                 |
| 11       | 7.04          | 0.611       | U           | U              | 0.0301      | U                 |
| 12       | 7.3           | 0.655       | U           | U              | 0.0336      | U                 |
| 13       | 7.37          | 0.644       | U           | U              | 0.0308      | U                 |
| 14       | 7.09          | 0.631       | U           | U              | 0.0313      | U                 |
| 15       | 7.05          | 0.621       | U           | U              | 0.0300      | U                 |

## Site #3 (Bryant Street)

Based on the results found at this home, it appears that the portion of the service line from the external service shut-off valve to the water main is made of lead as indicated by the increase in lead levels in samples 7 through 9.



### Site 3

| Sample # | Copper<br>(ug/L) | Lead<br>(ug/L) | Zinc<br>(ug/L) | Cadmium<br>(mg/L) | Iron<br>(mg/L) | Phosphorus<br>(mg/L) |
|----------|------------------|----------------|----------------|-------------------|----------------|----------------------|
| 01       | 40.7             | 2.63           | 132            | U                 | 0.0622         | U                    |
| 02       | 44.4             | 4.77           | 55.3           | U                 | 0.249          | U                    |
| 03       | 39.3             | 4.79           | 88.8           | U                 | 0.179          | U                    |
| 04       | 66.8             | 6.26           | 57.2           | U                 | 0.346          | U                    |
| 05       | 272              | 3.07           | 34.2           | U                 | 0.105          | U                    |
| 06       | 362              | 3.7            | 21.4           | U                 | 0.0598         | U                    |
| 07       | 331              | 11.7           | 19.5           | U                 | 0.0512         | U                    |
| 08       | 69.9             | 22.5           | 16.6           | U                 | 0.0399         | U                    |
| 09       | 42.5             | 12.7           | 15.1           | U                 | 0.0480         | U                    |
| 10       | 38.4             | 3.94           | 14.4           | U                 | 0.0489         | U                    |
| 11       | 37.5             | 3.72           | 14.5           | U                 | 0.0492         | U                    |
| 12       | 34.8             | 3.39           | 13.6           | U                 | 0.0481         | U                    |
| 13       | 33.1             | 3.23           | 13.1           | U                 | 0.0484         | U                    |
| 14       | 32.8             | 3.2            | 13             | U                 | 0.0480         | U                    |
| 15       | 31.4             | 3              | 12.3           | U                 | 0.0490         | U                    |

#### Analysis of [REDACTED] original service line pipe (galvanized iron portions)

Lead can also be found in galvanized pipe coatings as a contaminant in the zinc that is used to coat the surface of iron pipe in the galvanizing process. As such, two sections of the [REDACTED] original service line were analyzed for lead content.

The images and data presented below are for a typical range of galvanized iron pipe.

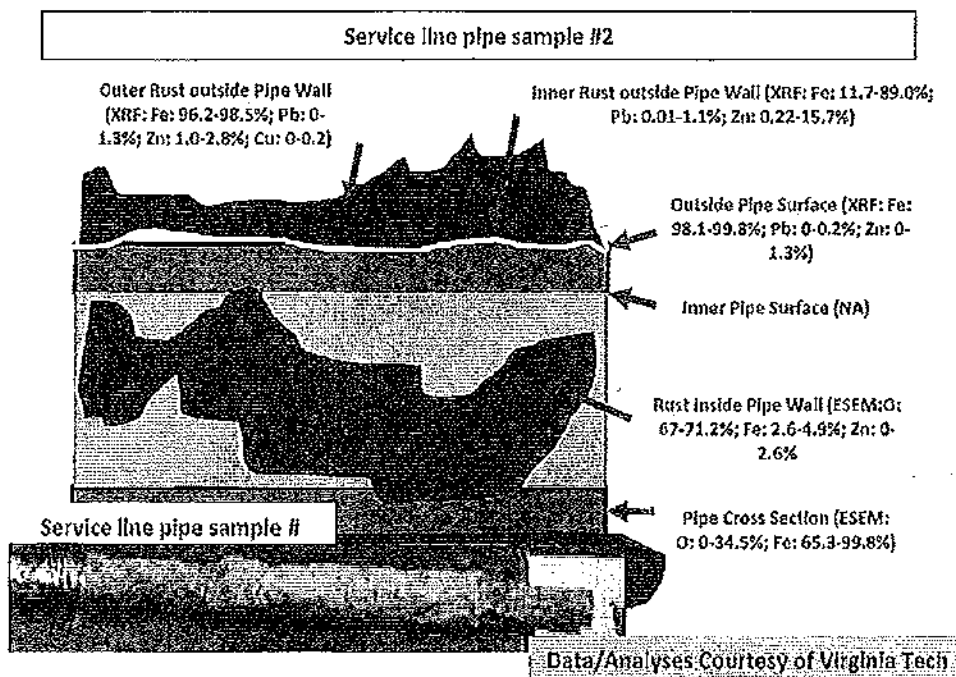
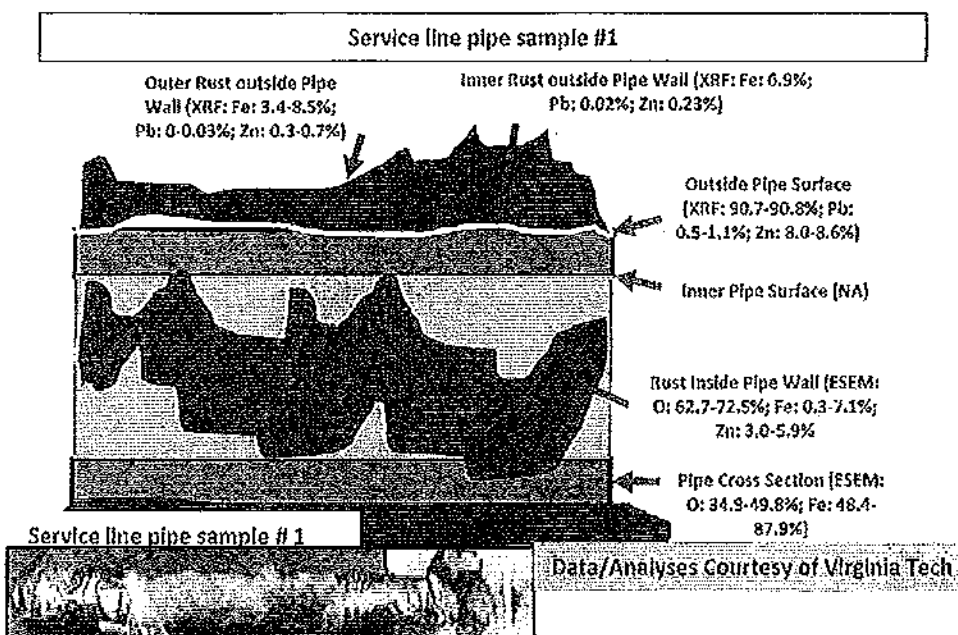
#### Lead Content of Galvanized Iron Pipe - Examples

| China                                                                               | Turkey                                                                              | US                                                                                  | No ID                                                                                |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |  |  |
| Inside: Fe: 16.8-94.3%, Zn: 0.1-83.7%, Pb: 0-0.7%                                   | Inside: Fe: 13.1-26.8%, Zn: 71.3-85.9%, Pb: 0.4-0.9%                                | Inside: Fe: 0.9-37.4%, Zn: 61.3-96.8%, Pb: ND                                       | Inside: Fe: 3.9-69.1%, Zn: 29.3-93.1%, Pb: 0-1.3%                                    |
|  |  |  |  |
| Outside: Fe: 4.6-12.6%, Zn: 81.5-94.1%, Pb: 1.0-1.1%                                | Outside: Fe: 37.6-57.1%, Zn: 41.6-60.1%, Pb: 0.8-1.0%                               | Outside: Fe: 1.8-14.9%, Zn: 19-98.1%, Pb: ND                                        | Outside: Fe: 7.2-13.0%, Zn: 86.2-91.7%, Pb: 0.5-0.8%                                 |

Data/Analyses Courtesy of Virginia Tech

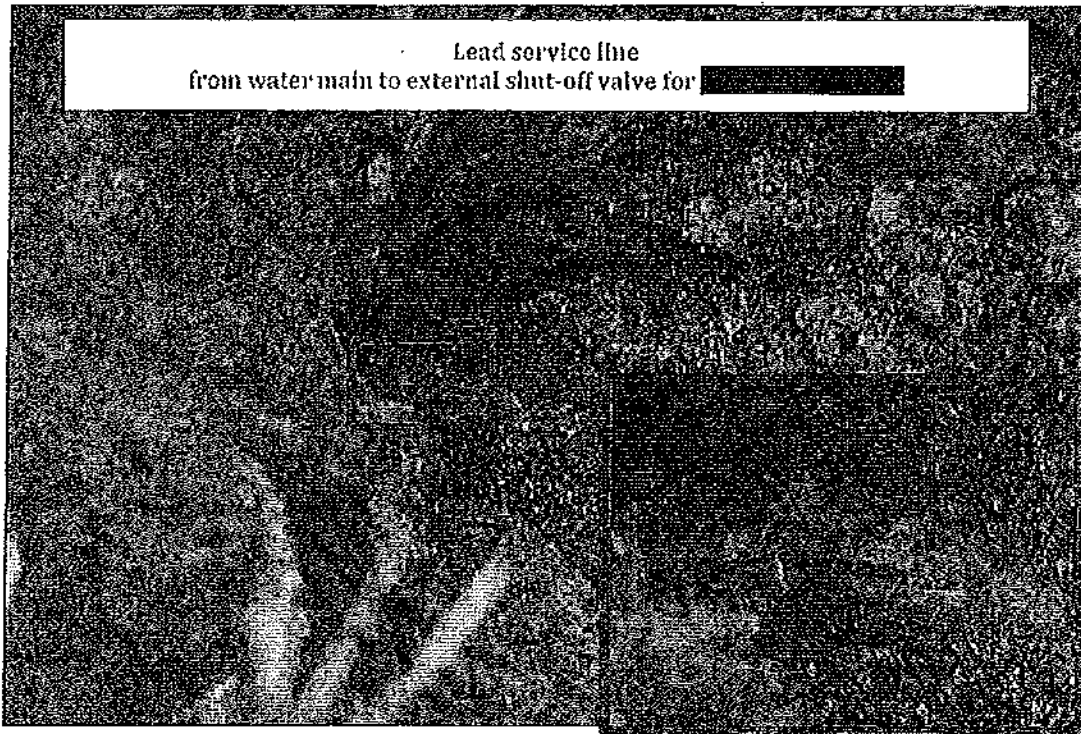
Final Report, October 21, 2015

Below are the results of the galvanized pipe analyses conducted by Virginia Tech on the two sections of galvanized iron pipe from the [REDACTED] original service line. The analyses indicate that the [REDACTED] original service line was a typical galvanized iron pipe.



### Lead portion of the [REDACTED] original service line

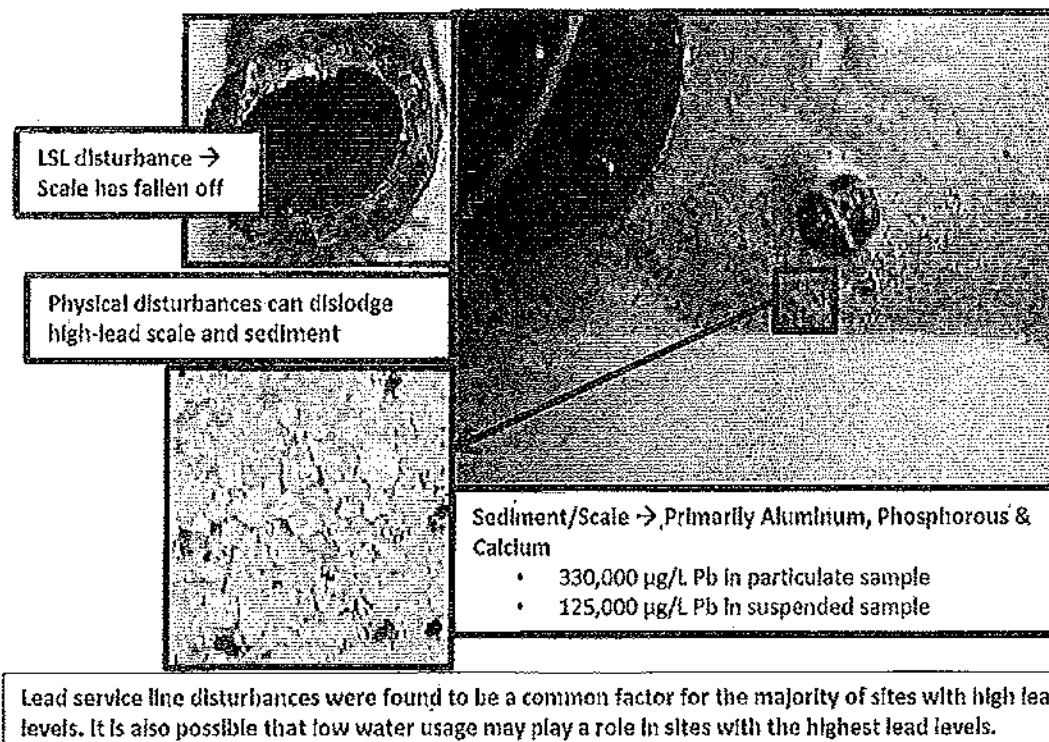
Lead service lines can contribute up to 75 percent of the total mass release into the water. The portion of the [REDACTED] original service line from the water main to the external shut-off valve at the corner of [REDACTED] and Bryant Street is made of lead and is estimated to be approximately 25 feet in length.



## Appendix C – Additional Information

### Physical disturbance of lead service lines

A recent EPA study indicates that physical disturbances to lead service lines or in proximity to lead service lines can cause the dislodging of the protective scales from within the lines. The photograph below shows the scale that was dislodged from inside a lead service line during routine maintenance work in another city due to a physical disturbance of the line. The dislodged scale and sediment contained a very high concentration of lead.



Lead service line scale analyses conducted by EPA's Office of Research and Development or obtained from peer-reviewed published literature from cities across the U.S. and in Canada (summarized below) show that scales within lead service lines can contain very high concentrations of lead. The yellow highlighted column in the table below shows the percentage of lead that has been found within different scales inside of lead service lines.

| Lead & Element Percentages in Important Corrosion Byproduct Solids |                                                                      |       |      |       |       |      |      |
|--------------------------------------------------------------------|----------------------------------------------------------------------|-------|------|-------|-------|------|------|
| Mineral Name                                                       | Formula                                                              | % Pb  | % C  | % O   | % S   | % P  | % Cl |
| litharge, massicot                                                 | PbO                                                                  | 97.80 | 0.00 | 7.20  | 0.00  | 0.00 |      |
| plattnerite, cerussite                                             | PbO <sub>2</sub>                                                     | 86.60 | 0.00 | 13.40 | 0.00  | 0.00 |      |
| Cerussite                                                          | PbCO <sub>3</sub>                                                    | 77.50 | 4.50 | 18.00 | 0.00  | 0.00 |      |
| Hydrocerussite                                                     | Pb <sub>3</sub> (CO <sub>3</sub> ) <sub>2</sub> (OH) <sub>2</sub>    | 80.10 | 3.10 | 16.50 | 0.00  | 0.00 | 0.00 |
| Plumbonacrite                                                      | Pb <sub>10</sub> (CO <sub>3</sub> ) <sub>8</sub> (OH) <sub>6</sub> O | 81.30 | 2.80 | 15.70 | 0.00  | 0.00 | 0.00 |
| Anglesite                                                          | PbSO <sub>4</sub>                                                    | 68.30 | 0.00 | 21.10 | 10.60 | 0.00 | 0.00 |

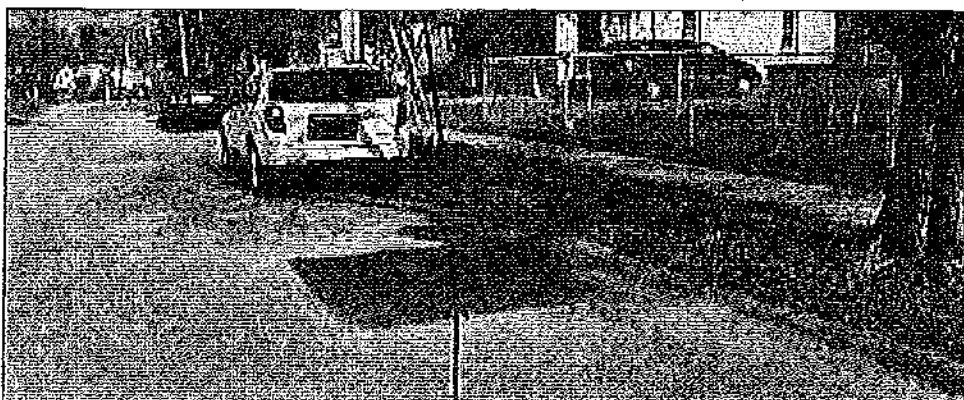
| Lead & Element Percentages in Important Corrosion Byproduct Solids |                            |       |      |       |      |      |      |
|--------------------------------------------------------------------|----------------------------|-------|------|-------|------|------|------|
| Mineral Name                                                       | Formula                    | % Pb  | % C  | % O   | % S  | % P  | % Cl |
| Leadhillite, Sussanite, MacPhersonite                              | $Pb_4(SO_4)(CO_3)_3(OH)_2$ | 76.80 | 2.20 | 17.80 | 3.00 | 0.00 | 0.00 |
| Hydroxypyromorphite                                                | $Pb_5(PO_4)_3OH$           | 77.43 | 0.00 | 15.55 | 0.00 | 6.95 | 0.00 |
| Chloropyromorphite                                                 | $Pb_5(PO_4)_3Cl$           | 76.38 | 0.00 | 14.15 | 0.00 | 6.85 | 2.61 |
| Tertiary Lead Orthophosphate                                       | $Pb_3(PO_4)_2$             | 76.60 | 0.00 | 15.80 | 0.00 | 7.60 | 0.00 |
| Lead(II) orthophosphate                                            | $Pb_2(PO_4)_2$             | 76.60 | 0.00 | 15.80 | 0.00 | 7.60 | 0.00 |

While visiting the [REDACTED] home, two fresh patches of asphalt were seen along the parkway where the [REDACTED] original service line was located. The jarring and vibration associated with excavation can dislodge the high lead-bearing scales from within the service line pipes.



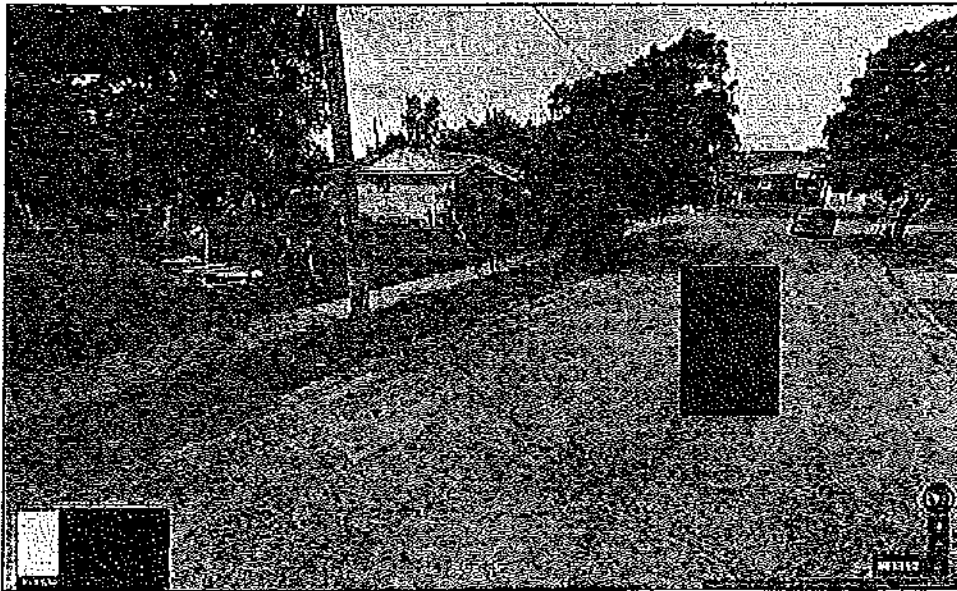
Recent patch (#1) of asphalt along curb next to the parkway where the [REDACTED] service line runs.

Photograph taken by U.S. EPA on April 27, 2015



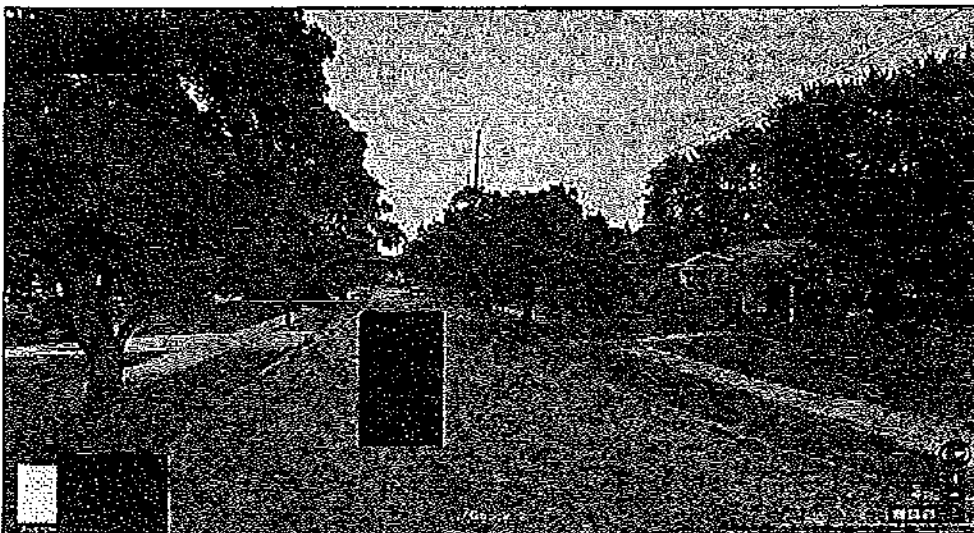
Recent patch (#2) of asphalt along curb next to the parkway where the [REDACTED] service line runs.

Photograph taken by U.S. EPA on April 27, 2015



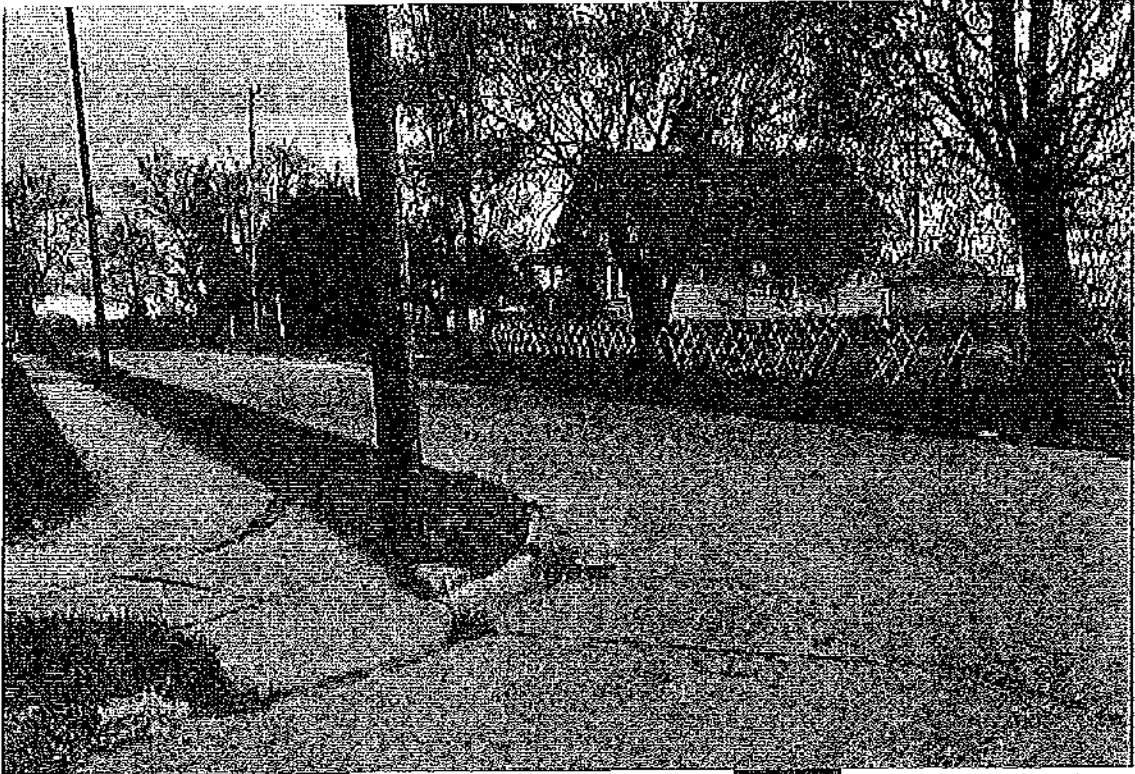
July 2011 image [REDACTED] (view from [REDACTED] toward Bryant Street).

Google 'Street View' Image 1 captured in July 2011 shows no patches in street along curb next to the parkway where the [REDACTED] service line runs toward Bryant Street, indicating that the physical disturbances occurred after the date this image was captured (July 2011).



July 2011 image of [REDACTED] (view from Bryant Street toward [REDACTED]).

Google 'Street View' Image 2 captured in July 2011 shows no patches in street along curb next to the parkway where the [REDACTED] service line runs toward Bryant Street, indicating that the physical disturbances occurred after the date this image was captured (July 2011).



Corner of [REDACTED] and Bryant Street (location of [REDACTED] original external shut-off valve).

Photograph taken by EPA on April 27, 2015 shows no visible signs of physical disturbances in the vicinity of the lead portion of the [REDACTED] service line from the external shut-off valve to the water main on Bryant Street.

## FOIA REQUESTS RELATING TO THE FLINT WATER ISSUE

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Flint FOIAs - prepared 12/13/2015

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| FOIA #         | Date      | First Name | Last Name | Company                                       | Description                                                                                                                                                                                                                              | Completed        |
|----------------|-----------|------------|-----------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <u>15-5521</u> | 7/22/2015 | Curt       | Guyette   | American Civil Liberties Union of Michigan    | Lead and copper tests in city of Flint, January 2015 thru June 2015, all communications                                                                                                                                                  | 8/11/2015        |
| <u>15-6034</u> | 8/18/2015 | Curt       | Guyette   | American Civil Liberties Union of Michigan    | Water sample tests for lead and copper, City of Flint water samples between January 1, 2015 and June 30, 2015 (DUPLICATE of 15-6123)                                                                                                     | Refer to 15-6123 |
| <u>15-6123</u> | 8/18/2015 | Curt       | Guyette   | American Civil Liberties Union of Michigan    | Lead and copper tests in city of Flint, January 2015 thru June 2015, all communications, procedures for handling and testing water samples                                                                                               | 8/28/2015        |
| <u>15-6360</u> | 9/2/2015  | Marc       | Edwards   | Virginia Tech                                 | MDEQ statement to a reporter with a Flint newspaper regarding lead poisoning of Flint children                                                                                                                                           | 9/22/2015        |
| <u>15-6422</u> | 9/4/2015  | Phil       | Phelps    |                                               | Any waivers, permits or applications to use the Flint River as a source for water and/or drinking water for the City of Flint, etc.                                                                                                      | 9/30/2015        |
| <u>15-6429</u> | 9/7/2015  | Marc       | Edwards   | Virginia Tech                                 | Flint lead in water: Original Flint LCR report which prompted a conference call with DEQ staff, that caused Flint to revise their report, all documents regarding conference call and rationale given for invalidating two samples, etc. | 9/14/2015        |
| <u>15-6525</u> | 9/7/2015  | Marc       | Edwards   | Virginia Tech                                 | Flint lead in water situation: EPA employee Miguel Del Toral, Virginia Tech research, MDEQ press statement, ACLU's work on Flint water                                                                                                   | 10/14/2015       |
| <u>15-6525</u> | 9/7/2015  | Marc       | Edwards   | Virginia Tech                                 | All documents discussing the need for corrosion control in Flint River water                                                                                                                                                             | 10/14/2015       |
| <u>15-6556</u> | 9/14/2015 | Marc       | Edwards   | Virginia Tech                                 | On July 9th, Mike Glasgow of Flint sent an e-mail saying he submitted more bottles, achieving 76 samples total for the LCR compliance. I would like to see the results of analyzing the 4-6 additional samples.                          | 9/16/2015        |
| <u>15-6675</u> | 9/18/2015 | Marc       | Edwards   | Virginia Tech                                 | LCR sampling protocol instructions used by Flint for past 25 years                                                                                                                                                                       | 9/25/2015        |
| <u>15-6797</u> | 9/25/2015 | Katrinell  | Davis     | University of Vermont Department of Sociology | Annual Reports on public water System violations, consumer confidence reports for City of Flint, drinking water complaints, etc.                                                                                                         | 10/29/2015       |
| <u>15-6857</u> | 9/29/2015 | Curt       | Guyette   | ACLU of Michigan                              | Any waivers, permits or applications to use the Flint River as a source for water and/or drinking water for the City of Flint, etc.                                                                                                      | PARTIAL          |

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| FOIA#   | Date       | First Name | Last Name   | Company                                 | Description                                                                                                                                                                        | Status                            |
|---------|------------|------------|-------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 15-6877 | 9/30/2015  | Hugh       | Madden      | Progress Michigan                       | Emails between DEQ and Office of the Governor regarding water service for the City of Flint, emails sent or received by Emergency Managers as well as city officials and employees | PARTIAL                           |
| 16-0045 | 10/5/2015  | Robin      | Erb         | Detroit Free Press                      | Test results and correspondence regarding the quality of the Flint City Water Supply                                                                                               |                                   |
| 16-0053 | 10/5/2015  | Ron        | Fonger      | MIlive Media Group                      | Correspondence regarding the quality of the Flint city water from January 2014 thru September 21, 2015                                                                             | Closed 12/8/15 due to no response |
| 16-0057 | 10/5/2015  | Ryan       | Felton      |                                         | All communications pertaining to the quarterly test results from December 2014 til January 2015 regarding Flint water                                                              | 11/5/2015                         |
| 16-0090 | 10/5/2015  | Nancy      | Kaffer      | Detroit Free Press                      | Correspondence regarding the quality of the Flint River as a permanent water supply for the City of Flint                                                                          | 11/5/2015                         |
| 16-0215 | 10/12/2015 | Valdemar   | Washington  | SETTLEmate, Inc.                        | Analysis of the Flint River as a Permanent Water Supply for the City of Flint, July 2011                                                                                           | 10/16/2015                        |
| 16-0317 | 10/15/2015 | Evan       | Feinauer    | Natural Resources Defense Council, Inc. | Records Concerning Administration of the Safe Drinking Water Act's Lead and Copper Rules                                                                                           |                                   |
| 16-0347 | 10/17/2015 | Marc       | Edwards     | Virginia Tech                           | Emails, documents, drafting documents, letters associated with Liane Shekter Smith and Ms. Lee-Anne Walters                                                                        | PARTIAL                           |
| 16-0367 | 10/20/2015 | Marc       | Edwards     | Virginia Tech                           | All communications between July 1, 2015 and present between Brad Wurfel and Sara Wurfel concerning Flint's drinking water                                                          | 11/20/2015                        |
| 16-0510 | 10/27/2015 | Yanna      | Lambrinidou | Parents for Nontoxic Alternatives       | Lead-in-water sampling protocols in use now or have been used to sample lead in drinking water of Flint schools between January 2014 and present                                   | 12/8/2015                         |
| 16-0609 | 10/23/2015 | John       | VanDeventer | Farough & Associates                    | Water testing standards and protocols for community water supply of Flint, etc.                                                                                                    |                                   |

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| FOIA#   | Date       | First Name | Last Name | Company                          | Description                                                                                                          | Status                 |
|---------|------------|------------|-----------|----------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------|
| 16-0731 | 11/5/2015  | Jim        | Henry     | Genesee County Health Department | Freeman Elementary School, Flint                                                                                     | Completed              |
| 16-0744 | 10/27/2015 | Hugh       | Madden    | Progress Michigan                | Communication from January 1, 2015 to present between Brad Wurfel and Sara Wurfel along with any attachments to same | Canceled<br>11/10/2015 |