Portland Water Bureau's Experience with a Non-Acute Total Coliform Rule Violation: Part 1 of 2

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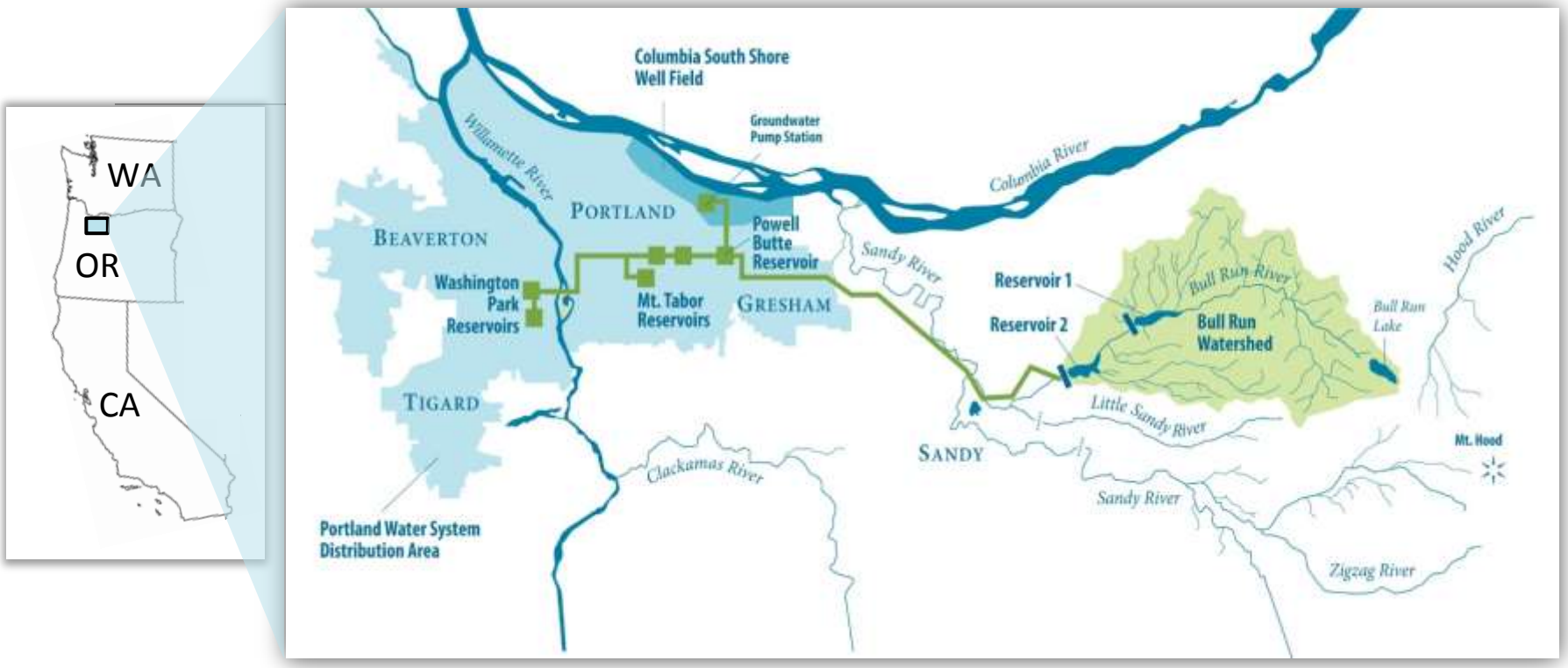
AWWA PNWS CONFERENCE
BELLEVUE, APRIL 30, 2015

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

Presentation Outline

- Overview of Portland's system
- Background of the total coliform event in SW Portland in September 2013
- Timeline of the event
  - Phase 1: Repeat sampling and preliminary mitigations
  - Phase 2: Secondary mitigations
  - Phase 3: Return to compliance
- Where we are today
- Lessons learned

Portland Water Bureau Overview



- Serves approximately 938,000 people – approximately 20% of Oregon
- 20 wholesaler customers which comprise approximately 42% of system demand

Portland's System

SUPPLY AND TREATMENT

Unfiltered

Treatment

- Gaseous chlorine for primary disinfection
- Ammonia to form chloramines for secondary disinfection
- Sodium hydroxide for pH adjustment

DISTRIBUTION SYSTEM

180 pressure zones

70 storage tanks

39 pumping plants

Over 2000 miles of distribution pipeline

3 large uncovered finished water reservoirs that are routinely in service

A Quick Review of Regulatory Requirements under the TCR

The Total Coliform Rule (TCR) requires that drinking water providers test for total coliform/*E.coli* in their distribution systems

A total coliform detection by itself does not result in a violation under the TCR

Violations of the TCR can occur - two main ways to violate the rule:

- Confirmed detection of *E.coli* in the distribution system
- More than 5% of total samples taken in the system during a month are positive for total coliforms
  - This is what occurred in Bertha

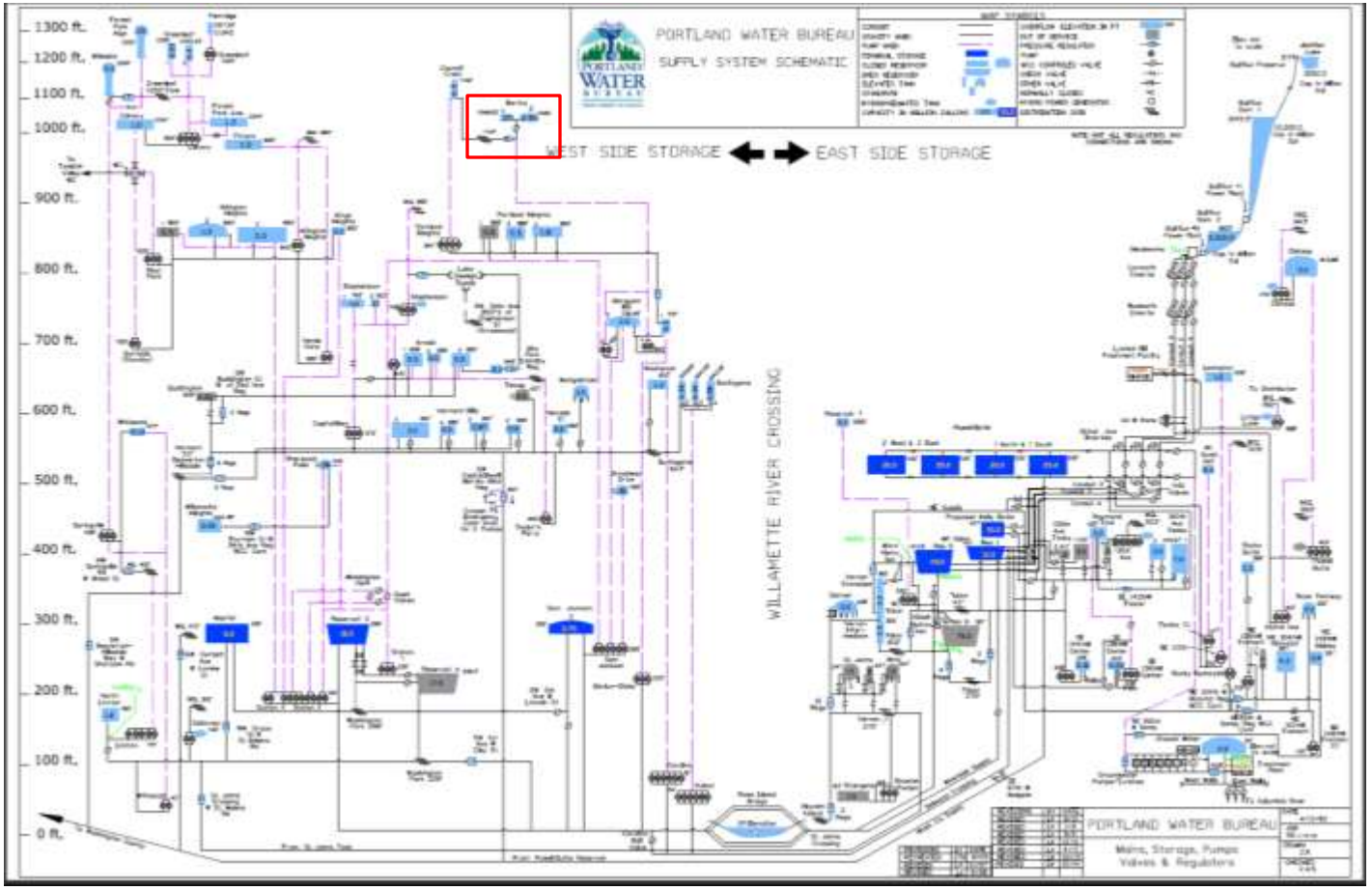

OREGON DEPARTMENT OF HUMAN SERVICES: PUBLIC HEALTH DIVISION

NOTICE

Your water system recently received one or more violations. Please visit our Web site at **http//170.104.63.9/violsum.php** to review your violation(s). Please remember that sample results must be received in the Drinking Water Program office by the 10th of the month following the monitoring period to avoid a non-reporting violation. If you have any questions, please contact your technical representative listed on the Web site or the Oregon Drinking Water Program in Portland at **971-673-0405.**

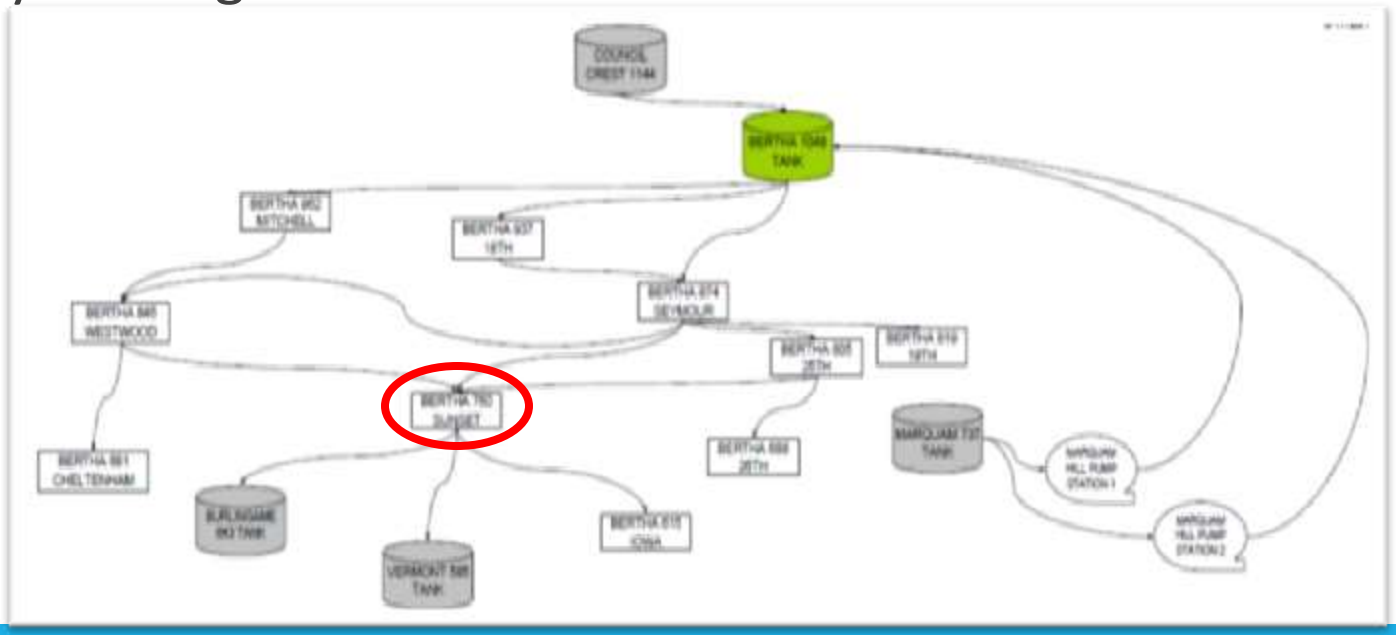
OHS | Independent. Healthy. Safe.

Background: System Hydraulics



Background – Bertha Area Hydraulics

The Bertha area is a collection of 10 pressure zones that are fed predominantly through Bertha 1 and 2 Tanks. The Bertha Tanks are at the highest hydraulic grade in the Bertha area, and water is fed downstream to the rest of the Bertha pressure zones through gravity and regulators.



Events Leading up to the Incident

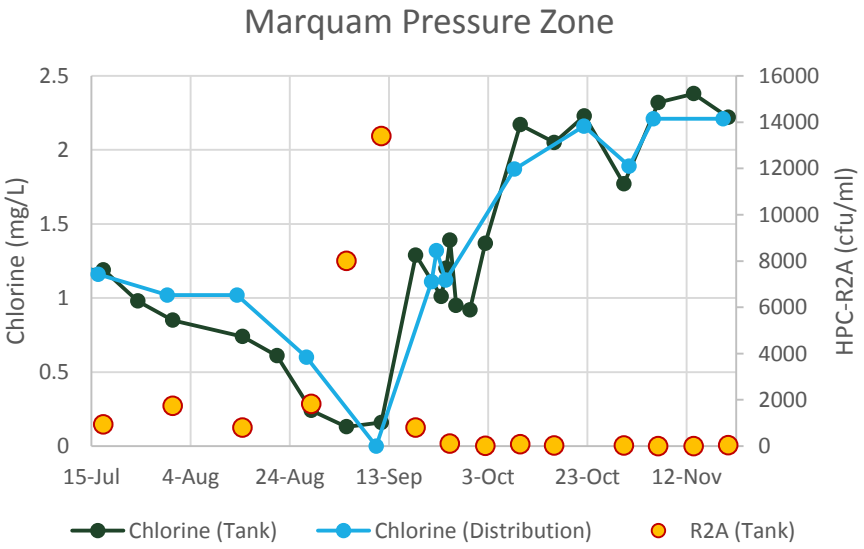
A robust nitrification plan was implemented in early summer 2013

As part of that nitrification monitoring, water quality issues were noted in Marquam Hill #2 Tank and distribution system in early September

Numerous mitigations were employed to improve the water quality in this area

- Flushing
- Deep cycled the tanks
- Lowered operating levels in the tanks
- Adjusted pumping operations
- Took storage offline

Water quality improved in the Marquam Hill Tanks and PZ as a result of these activities, however….



Water Quality in Marquam PZ Prior to the Incident

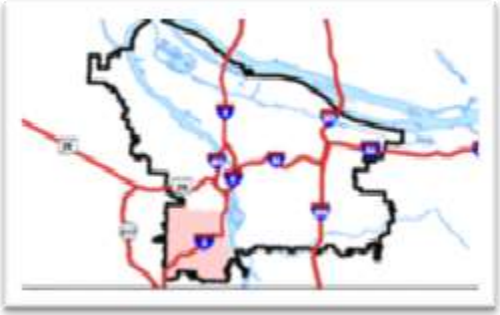
…it is possible that a slug of this water may have been inadvertently pumped up to Bertha Pressure Zone

Bertha is supplied by the Marquam Hill Tanks

It All Started on September 18

On September 18th, a routine TCR sample came back positive for total coliforms, negative for *E.coli*

- WQSS 200 (SW 27th Ave and Nevada) - located in the Bertha 750 Pressure Zone, in the southwest portion of Portland's distribution system.
  - Cl=0.14 mg/L; T=17.9 C

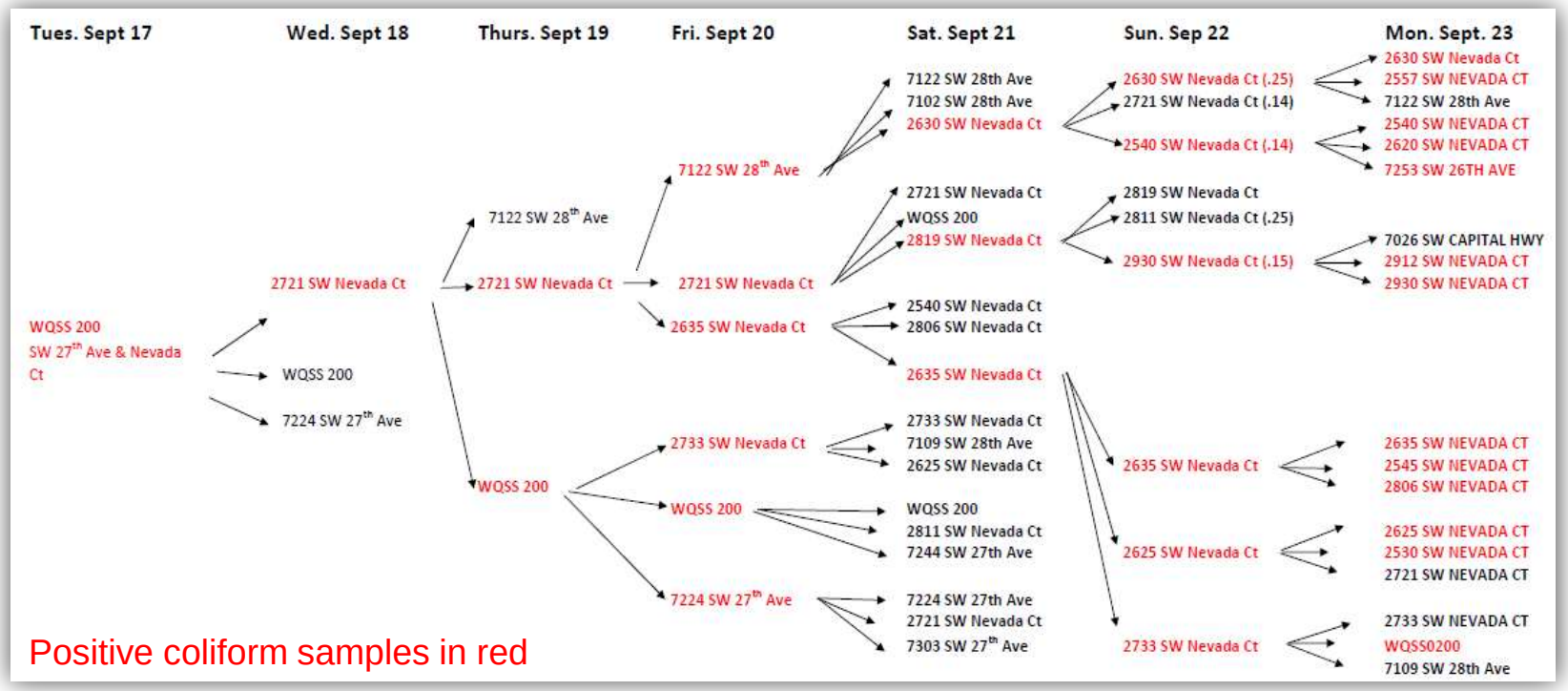


As required by regulation, three resamples were collected at the site (upstream, repeat, downstream) within 24 hours

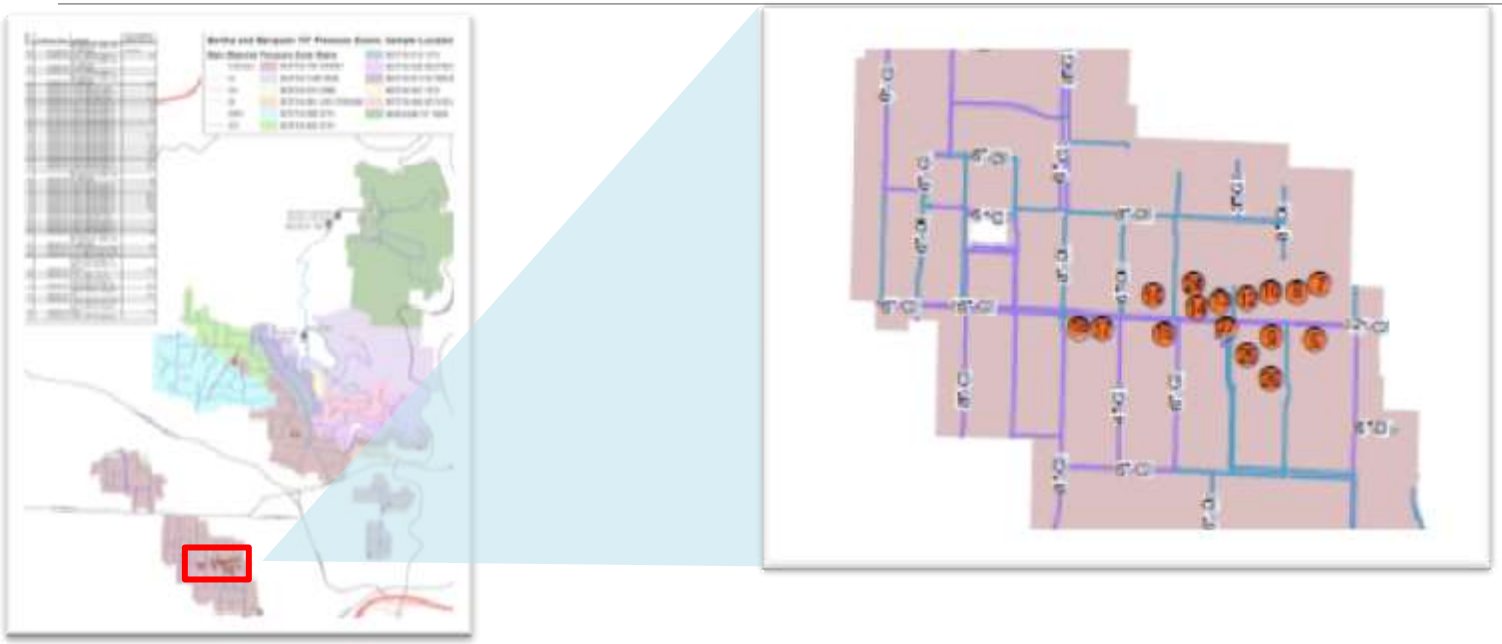
- PWB standard protocol is resample immediately once a sample comes back positive

Sampling: Sept 18-23

The situation in Bertha was especially unusual because the resamples also came back positive for total coliforms. Typically our resamples come back negative, but this was not the case here.



Positive samples were clustered in a small pocket of the Bertha 750 PZ



Due to the extensive sampling conducted Sept 18-30 (67 voluntary surveillance samples in addition to the routine TCR samples collected during this time) as well as the hydraulics in the area, PWB felt confident that the contamination was limited to a small pocket in the SW of the system

Initial Mitigations

First we tried to improve the situation through operational changes (we utilized our mitigation strategies from our nitrification toolbox):

- Flushing
- Adjusted pumping operations
- Deep cycled the tanks
- Lowered operating levels in the tanks
- Drained and refilled tanks with fresh water
- Cleaned tanks ahead of schedule
- Took storage out of service

Unfortunately these mitigations were not effective in the Bertha area (water quality did not stabilize as evidenced by unstable chlorine residuals)

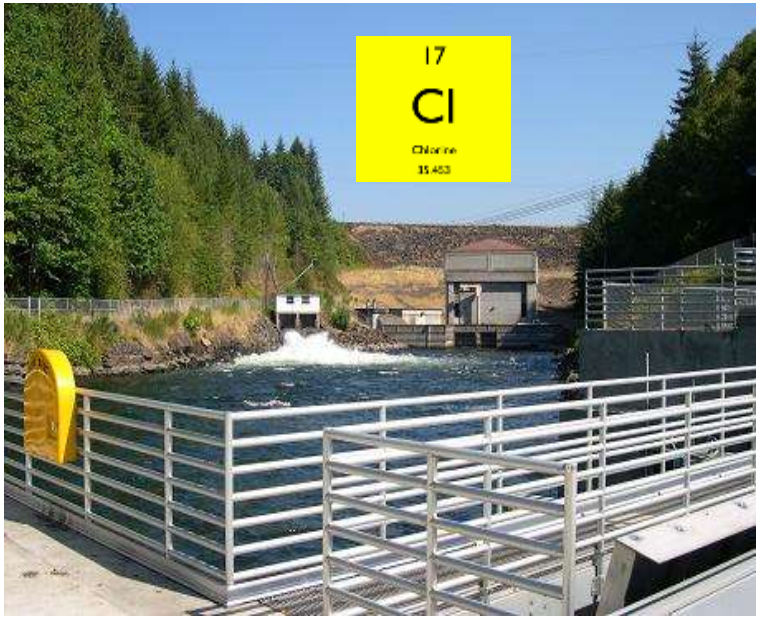
As a result, more aggressive responses were required

Secondary Mitigations: UDF

- Unidirectional flushing (UDF) is a flushing procedure that involves the systematic opening and closing of valves and hydrants, one section of main at a time to force the water through the pipes at high velocity, removing accumulated sediment and biofilm
- A UDF plan was developed for Bertha

Secondary Mitigations: Increased Chlorine Dose

Between September 30 and October 2, the chloramine target dose was increased from 1.8 mg/L to 3 mg/L leaving the Lusted Hill Treatment Facility



Continued WQ Monitoring

During this next phase of mitigations, water quality was monitored throughout the Bertha area daily (and several times a day in some cases)

- To evaluate the effectiveness of our mitigation strategies

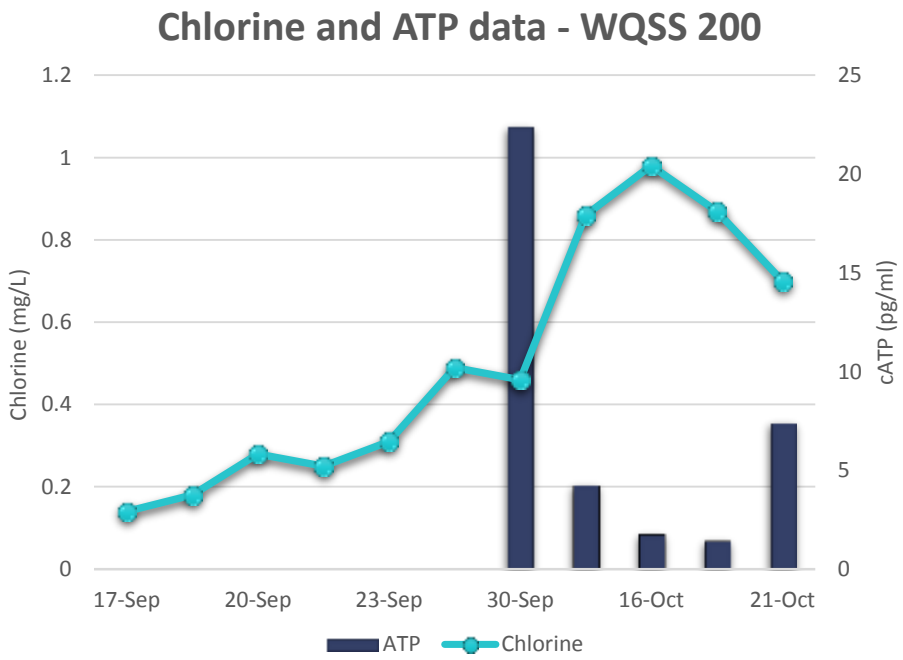
Monitored chlorine and temperature but needed an indicator of microbial activity

- Coliform testing could have thrown us back into the resampling loop
- Did not want to wait 7 days for the R2A results
- Monitored for ATP

October 21 – Success!

Once monitoring results provided confidence that the mitigations had been effective, five bacteriological samples were collected in the Bertha 750 PZ (including WQSS 200) on October 21

All samples were negative for TC/EC



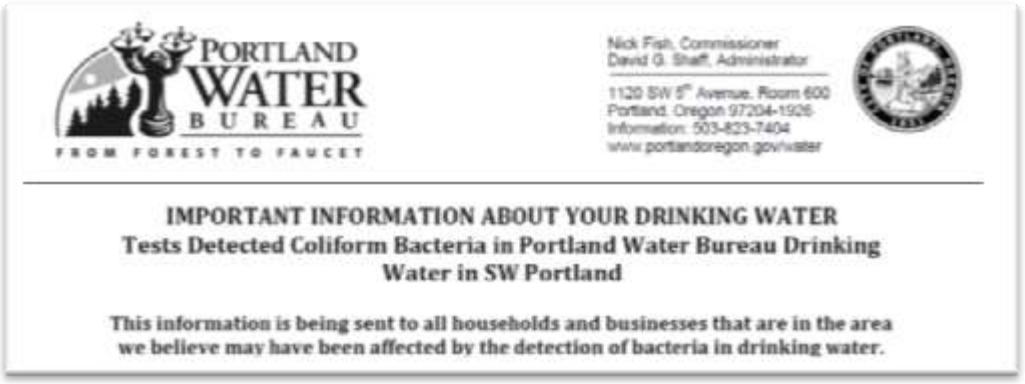
Tier 2 Notification

PWB still had to submit a justification to OHA requesting that the affected area for customer notification be limited to the Bertha area and all areas downstream of Bertha

- The OHA granted this request and a Tier 2 Notification was limited to approximately 17,500 connections

PWB also had to submit a return to compliance report detailing possible sources of the problem and what mitigations had been conducted

- Conducted a voluntary Level 1 Assessment (RTCR)
- Nitrification in the Marquam area could have contributed to this problem



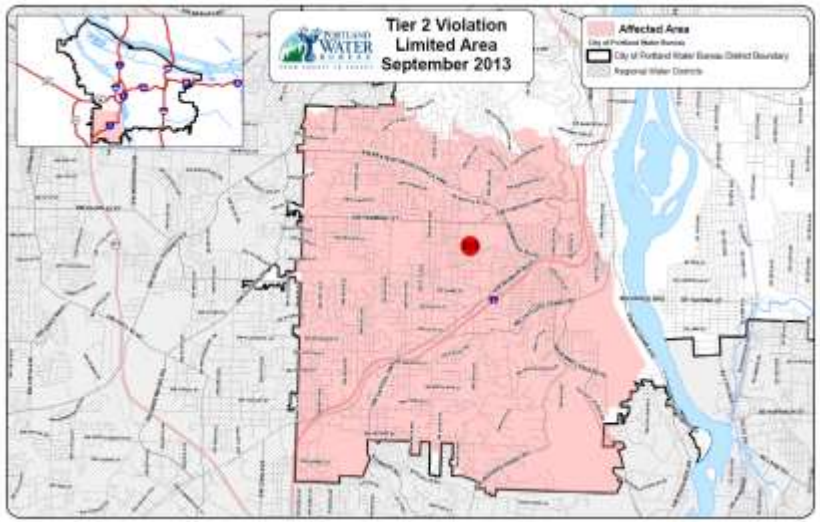
PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

Nick Fish, Commissioner
David G. Shaff, Administrator

1120 SW 5th Avenue, Room 600
Portland, Oregon 97204-1926
Information: 503-823-7404
www.portlandoregon.gov/water

IMPORTANT INFORMATION ABOUT YOUR DRINKING WATER
Tests Detected Coliform Bacteria in Portland Water Bureau Drinking Water in SW Portland

This information is being sent to all households and businesses that are in the area we believe may have been affected by the detection of bacteria in drinking water.



Tier 2 Notification Continued

Under the RTCR, the situation in Bertha would not have required a Tier 2 notification

- Instead a Level 1 Assessment would have been required

The RTCR takes a 'find and fix' approach – it requires public water systems to perform assessments to identify sanitary defects and subsequently take action to correct them


CONCEPT EXAMPLE
Level 1 Assessment Form

System Name: PORTLAND WATER BUREAU
Source Water: SURFACE WATER
PWSID #: OR 4100657
System Type: CWS
Population Served:
Operator in Responsible Charge (ORC)
Phone
City, State: PORTLAND, OR
County: MULTNOMAH
Date Assessment Completed:

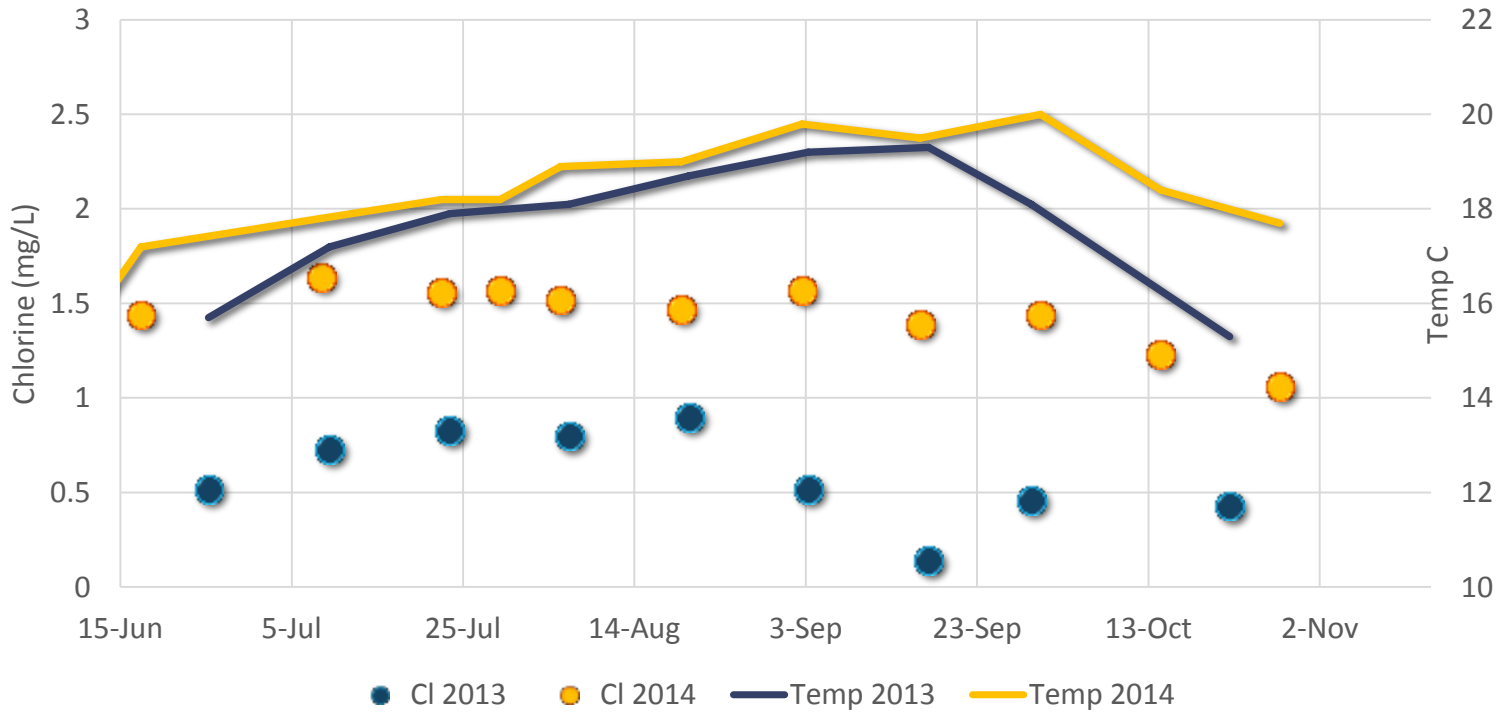
Questions (1-5)	Reviewed and checked?	Issue(s) found? (Y/N)	Issue Description	Corrective Action Taken (Including Date)
1. Have any of the following occurred at relevant facilities prior to the collection of TC samples?	✓	Possible		
2. Have there been any recent operational changes in the system?	✓	N		
3. Evaluate sample site.	✓	N - multiple taps used		
4. Sample protocol followed and reviewed.	✓	N - multiple samplers, sample protocol confirmed		

Press Coverage

"PWB kept quiet on contaminated water"
--October 31, 2013 - KOIN 6

"No gloves required for PWB water testers. EPA recommends gloves for water contamination test"
--November 4, 2013 – KOIN 6

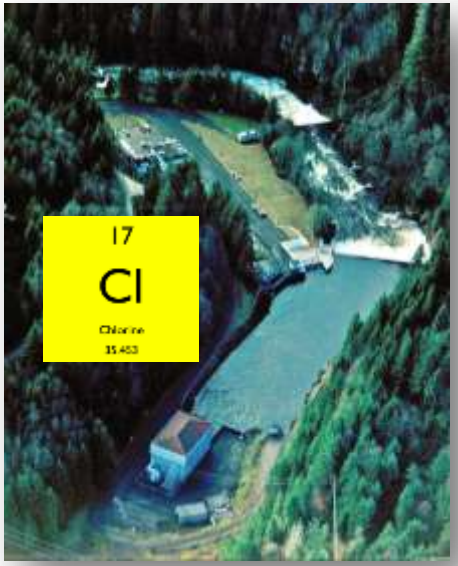
Where we are today in the Bertha PZ (WQSS 200)….



These Results are due to an Ongoing Proactive Approach to WQ

Based on the 2013 results from our nitrification program (as well as the Bertha incident), a very proactive approach to water quality has been instituted

- Seasonally adjust our chloramine target
- Seasonally take storage out of service
- Lowered operating levels/began deep cycling a number of critical tanks
- Installed mixers
- Changed regulator settings to increase demand on certain parts of the system



Ongoing Proactive Approach Continued

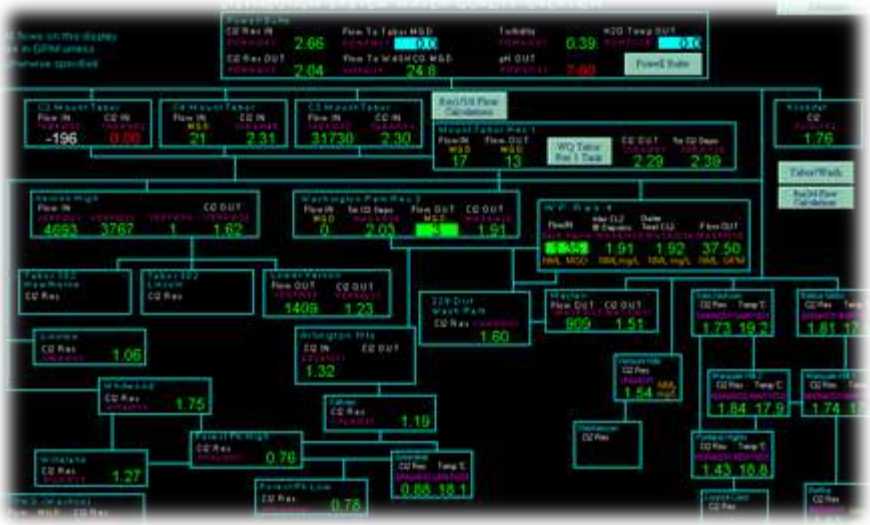
Installed chlorine residual analyzers at 7 key tanks

Ongoing UDF with prioritization of PZs based on WQ

Adjust spot flushing schedules based on WQ

Started using an autoflusher

Time pumping operations



Lessons Learned from the Bertha Incident

Conventional flushing is a good tool, but not necessarily the silver bullet in all situations

- A multi-approach solution may be required for some more difficult situations

Alternatives to UDF should be developed, in particular for areas where scouring velocity cannot be achieved

Surveillance sampling and isolating the area are key to understanding how widespread the issue is and to limiting the affected area

Good communication with wholesalers and retail customers is very important, especially with so much misinformation about the situation in the media

Follow up from the Bertha Incident

Continued monitoring of the area is required to ensure that the problem will not occur in this area in the future

Mitigation tools developed as part of our nitrification program and seasonal chlorine target adjustments were effective at mitigating the issue

- But a proactive approach is better!

Confluence Evaluation

- We hired Confluence Engineering to evaluate the Bertha incident, particularly possible causes and improvements in our response

Questions?

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