

# City of Longview Distribution System Water Quality: Evaluation of Issues and Options



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# Presentation Overview

- **Overview of Transition / Events / Response**
- **Context of the Issue**
- **Study Approach**
- **Key Findings**
- **Preliminary Recommendations**
- **Potential Responses**
- **Customer Impacts / Reimbursements**
- **Bottled Water Options**
- **Public Outreach**



# Preparation for Transition

## ■ Temporary issues anticipated during transition

- ❑ Temporary release of scale dislodged by reversed flow
- ❑ Potential for leaks due to increased flow and pressure
- ❑ Potential release of lead, copper, and iron corrosion
- ❑ Mineral deposits due to moderate hardness

## ■ Preventive measures taken to facilitate transition

- ❑ Bi-directional flushing program implemented 2 years in advance
- ❑ Main most vulnerable to leaks was replaced (33<sup>rd</sup> Ave)
- ❑ Rapid transition plan to minimize mixing of dissimilar waters
- ❑ pH adjustment to match surface water chemistry
- ❑ Reservoirs cleaned to remove sediment
- ❑ Citizen sentinels used to provide real-time feedback



# Overview of Events

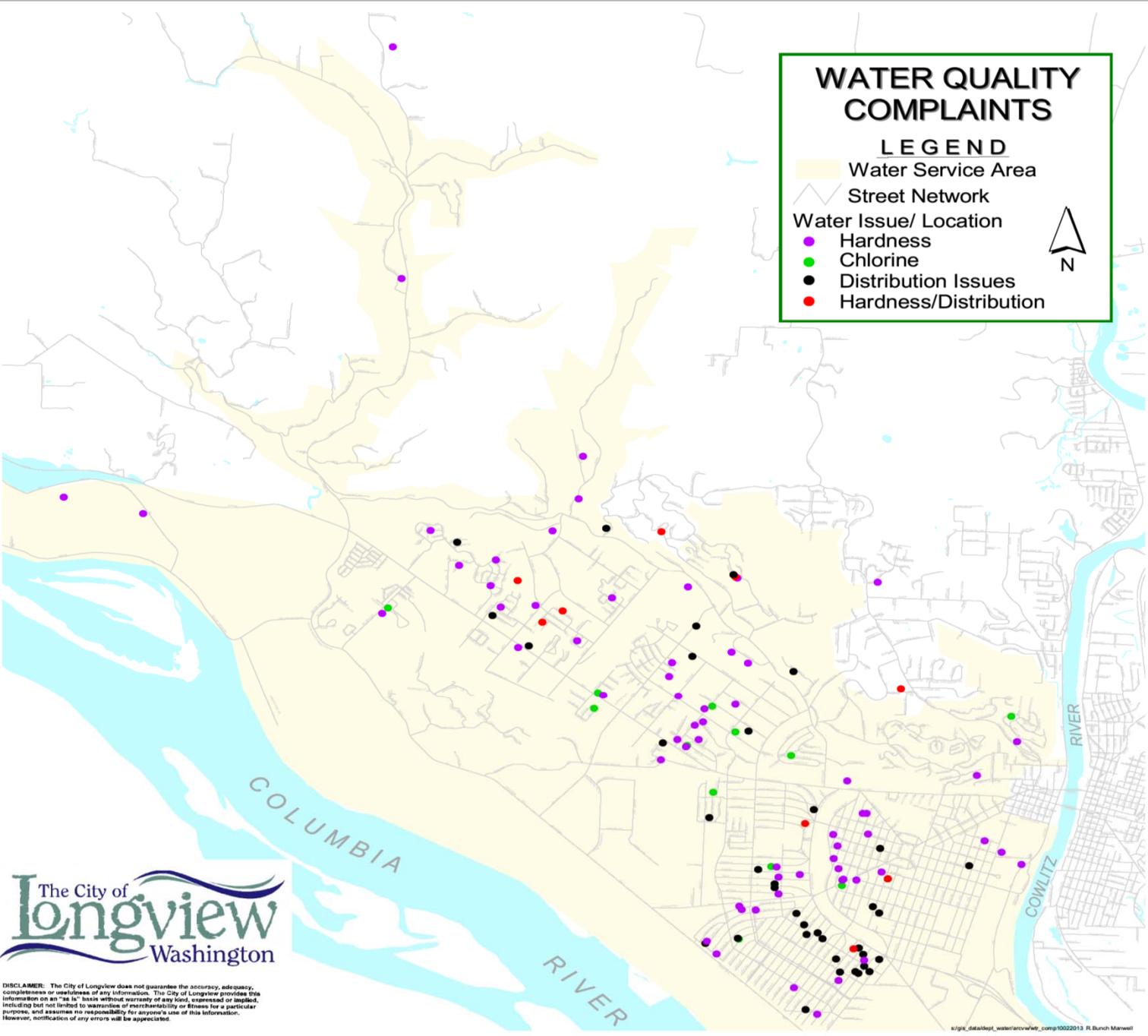
## ■ 235 complaints received since February-2013

- ❑ (100) Water quality complaints – localized areas
- ❑ (142) Hard water complaints – City wide
- ❑ (12) Chlorine complaints
- ❑ (1) Claim for damages

## ■ City response to water quality complaints

- ❑ Contact each customer to investigate
- ❑ Site visit to determine nature of complaint and test chlorine
- ❑ If needed, flush main or assist customer to flush household plumbing
- ❑ Due to increased complaint volume, now respond by mail, email or phone to distribute fact sheet based on type of complaint
  - Site visit if complaint differs from predominant complaint types





### WATER QUALITY COMPLAINTS

**LEGEND**

- Water Service Area
- Street Network
- Water Issue/ Location**
- Hardness
- Chlorine
- Distribution Issues
- Hardness/Distribution



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# Overview of Events

- **Increasing complaint volume indicated flushing program may not keep pace with water quality deterioration in distribution system**
- **July 2013 - Contracted with Confluence Engineering to evaluate water quality issues and softening alternatives**
- **July 2013 – Utility Service Group performed ice pigging in the most impacted area**

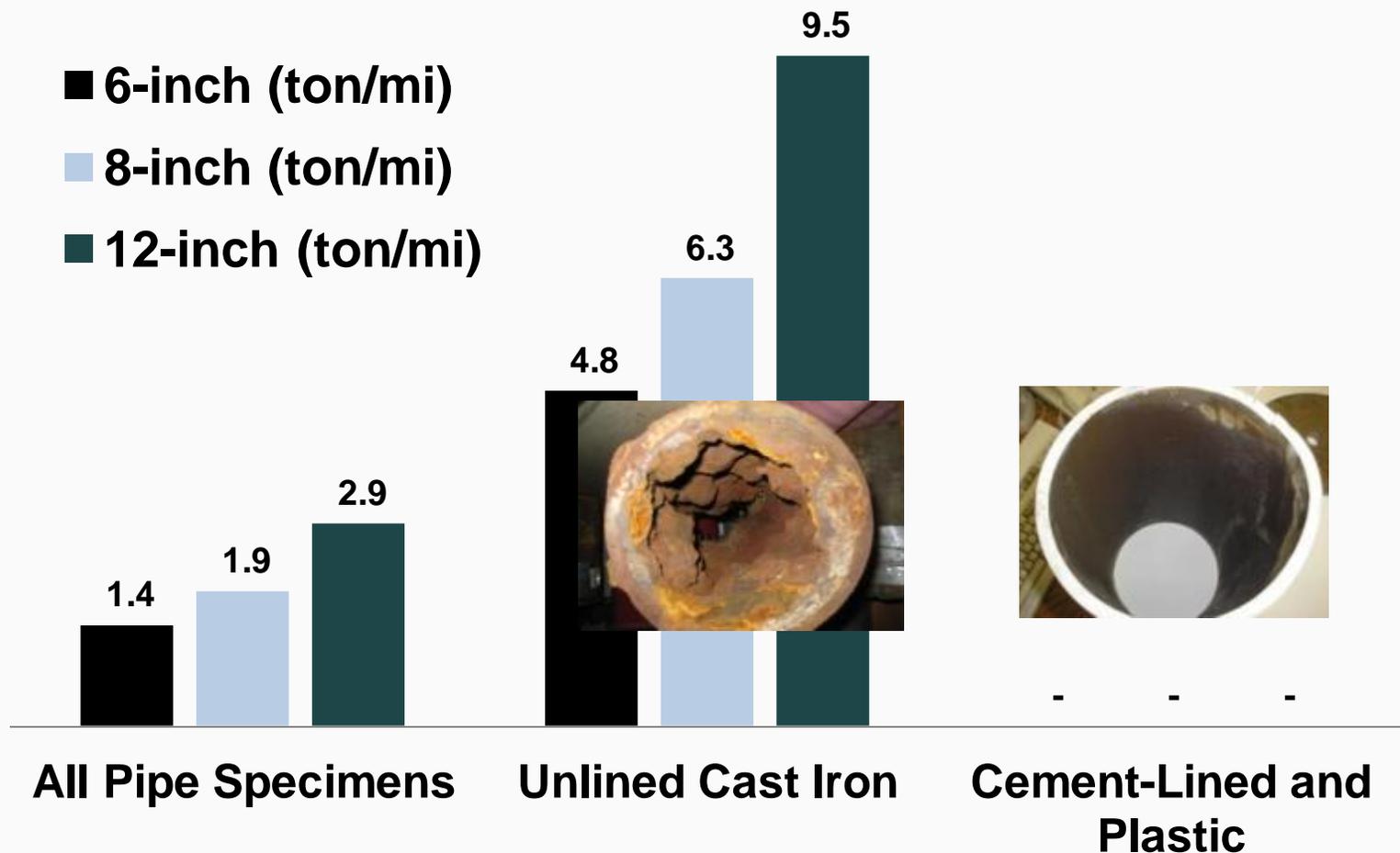


# Ice Pigging Trial



# Context of Issue – Distribution System Pipes Serve as Reservoirs for Accumulated Materials

**Median Solids Accumulation Rates  
(tons per mile)**

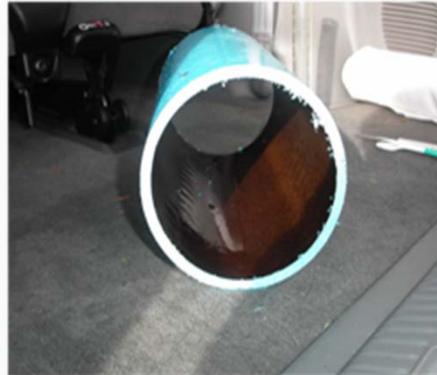


Source: Friedman and Hill et al., 2010, Water Research Foundation

# Different Pipe Materials Pose Different Challenges



**Unlined Cast Iron is  
"Scale Forming"**



**Cement Lined and Plastic  
are "Non-Scale Forming"**



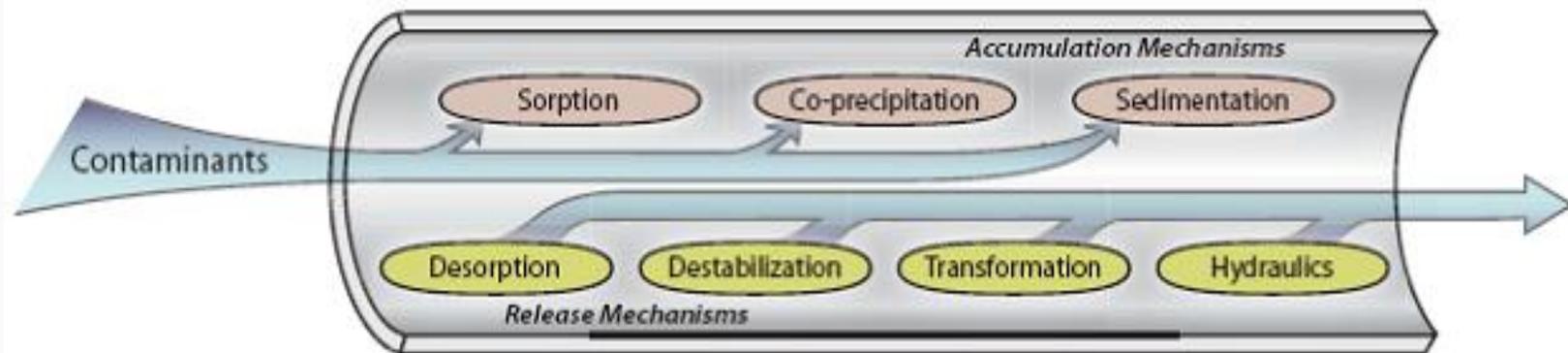
**Galvanized pipe and service  
lines "Scale Forming" once  
zinc coating is lost**

# Live Pipe Images



# Water Quality Impacts of Distribution System Pipes

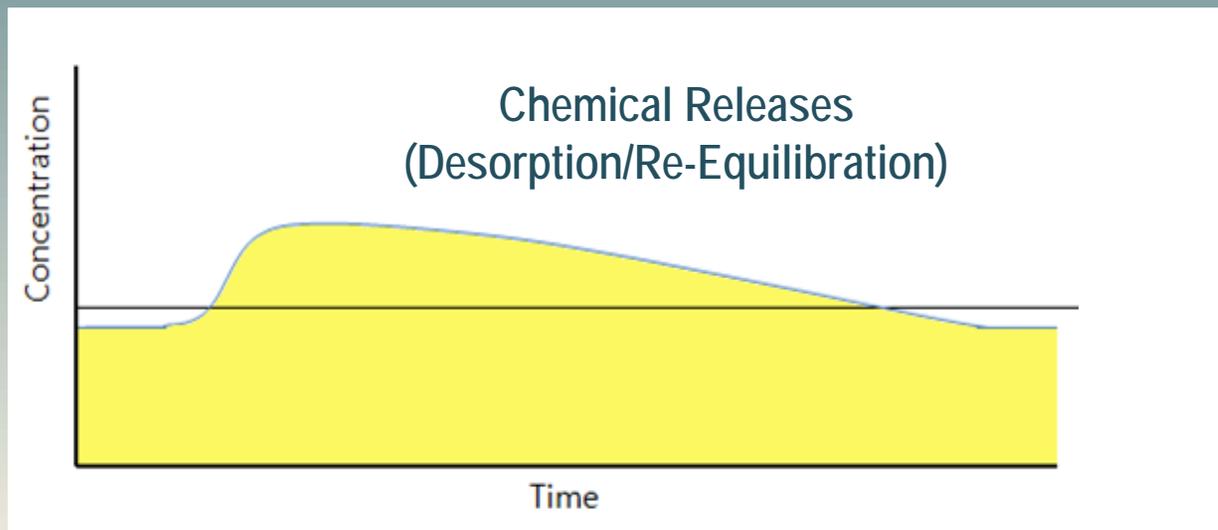
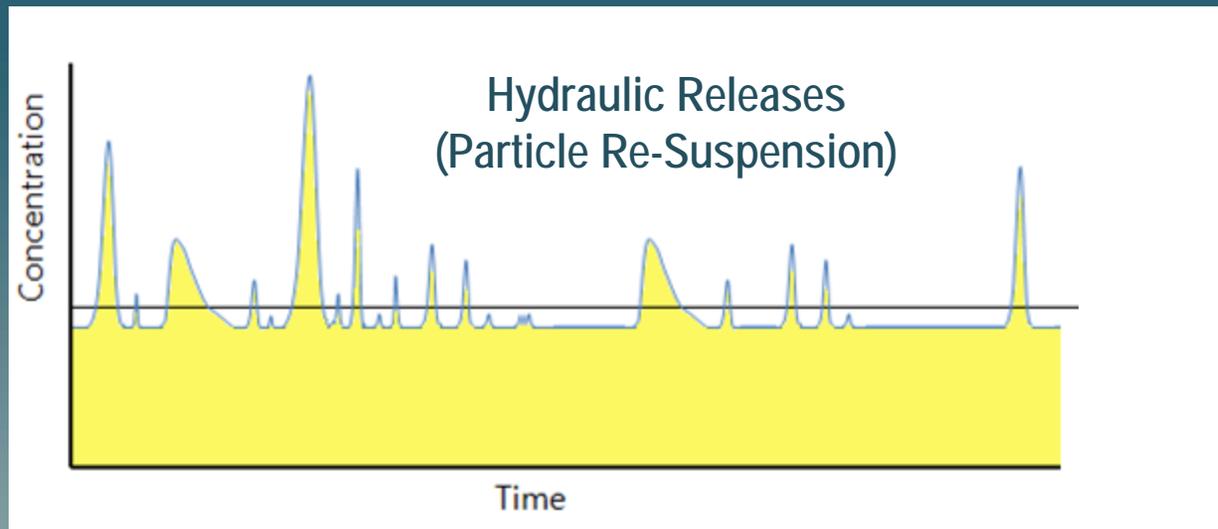
- Distribution system isn't just a conduit – it's a reactor
- Water quality and hydraulics are dynamic
- Non-conservative water quality behavior:  $in \neq out$



Source: Hill and Friedman et al., 2010 Journal AWWA



# Hydraulic vs. Chemical Release Profiles



# Discolored Water Events – Unsightly but not Uncommon Nationwide....



*Source: HDR Engineering*

- Fire flow events
- Distribution system flushing
- Distribution system reconfiguration
- Treatment changes
- Blending of different sources
- Etc...

# White Spotting

- **Increase in mineral content results in spotting after water evaporates**
- **Could be exacerbated by releases from pipe scales**
- **May or may not be dominated by Calcium Carbonate hardness**
- **In process of verifying controlling solids so that appropriate action can be taken**

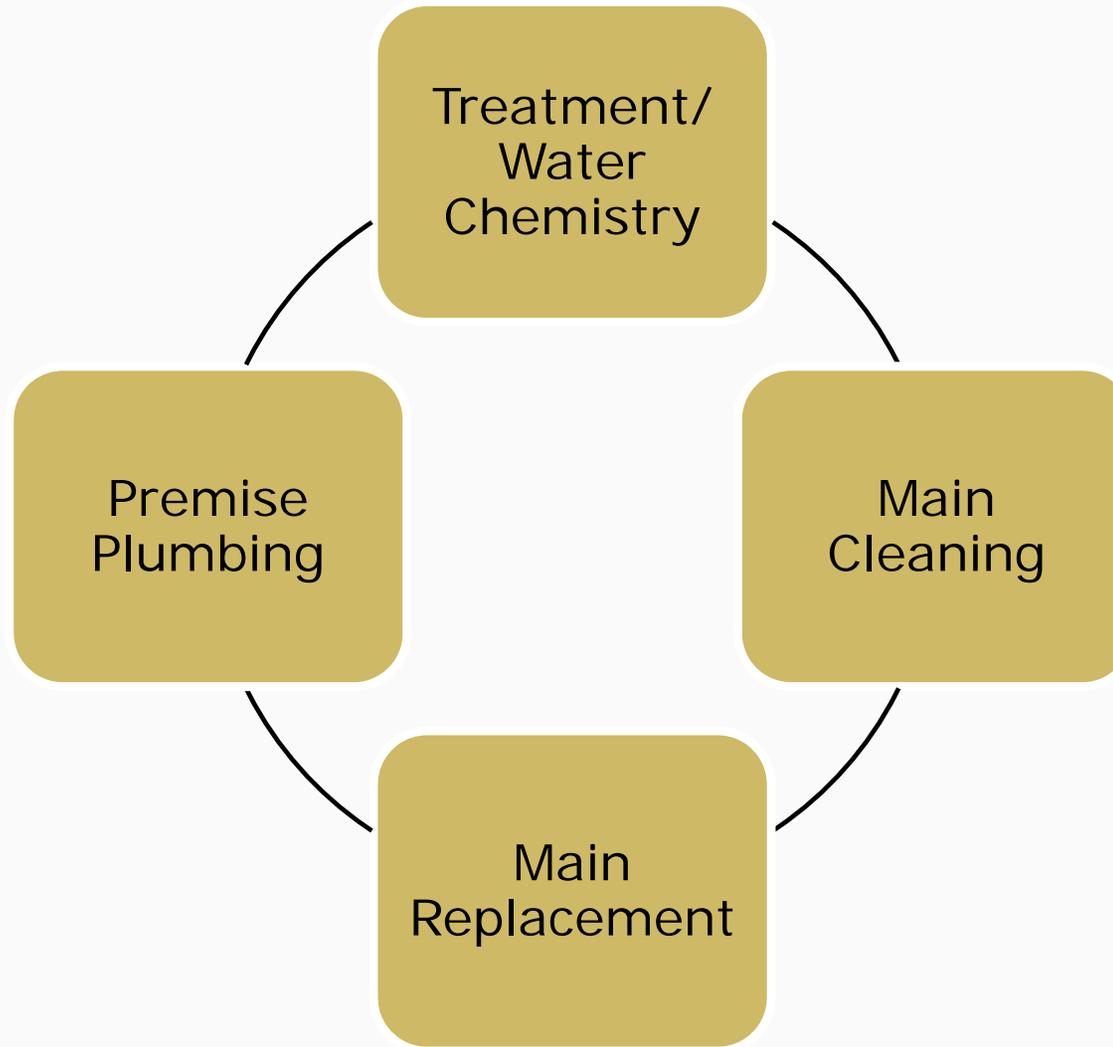


# These are complex phenomena...

- System is undergoing a “re-equilibration” process
- Need to understand the degree of chemical, physical, and microbial contribution to problems
- Cannot just start changing chemistry and/or operations without understanding controlling factors
- On-going protection of public health is the number one priority



# Multi-Pronged Study Approach



# Treatment/Water Chemistry



# Implemented Rigorous Monitoring Program

## ■ 23 Locations

- Geographic spread
- Representing known problem areas, interties, and control sites

## ■ 22 Parameters – Public Health and Aesthetics

- Chemical
- Physical
- Microbial

## ■ Refined Program after a Few Weeks

- On-going at 9 locations

## ■ Now have 2 months of results and visible trends are emerging



# Sampling Locations

SAMPLING LOCATIONS FOR DISTRIBUTION SYSTEM WATER QUALITY MONITORING

## SAMPLING LOCATIONS

- ( 1 ) 136 Tanglewood Dr. (Not Shown)
- ( 2 ) 1824 Coal Creek Rd. (Not Shown)
- ( 3 ) 1051 Coal Creek Road
- ( 4 ) 150 Clark Creek Lane
- ( 5 ) 2770 48th Avenue
- ( 6 ) 16 Clearview Drive
- ( 7 ) 188 Curtis Drive
- ( 8 ) 3747 Sunset Way
- ( 9 ) 3170 N. Ammons Dr.
- (10) 3544 Fairway Lane
- (11) 2302 Cedar Place
- (12) 2430 Park Hill Drive
- (13) 1155 Weber Ave (MFRWTP)
- (14) 2853 Florida Street
- (15) 2105 Larch Street
- (16) 345 19th Avenue
- (17) 640 17th Avenue
- (18) 1100 Commerce Ave
- (19) 101 Fishers Ln. (BHWSD Intertie)
- (20) Hillside Pump Stn (BHWSD Intertie)
- (21) Maplewood x Cedar (BHWSD Intertie)
- (22) 7400 Blk Willow Grove Rd.
- (23) 5403 Oriole Drive

# Results from 600 Block 17<sup>th</sup> Ave

## ■ Monitoring conducted on July 11<sup>th</sup> and July 15<sup>th</sup> by the City

## ■ Complete metals analysis

- ❑ All regulated metals (primary MCL) were non-detect, with the exception of arsenic, which was 1/3 of the MCL.
- ❑ Iron was elevated (secondary MCL)
  - 0.9 – 1.0 mg/L
  - Approximately 3X the secondary MCL of 0.3 mg/L
  - Discolored water!
- ❑ Manganese was present (secondary MCL)
  - 0.035 - 0.049
  - Just below the secondary MCL of 0.05 mg/L
  - Contributed to additional discoloration

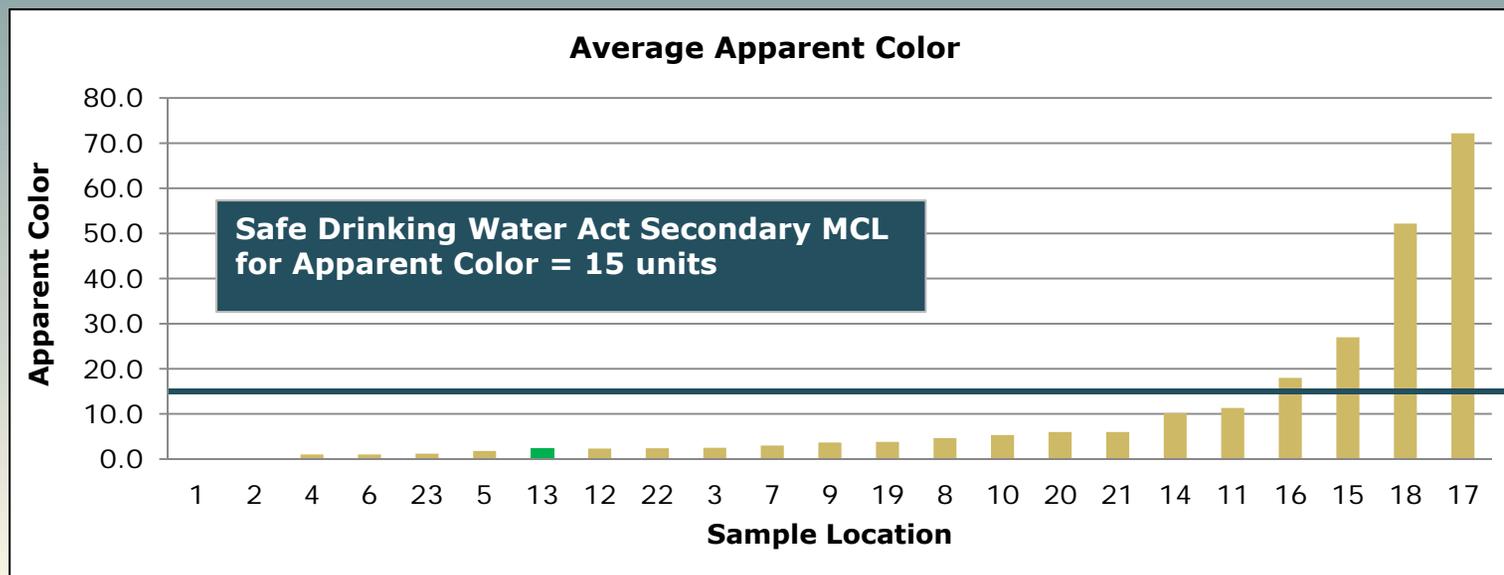
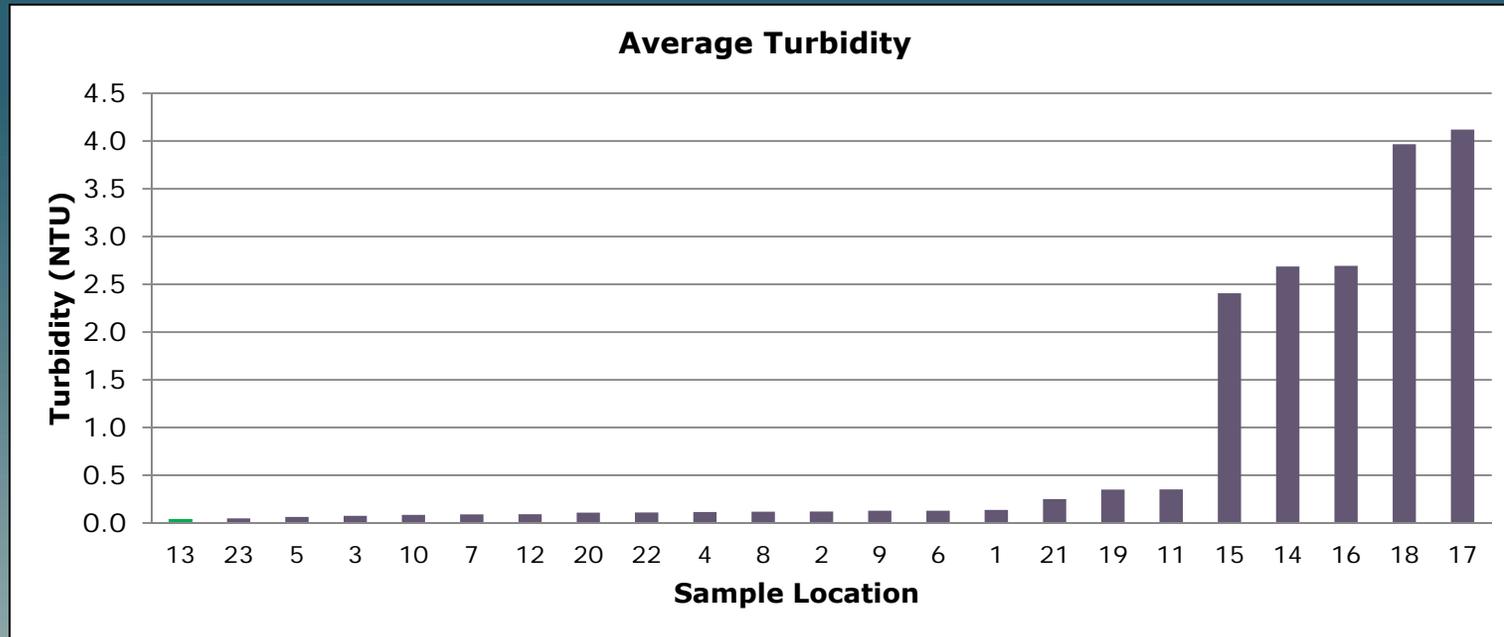
Even though discolored and probable metallic taste and odor, still safe to drink!



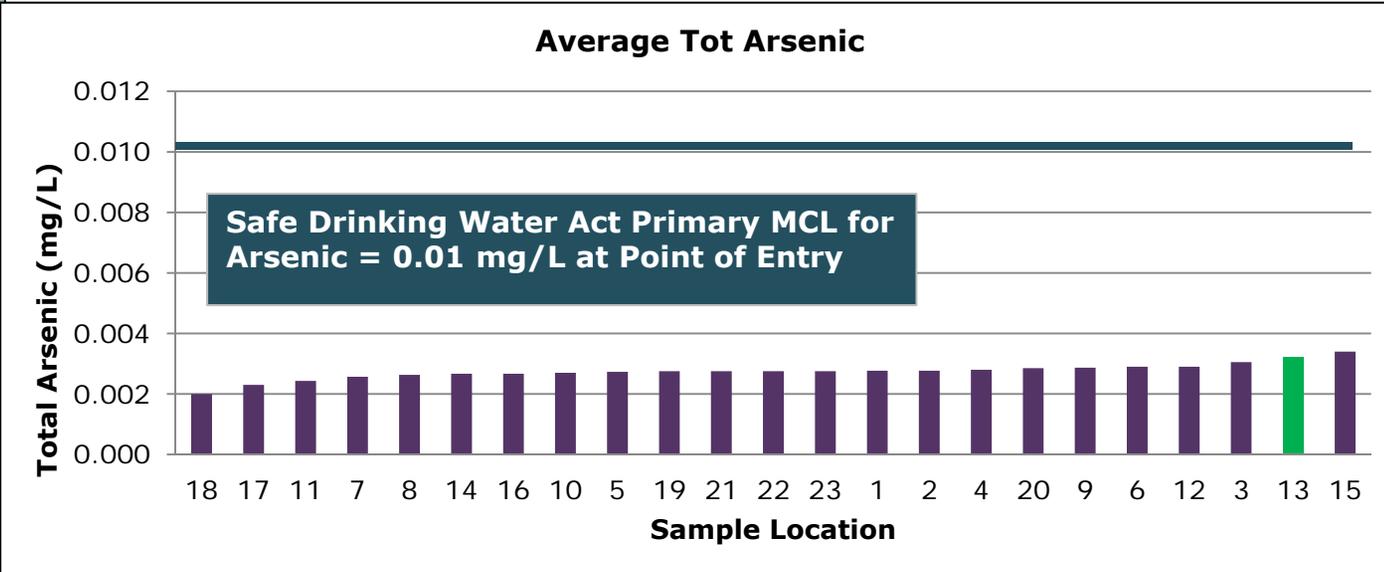
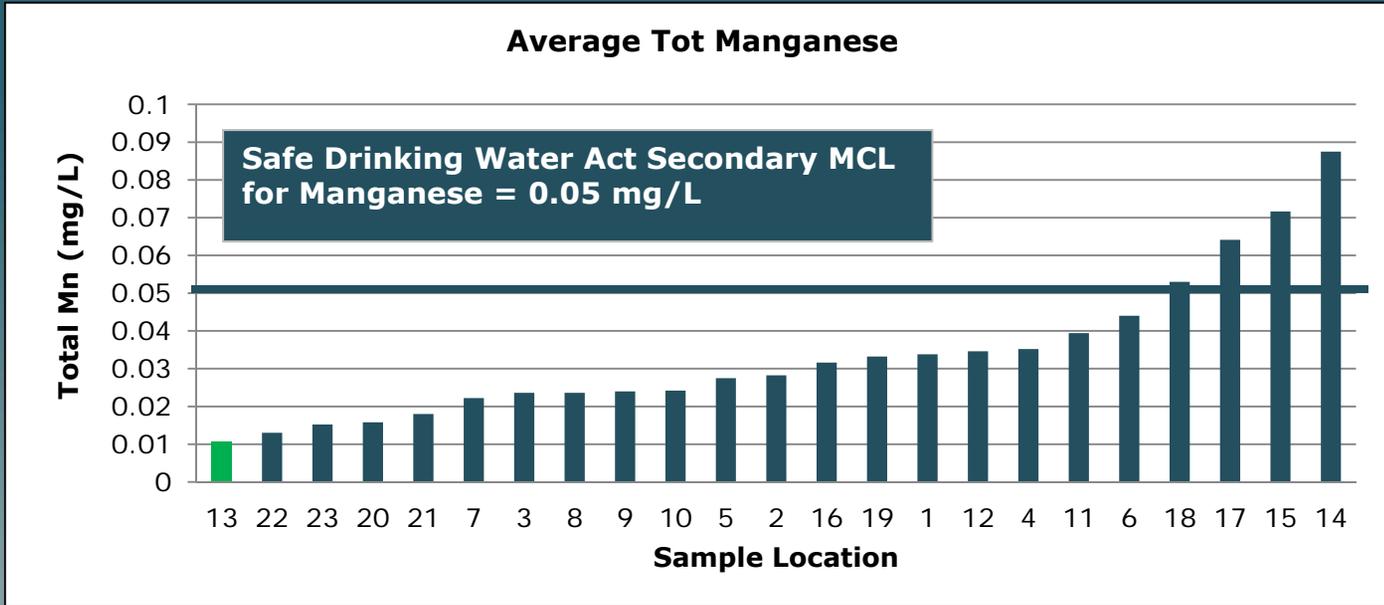
## Comparison of Average Concentrations at Point of Entry vs. Distribution System Problem Area

Parameter	Requirement or Guideline	MFWTP (Site 13)	640 17 <sup>th</sup> Ave (Site 17)
Free Chlorine (mg/L)	Detectable (Treatment Technique)	1.15	0.11
Heterotrophic Bacteria (CFU/mL)	≤500 (Treatment Technique)	1	210
Total Arsenic (mg/L)	0.01 (Primary MCL)	0.003	0.002
pH	6.5-8.5 (Secondary MCL)	7.65	7.72
Total Iron (mg/L)	≤0.3 (Secondary MCL)	0.00	0.04
Total Manganese (mg/L)	≤0.05 (Secondary MCL)	0.01	0.06
Color (Color Units)	≤15 (Secondary MCL)	2.2	69
Oxidation-Reduction Potential (mV)	Not Regulated	768	332
Turbidity (NTU)	Not Regulated for Groundwater	0.04	4.12

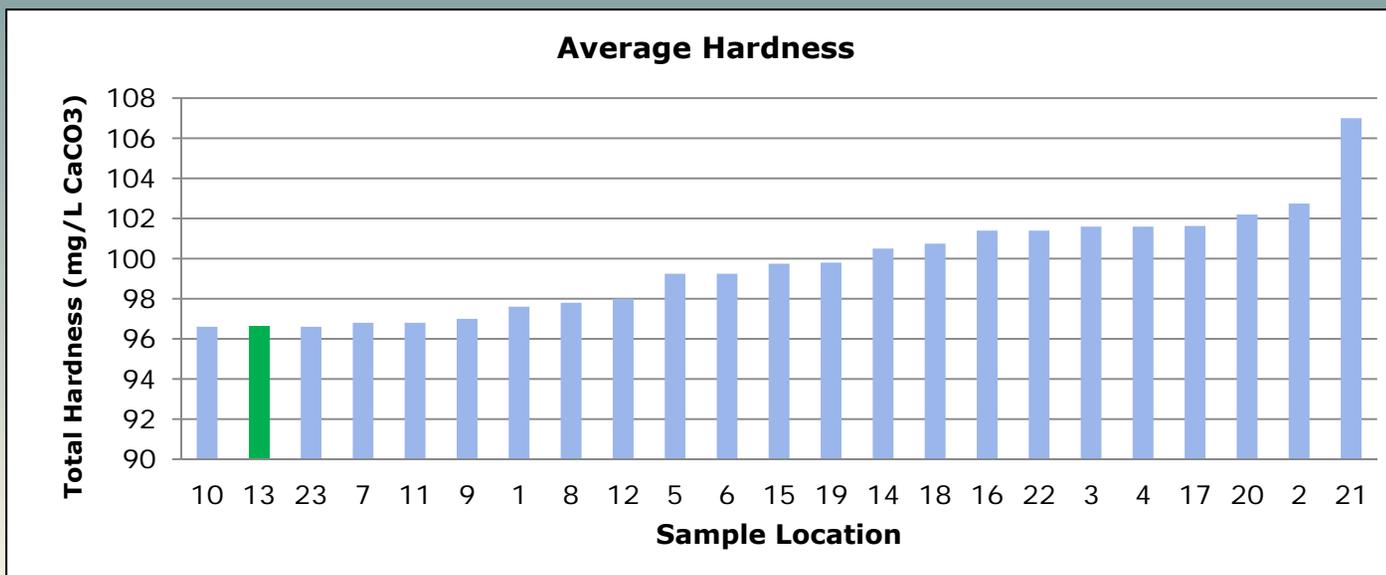
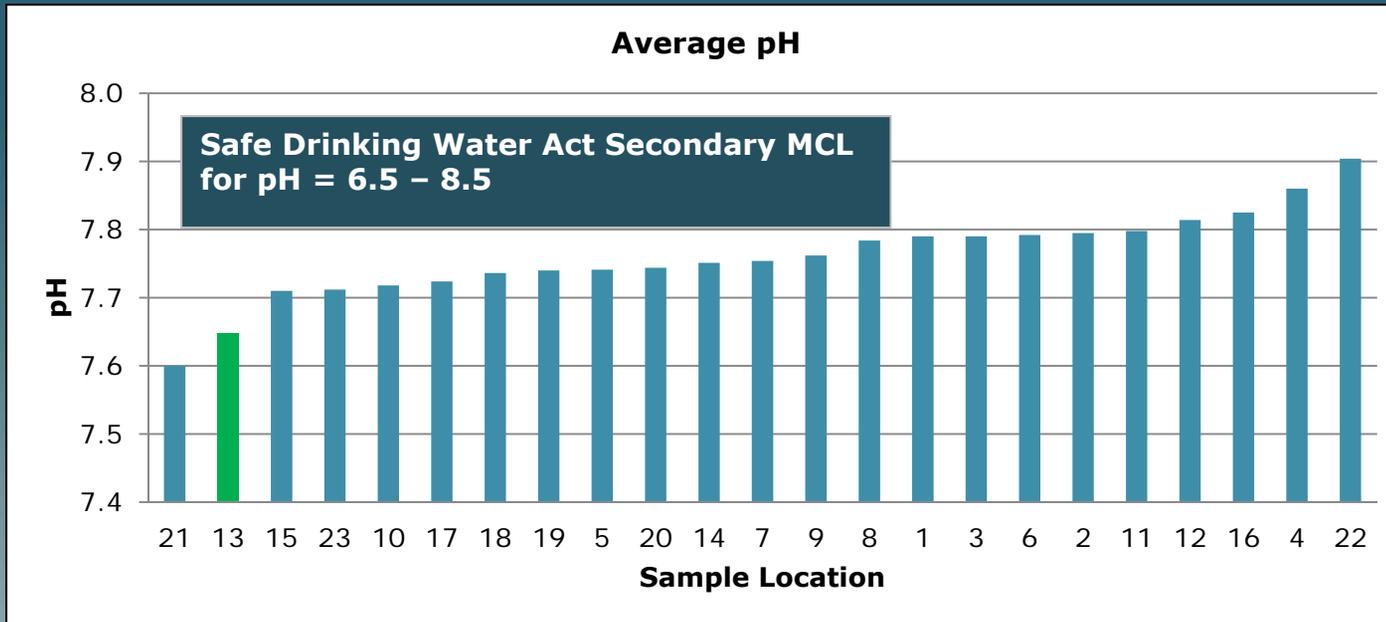
# Test Results



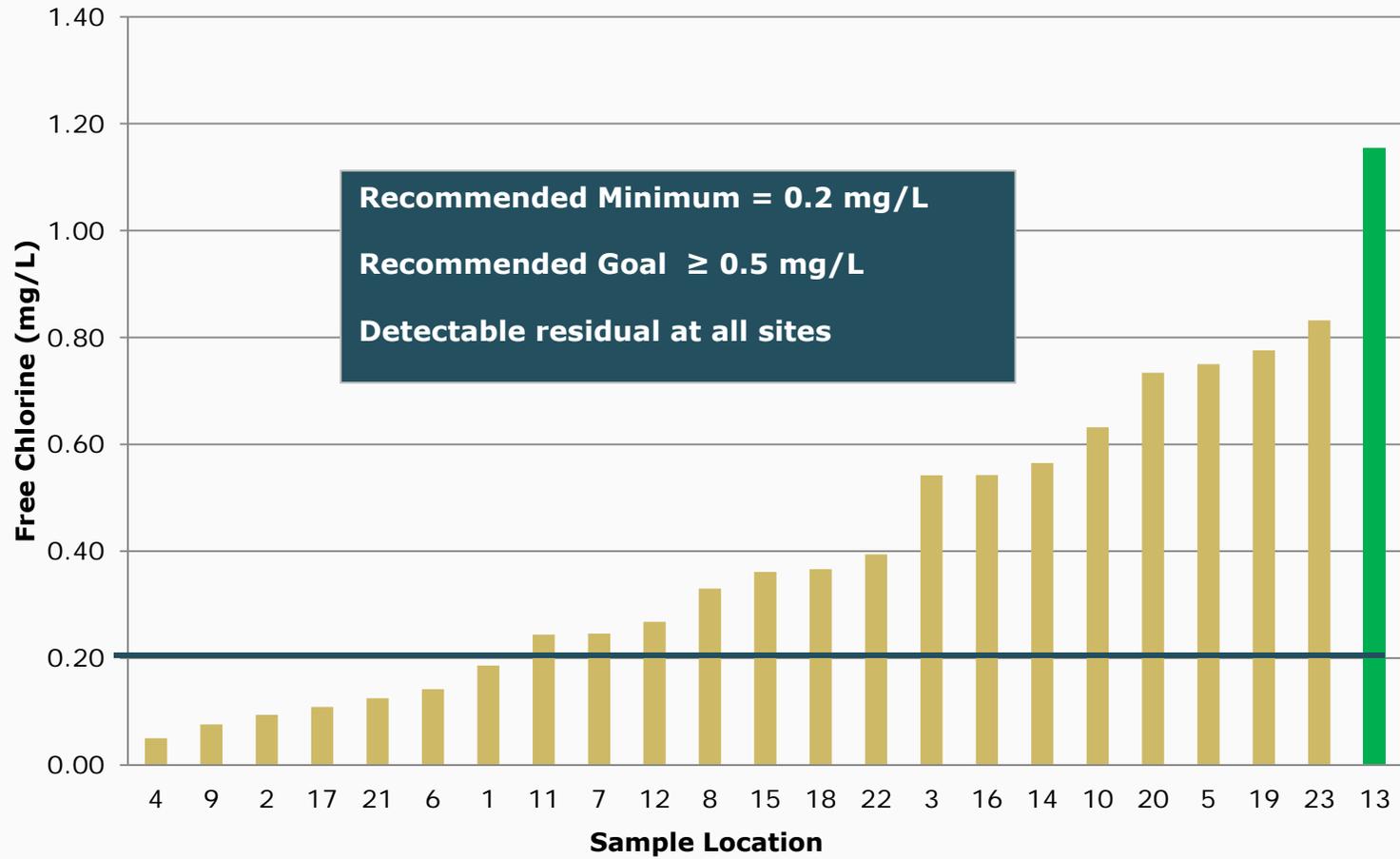
# Test Results



# Test Results



# Test Results



# Key Findings

- **Water is safe to drink**

- Chemical
- Microbial
- Physical

- **Some locations with aesthetic water quality issues**

- Color
- Turbidity
- Manganese

- **Disinfectant residual should be increased in portions of the system**



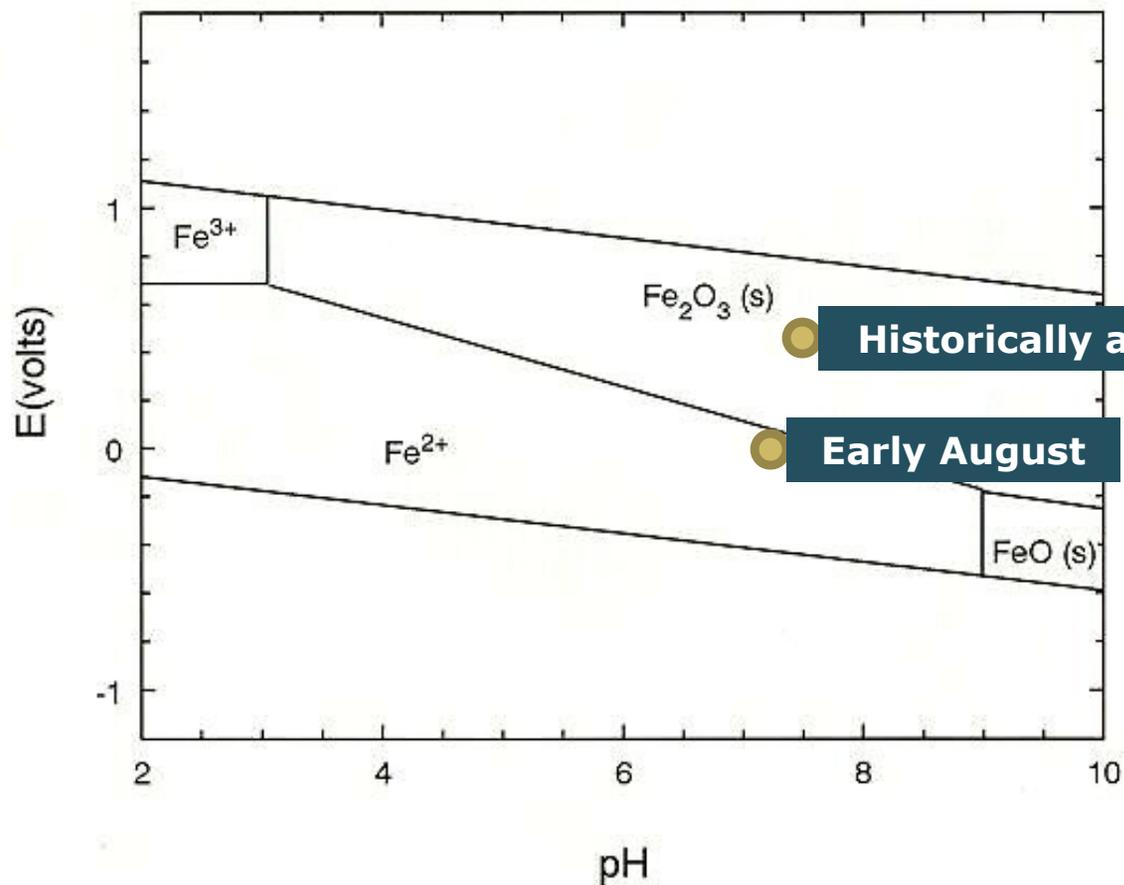
# Why We Care About Chlorine

- **Primary barrier to microbial contamination and waterborne disease outbreak**
- **Keeps Oxidation-Reduction Potential (ORP) Positive**
- **Prevents metals from becoming soluble and leaching out of scales**

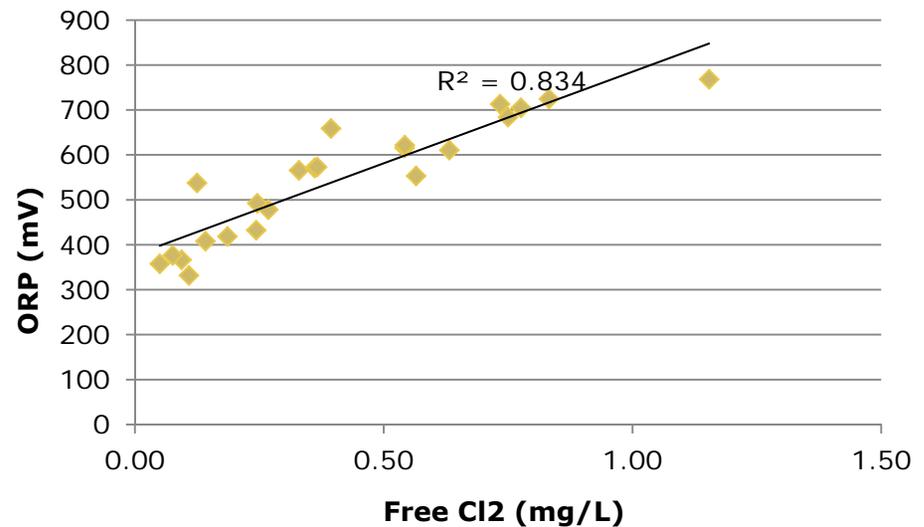
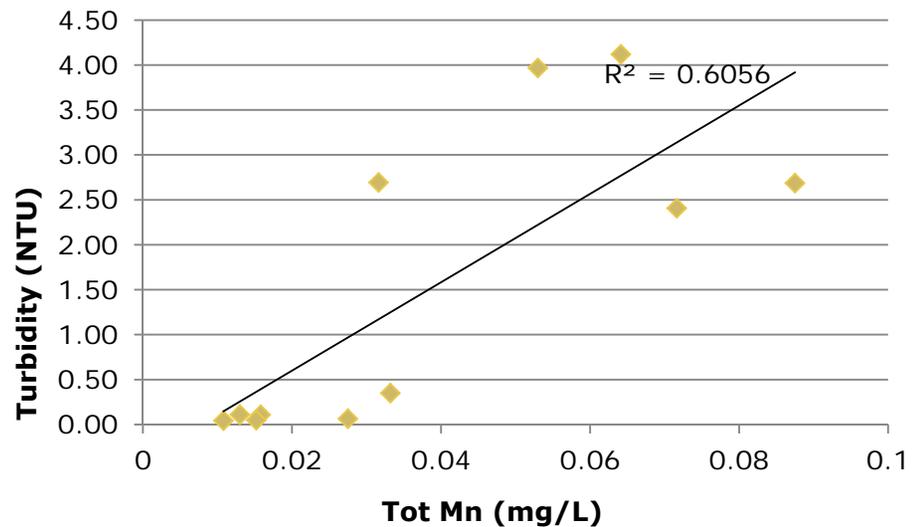
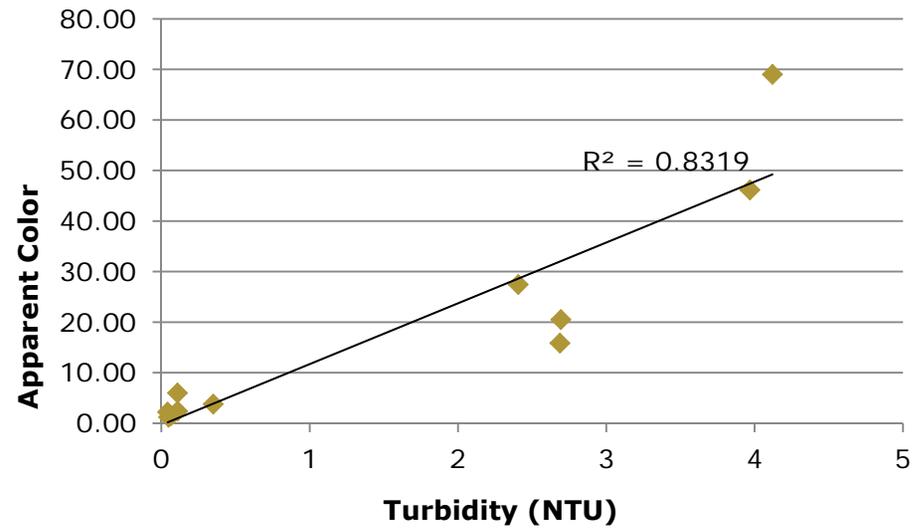
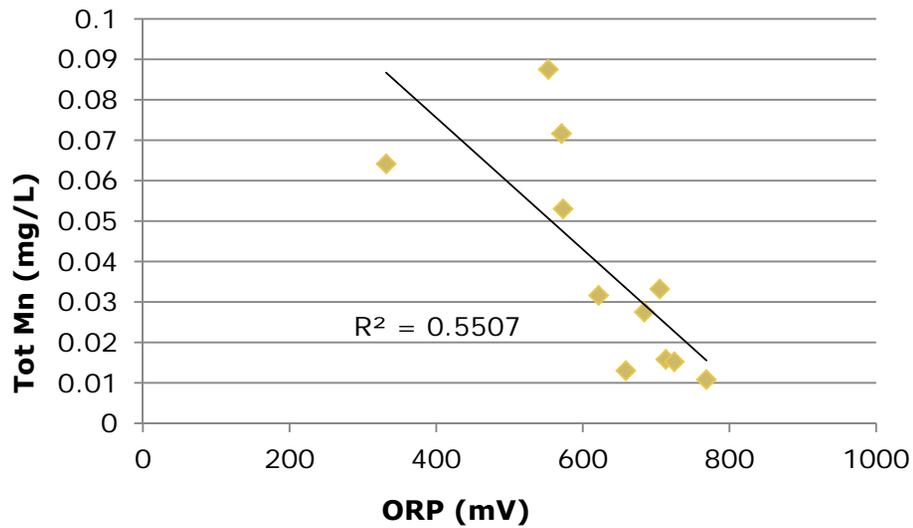


# Example of Why We Want to Keep ORP Positive and High!

Simplified Pourbaix Diagram for Some Naturally Occurring Forms of Fe



# Chemistry of the City's Distribution Systems

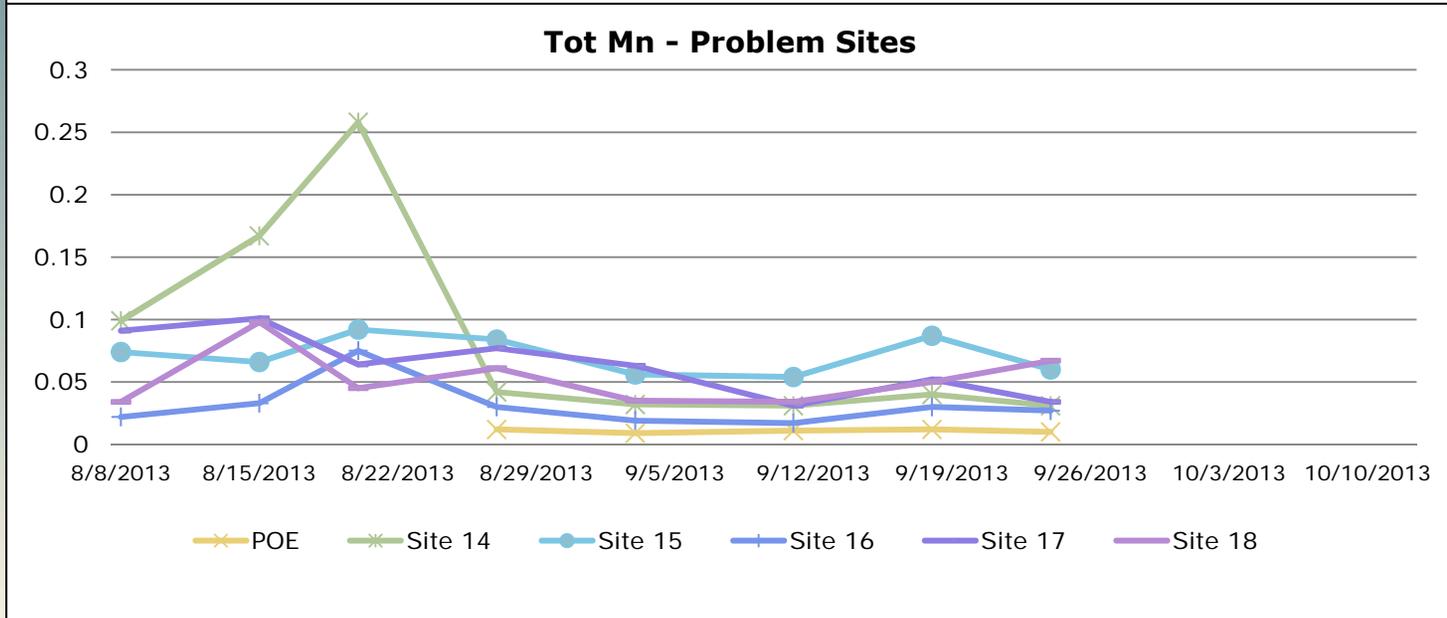
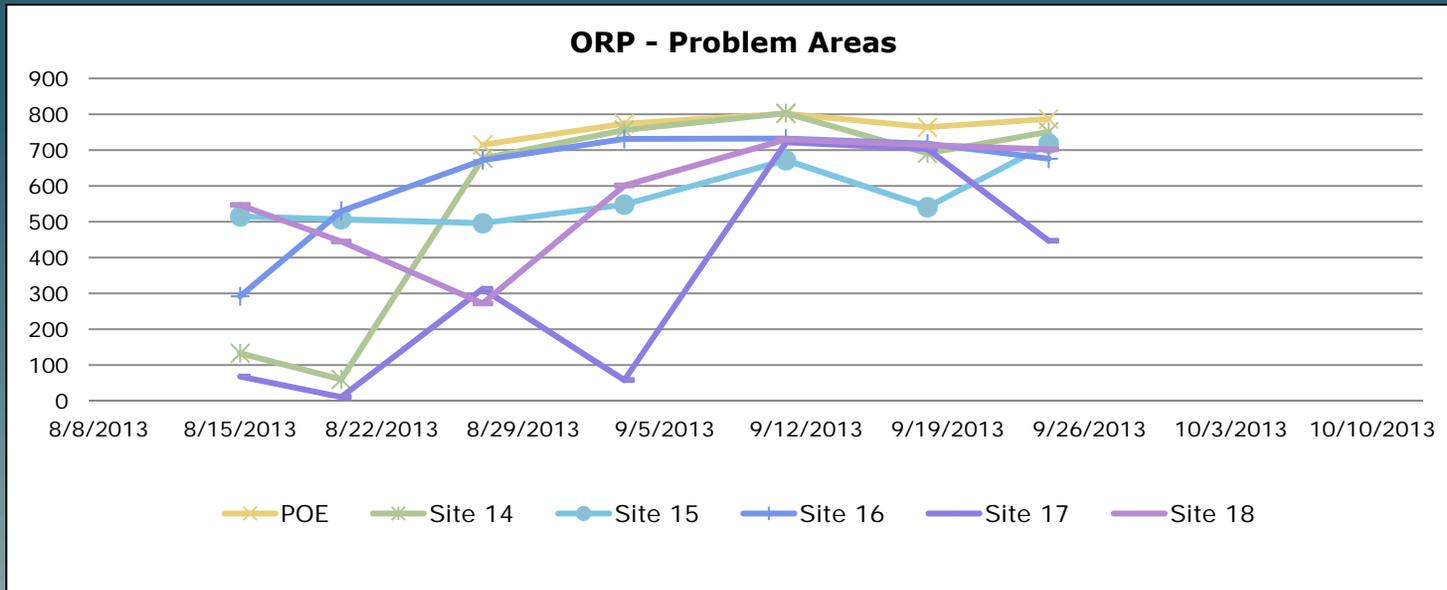


# And the Good News Is....

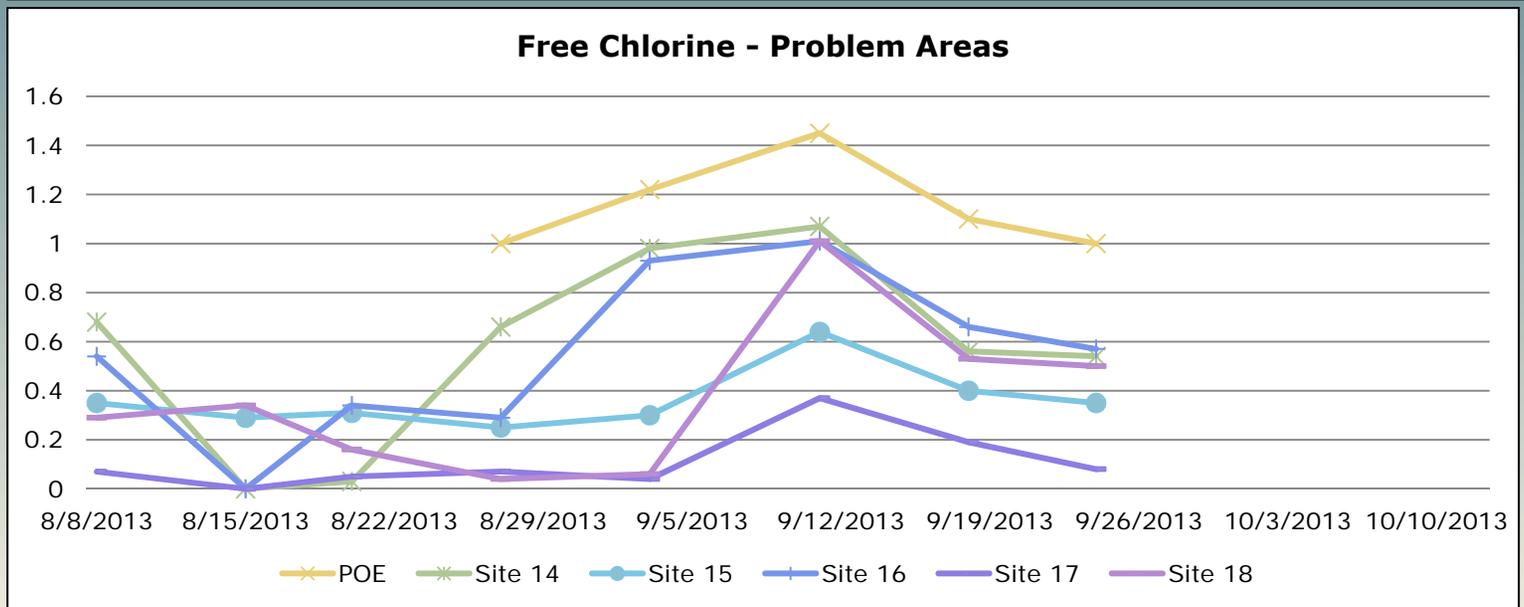
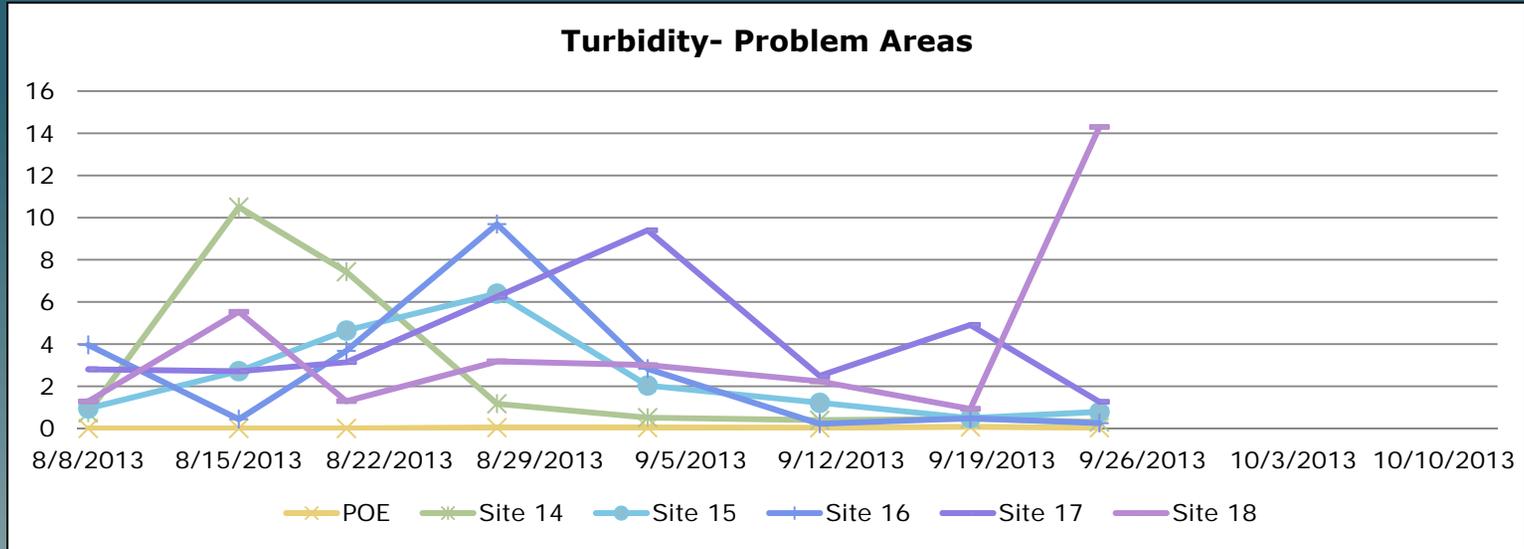
- **The system appears to be stabilizing due to**
  - Small but important adjustments in finished water chemistry
    - Increased pH
    - Increased chlorine residual
  - Main cleaning
    - Flushing
    - Ice pigging
  - Time for equilibration to occur



# Stabilization Trends



# Stabilization Trends



# Preliminary Recommendations

- **Continue monitoring to demonstrate safety of water and continued scale stabilization**
- **Work with customers to better understand types and severity of water quality impacts in premise plumbing and appropriate mitigation strategies**
- **Assess costs/feasibility of additional treatment**
  - Speed up stabilization process
  - Sequester iron and manganese to reduce staining
  - Sequester calcium and other elements to reduce white spotting
- **Continue with main cleaning program**
- **Continue with prioritization of mains in need of replacement**



# Potential Responses - Budgetary Costs

	PROS	CONS	EST. COST
<i>Ongoing Monitoring and Stabilization</i>	<ul style="list-style-type: none"> <li>• Utilize City staff</li> <li>• Inexpensive</li> <li>• No unintended consequences</li> </ul>	<ul style="list-style-type: none"> <li>• Length of time to complete re-stabilization process is unknown</li> </ul>	~\$500/week in lab costs for (9) sample locations
<i>Additional Treatment (Stabilize Distribution System)</i>	<ul style="list-style-type: none"> <li>• Speed re-stabilization</li> <li>• Sequestering agent to reduce staining and spotting</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive</li> <li>• Initially worse before better</li> <li>• Introduces new chemical</li> <li>• 6-8 weeks to implement</li> <li>• Degree of effectiveness unknown</li> <li>• Potential for unintended consequences</li> </ul>	\$300,000 (permanent facilities not including soil improvements)  \$575,000/year chemical cost
<i>Flushing</i>	<ul style="list-style-type: none"> <li>• Utilize City staff</li> <li>• Inexpensive</li> <li>• Immediate result</li> <li>• Minimal downtime</li> </ul>	<ul style="list-style-type: none"> <li>• Limited staffing</li> <li>• Large water volume used</li> <li>• Short term improvement</li> </ul>	\$1/LF  (~ \$4k/week)
<i>Ice Pigging</i>	<ul style="list-style-type: none"> <li>• No excavation</li> <li>• No pipeline disinfection</li> <li>• Immediate result</li> <li>• Minimal downtime</li> <li>• More effective than flushing</li> </ul>	<ul style="list-style-type: none"> <li>• Doesn't remove heavy scale</li> <li>• Limited equipment availability</li> <li>• May lead to pinhole leaks</li> </ul>	\$3/LF  \$12k/day minimum
<i>Main Replacement</i>	<ul style="list-style-type: none"> <li>• Eliminates problem</li> <li>• Pipe rehab options are preferred to limit cost</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive</li> <li>• Delayed implementation to design, bid and construct</li> </ul>	\$270/LF (\$400k/sidestreet) (\$1M for Baltimore)

# Potential Response Schedules

		Anticipated Schedule																							
		2013											2014											2015	
		M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Strategy 1	Optimize Existing Treatment																								
Strategy 2	Implement New Treatment																								
Strategy 3	Main Cleaning																								
Strategy 4	Main Replacement																								
Strategy 5	Assess Premise Plumbing																								
Strategy 6	Transition Monitoring and Assessment																								
Strategy 7	Communication of Findings/Progress																								

# Consumption Impacts (Feb thru Sept)

Address (Complaint location)	2012 (CCF)	2013 (CCF)	Increase/ (Decrease)	% Change	Cost/ Savings
<i>SINGLE HOME RESIDENCES</i>					
620 17th Ave.	39	42	3	7.69%	\$8.44
608 17th Ave.	74	80	6	8.11%	\$16.88
651 17th Ave.	24	23	-1	-4.17%	-\$2.81
602 22nd Ave.	76	66	-10	-13.16%	-\$28.14
526 16th Ave.	61	64	3	4.92%	\$8.44
527 15th Ave.	49	50	1	2.04%	\$2.81
2392 Florida St.	44	58	14	31.82%	\$39.40
556 24th Ave.	26	20	-6	-23.08%	-\$16.88
620 25th Ave.	51	44	-7	-13.73%	-\$19.70
Average	49	59	0.33	0.05%	\$0.94
<i>MULTI-FAMILY DWELLINGS</i>					
2005 Tibbetts Dr.	824	899	75	9.10%	\$211.06
1942 Dorothy St.	258	173	-85	-32.95%	-\$239.20

# Potential Customer Reimbursements

	PROS	CONS	EST. COST
<i>Consumption Based</i>	<ul style="list-style-type: none"> <li>• Offsets water used to flush household plumbing, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Manual credit calculation</li> <li>• Staff limitations</li> </ul>	\$0.00
<i>Point of Use Filters</i>	<ul style="list-style-type: none"> <li>• Simple installation</li> </ul>	<ul style="list-style-type: none"> <li>• Single faucet only</li> <li>• Ongoing maintenance cost</li> <li>• Household plumbing may re-introduce problems</li> <li>• Ineffective except for chlorine and lead removal</li> </ul>	\$25-75 (faucet)  Replacement cartridges: \$40 (fridge) \$40 (under sink)
<i>Household Filtration Systems</i>	<ul style="list-style-type: none"> <li>• Possible to coordinate installation with licensed local plumbers to eliminate up-front cost to customer</li> </ul>	<ul style="list-style-type: none"> <li>• Ongoing maintenance cost</li> <li>• Household plumbing may re-introduce problems</li> </ul>	\$800 installed
<i>Household Filtration/Softening Systems</i>	<ul style="list-style-type: none"> <li>• Combination filtration/softening systems are available</li> </ul>	<ul style="list-style-type: none"> <li>• Ongoing maintenance cost</li> <li>• Household plumbing may re-introduce problems</li> <li>• Potential increased sodium intake</li> </ul>	\$1,700 Installed  \$280/year

# Bottled Water

- 2 gallons per person per day (USEPA 2009)
- 2.9 people per household (2010 Census)
- Approximately 1% of water used is consumed through drinking
- Not useful for bathing, laundry, etc.
- Determining need may be challenging



# Bottled Water Options

	PROS	CONS	EST. COST
<i>Home Delivery (5 gallon bottles and dispenser)</i>	<ul style="list-style-type: none"> <li>• <i>Outside delivery service available</i></li> <li>• <i>Delivered directly to customers</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Limited to customers in need</i></li> </ul>	<p><i>\$180/month per household</i></p> <p><i>\$35 activation fee per household</i></p>
<i>Pick-up Sites (1-gallon jugs)</i>	<ul style="list-style-type: none"> <li>• <i>Available to all customers</i></li> <li>• <i>Can be made available in more than one location</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Requires customer pick-up</i></li> <li>• <i>Uncontrolled distribution</i></li> </ul>	<i>\$175/month per household</i>
<i>Retail Purchase (1-gallon jugs)</i>	<ul style="list-style-type: none"> <li>• <i>Available to all customers</i></li> <li>• <i>Can be purchased at more than one location</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Requires customer pick-up</i></li> </ul>	<i>\$140/month (discounted City price)</i>
<i>Potable Water Truck (Stationary dispensing location)</i>	<ul style="list-style-type: none"> <li>• <i>Available to all customers</i></li> <li>• <i>Can be made available in more than one location</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Customer must provide container</i></li> <li>• <i>Dispensed by customer</i></li> <li>• <i>Uncontrolled distribution</i></li> <li>• <i>Potential contamination of dispensing faucet</i></li> </ul>	<i>Unknown</i>
<i>Dispensing Station (Mint Farm RWTP)</i>	<ul style="list-style-type: none"> <li>• <i>Card lock options to control distribution</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Requires customer pick-up</i></li> </ul>	<i>Unknown</i>

# Public Outreach Plan

- **Continue utility bill stuffer (began Sept)**
- **Publish distribution system water quality monitoring plan and results**
- **Distribute fact sheets and AWWA consumer information brochures**
- **Post weekly Facebook updates to City page and Citizen Against Longview Water page**
- **Tweet weekly updates to City Twitter account**
- **Re-activate citizen sentinels for regular feedback**
- **Additional outreach needed if decision is made to pursue reimbursement options**



# Discussion