Operational Goals and Putting Them Into Practice

How Philadelphia Water is Making Use of Available Tools

Workshop on the Science of Disinfectant Residual
Mechanicsburg, PA
November 24, 2015

Pennsylvania AWWA
American Water Works Association

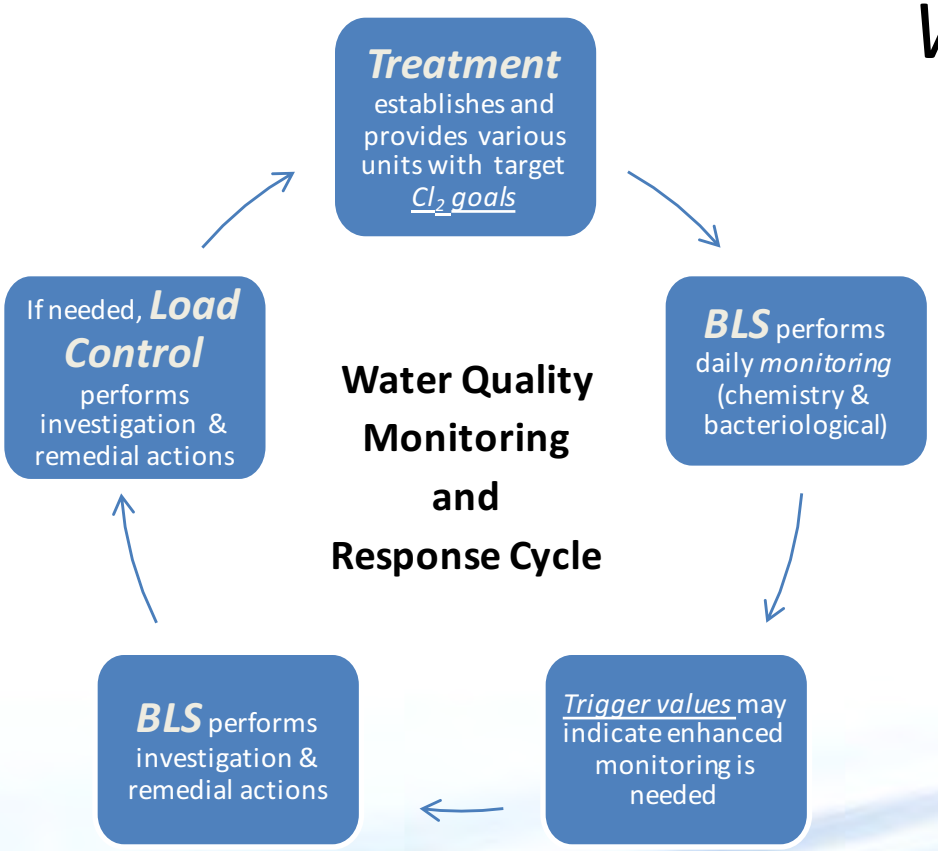
THE WATER WORKS OPERATORS' ASSOCIATION OF PENNSYLVANIA
1927

PHILADELPHIA WATER
EST. 1801

Agenda

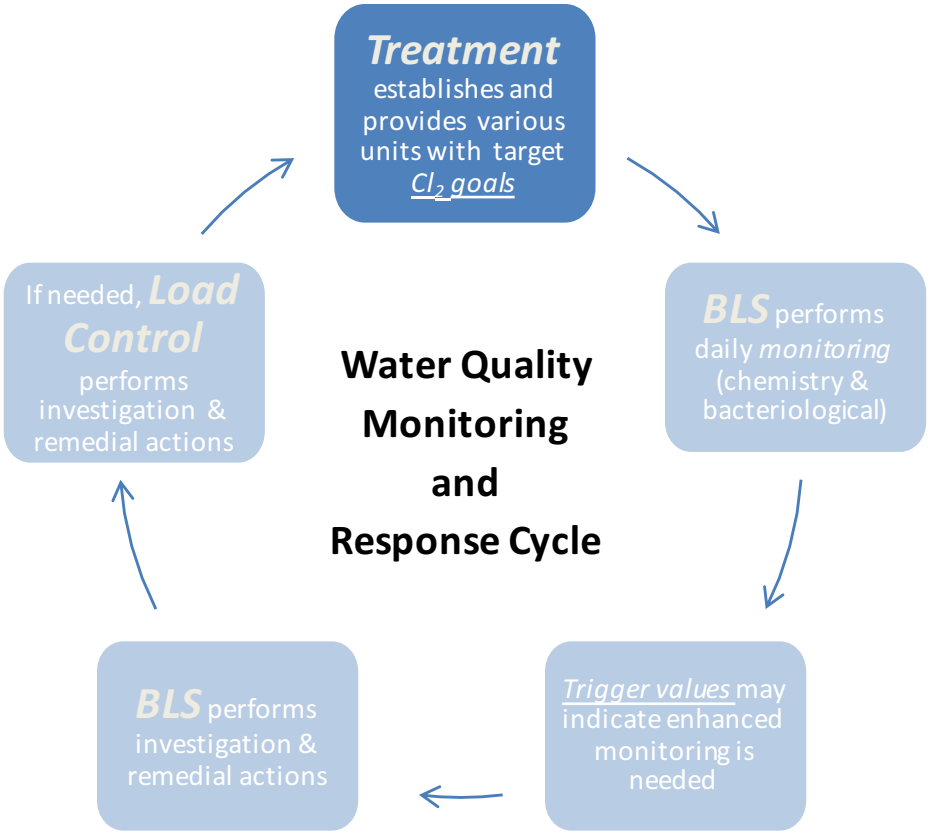
- Response to Declining Water Quality
  - Treatment
  - Bureau of Laboratory Services (BLS)
  - Load Control
- Case studies
- Findings & Conclusions

Response to Declining Water Quality

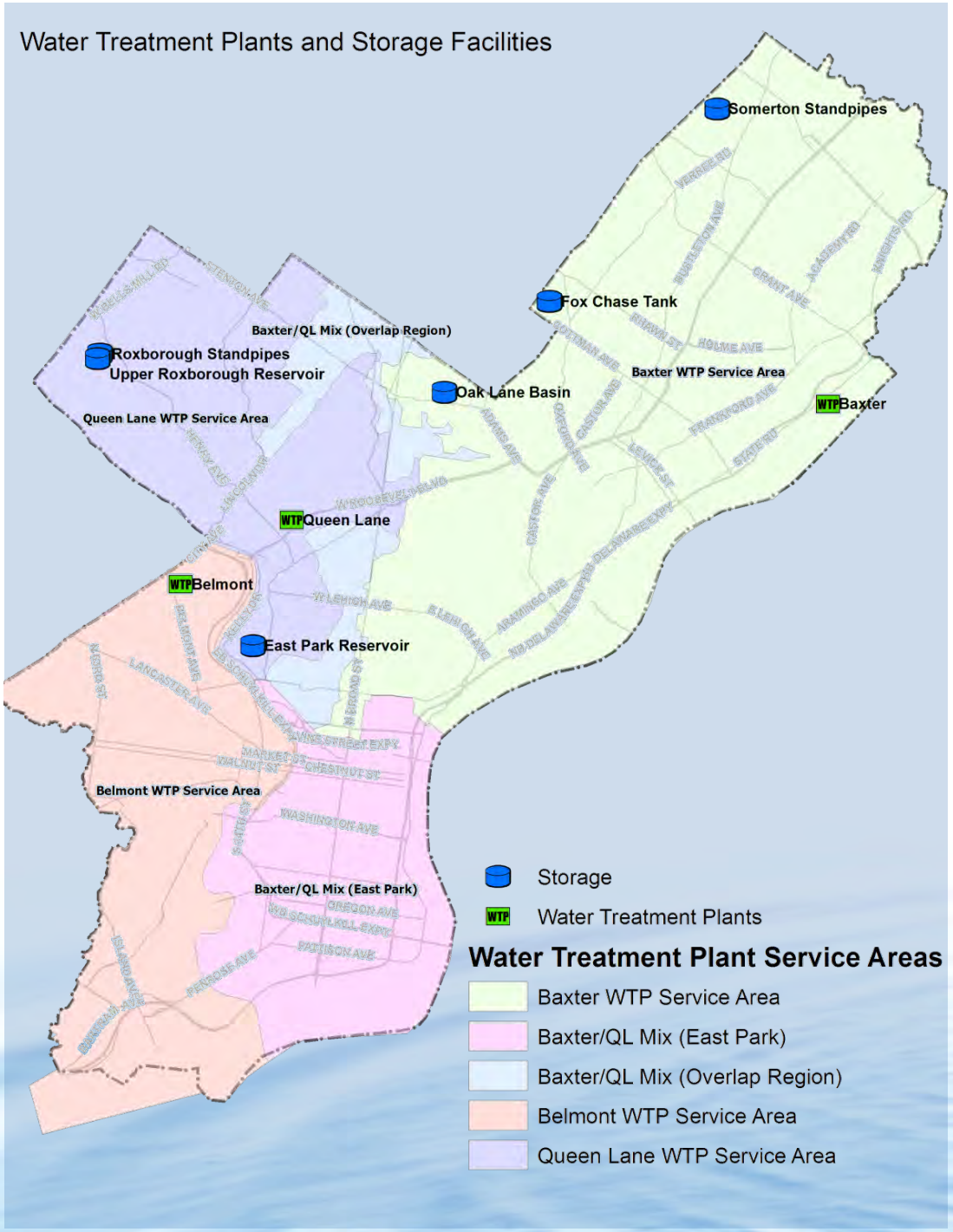


- *Continual, cyclical effort among various Philadelphia Water units:*
  - Treatment
    - Seasonal Cl_2 progressions
  - BLS
    - WQ monitoring (routine and online)
    - Trigger levels
    - Premise & Hydrant Investigations
  - Load Control
    - Hydraulic Investigations & remedial actions
      - Flushing, valving, and water movement operations

Response to Declining Water Quality – Treatment



- *Continual, cyclical effort among various Philadelphia Water units:*
  - Treatment provides seasonal Cl_2 progressions, typically dependent on:
    - Temperature (as water temps. ↑, target Cl2 ↑'s)
    - Operational changes
    - Water age, system demands
    - District trends

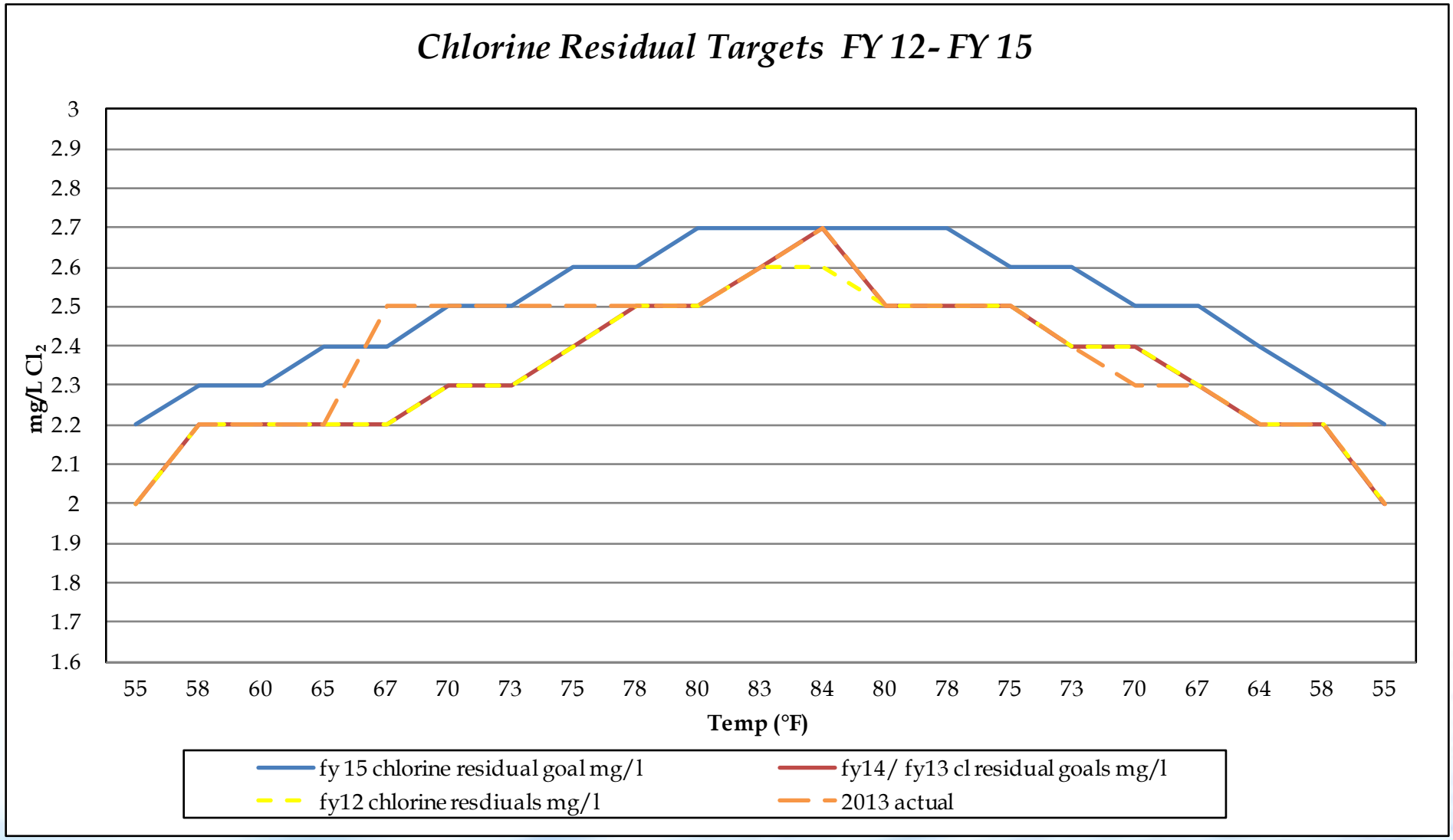

Water Treatment Plants and Storage Facilities
Somerton Standpipes
Fox Chase Tank
Baxter/QL Mix (Overlap Region)
Roxborough Standpipes
Upper Roxborough Reservoir
Oak Lane Basin
Baxter WTP Service Area
WTP Baxter
Queen Lane WTP Service Area
WTP Queen Lane
WTP Belmont
East Park Reservoir
Belmont WTP Service Area
Baxter/QL Mix (East Park)
Storage
WTP Water Treatment Plants
Water Treatment Plant Service Areas
Baxter WTP Service Area
Baxter/QL Mix (East Park)
Baxter/QL Mix (Overlap Region)
Belmont WTP Service Area
Queen Lane WTP Service Area

2014 Chlorine Residual Targets- Water Temperature Dependent				
Distribution Storage Influent mg/l Goal	**Entry Point mg/l Goal**	**Water Temp Distribution Storage online**	**Storage Effluent Online TCL mg/l Goal ≥ 1.50 mg/l**	**Pressure District 13 Influent Online TCL mg/l Goal ≥ 1.00 mg/l**
2	2.2	56F/13.3 C		
2.2	2.2	64F/ 17.7 C		
2.3	2.3	69F/ 20.6 C		
2.4	2.4	74F/23.3 C		
2.5	2.5*	78F/ 25.6 C		
2.6	2.6	81F/ 27.2 C		
2.7	2.7	84F/ 29.4 C		

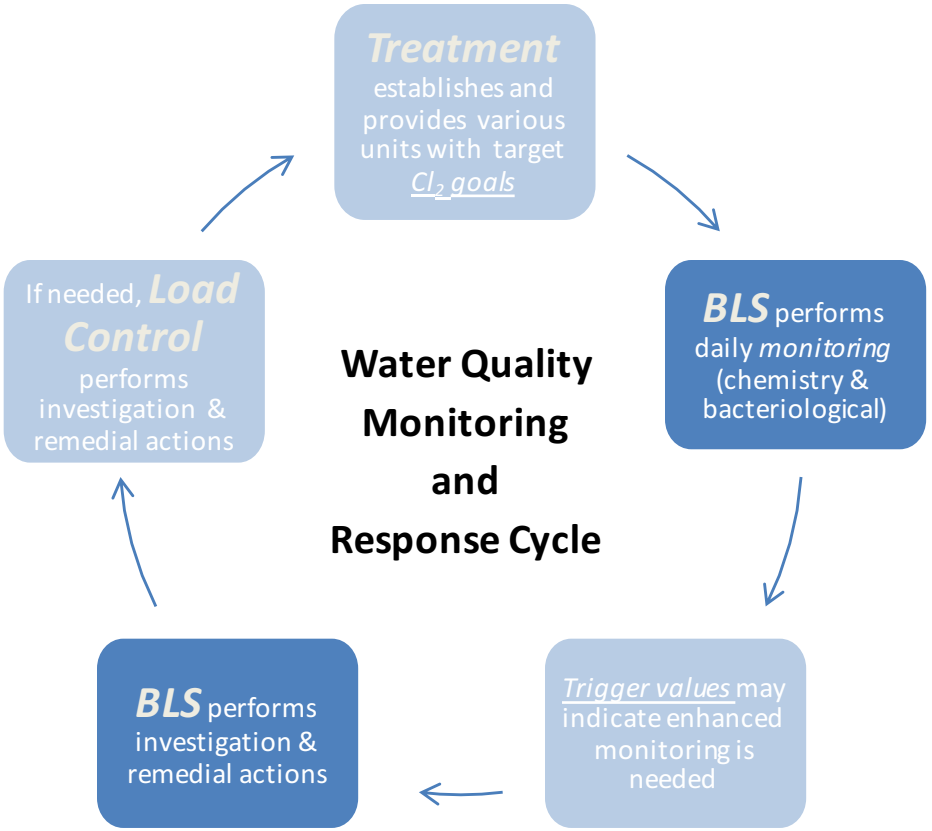
Note: Increased Residual Goal to 2.5 on June 27, 2014 78 F

2015 Chlorine Residual Targets- Water Temperature Dependent				
Distribution Storage Influent mg/l Goal	**Entry Point mg/l Goal**	**Water Temp Distribution Storage online**	**Storage Effluent Online TCL mg/l Goal ≥ 1.50 mg/l**	**Pressure District 13 Influent Online TCL mg/l Goal ≥ 1.00 mg/l**
2	2.2	50 F/13.3 C		
2.2	2.2	55 F/ 17.7 C		
2.3	2.3	58 F/ 20.6 C		
2.4	2.4	64 F/23.3 C		
2.5	2.5	70 F/ 25.6 C		
2.6	2.6	75 F/ 27.2 C		
2.7	2.7	80 F/ 29.4 C		

Note: Increased Residual Goal to 2.5 on June 27, 2014 78 F

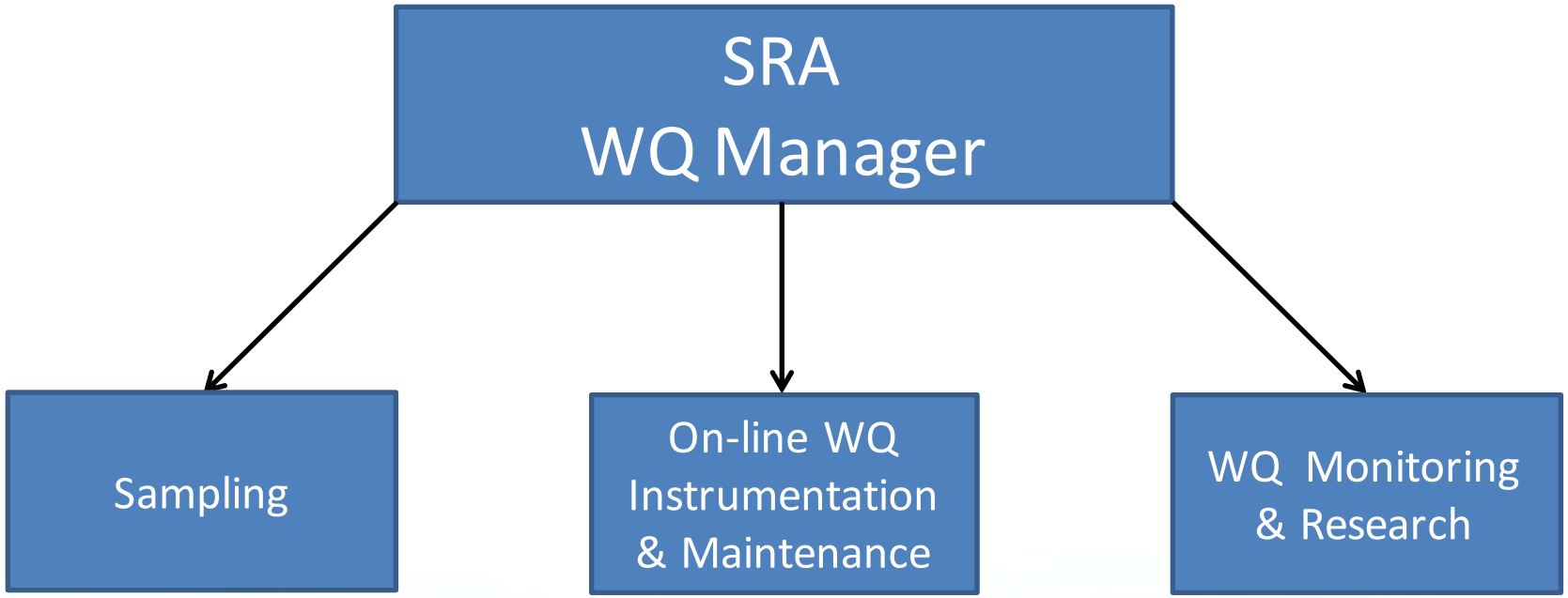

Chlorine Residual Targets FY 12- FY 15
mg/L Cl2
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
55 58 60 65 67 70 73 75 78 80 83 84 80 78 75 73 70 67 64 58 55
Temp (°F)
fy 15 chlorine residual goal mg/l
fy14/ fy13 cl residual goals mg/l
fy12 chlorine resdiuals mg/l
2013 actual

Response to Declining Water Quality – BLS



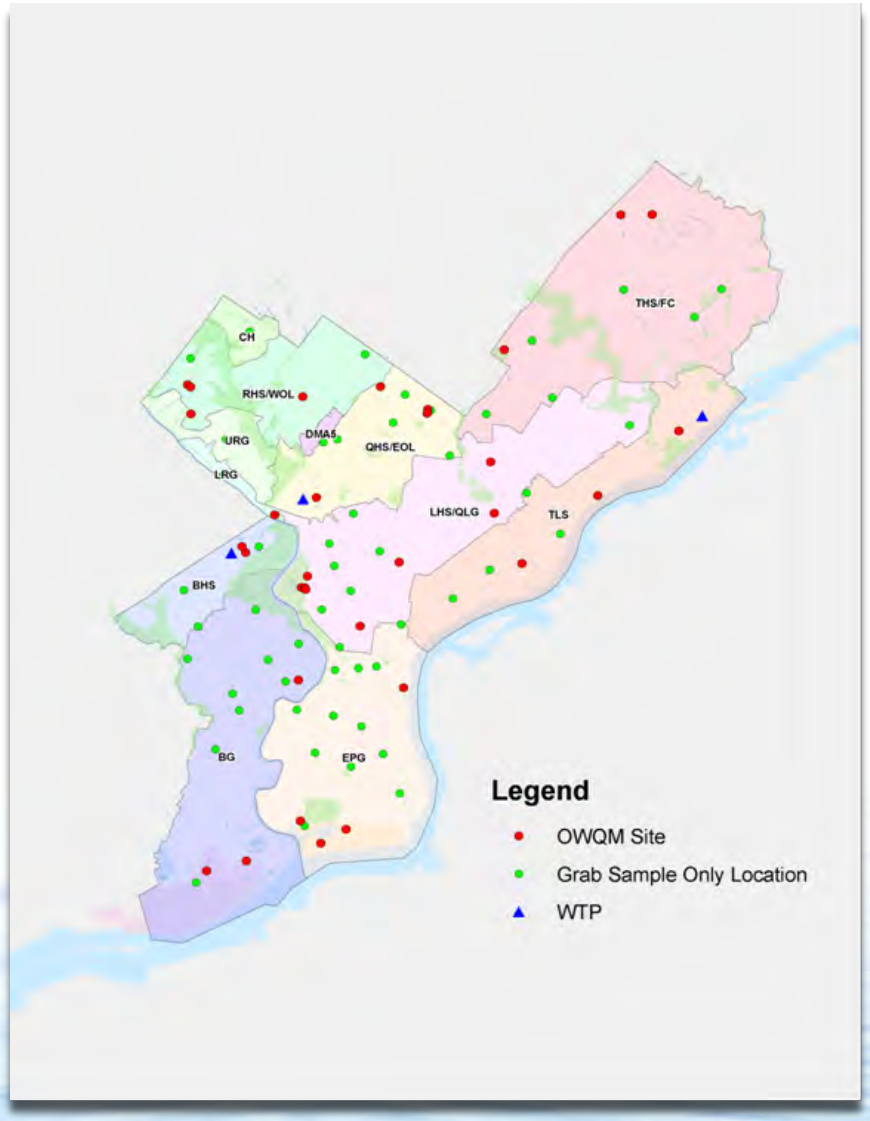
- *Continual, cyclical effort among various Philadelphia Water units:*
  - BLS continually monitors various water quality parameter throughout the distribution system
    - Daily WQ monitoring (routine and on-line)
    - Establishes trigger levels for various parameters
    - Performs premise & hydrant Investigations

BLS Water Quality Management Scientific & Regulatory Affairs Unit (SRA)



Routine Sampling Program

- *Extensive routine "grab" sampling & monitoring program*
- Samples are collected from representative locations throughout the distribution system
  - 80+ sampling locations
  - *Pre-determined* sampling frequency schedule
  - Procedures in place so that water samples collected represents water "from the main"

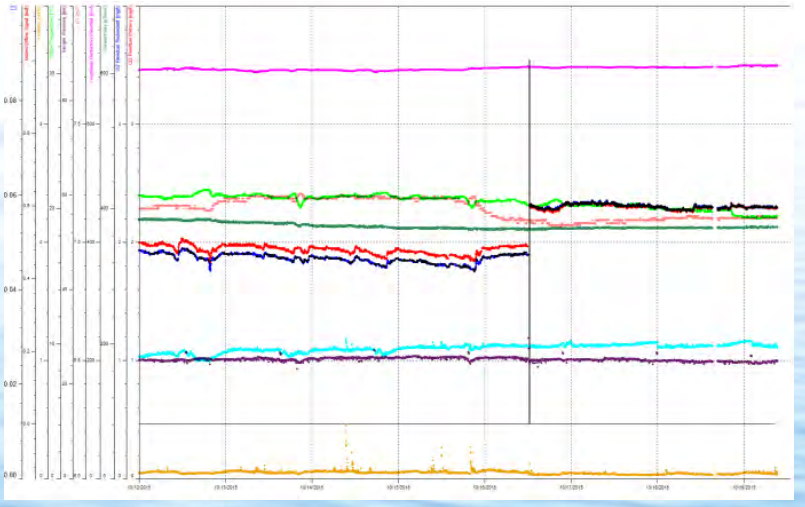


Routine Sampling Program

- *Extensive routine "grab" sampling & monitoring program*
- Population Served: 1,520,001 to 1,850,000
- 360 monthly samples required for TCR
- Philadelphia Water typically collects and analyses:
  - 500+ monthly TCR samples
  - 750+ monthly chlorine residual samples

On-line Monitoring Program

- *Monitor water quality in real-time to establish trends & detect anomalies*
- 36 online sites
- 4 portable units
- Located at WTP effluents, pump stations, storage tanks, reservoirs, and distribution sites
- Real-time 2 minute data transmitted
- Multiple sensors
  - All sites – Cl2, conductivity, pH, ORP, pressure, temperature, turbidity
  - Select sites – flow, UV 254



On-line Monitoring Program

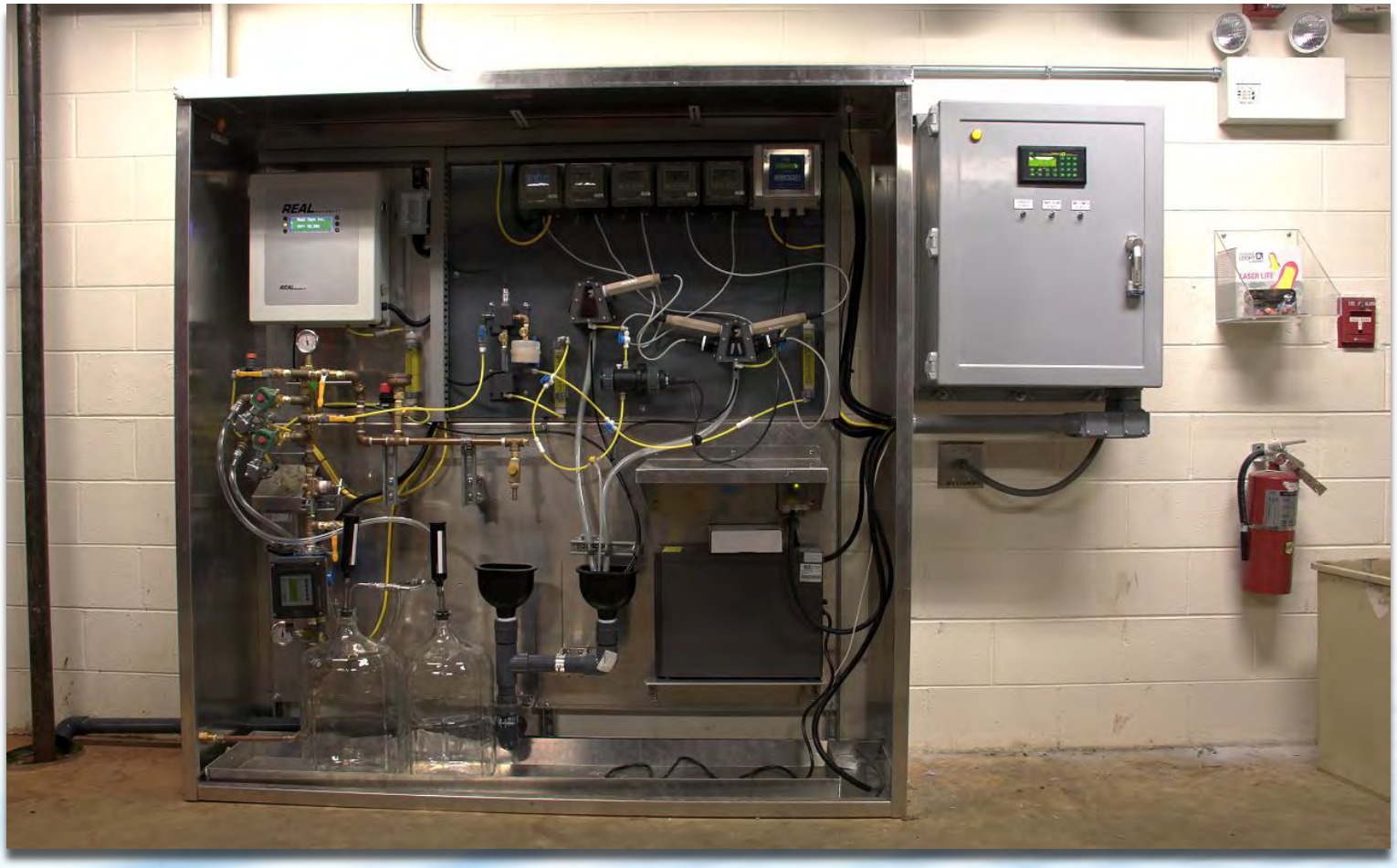
- *Philadelphia Water Facility Water Quality Monitoring Panel*

On-line Monitoring Program

- *Public Building Water Quality Monitoring Panel*

On-line Monitoring Program

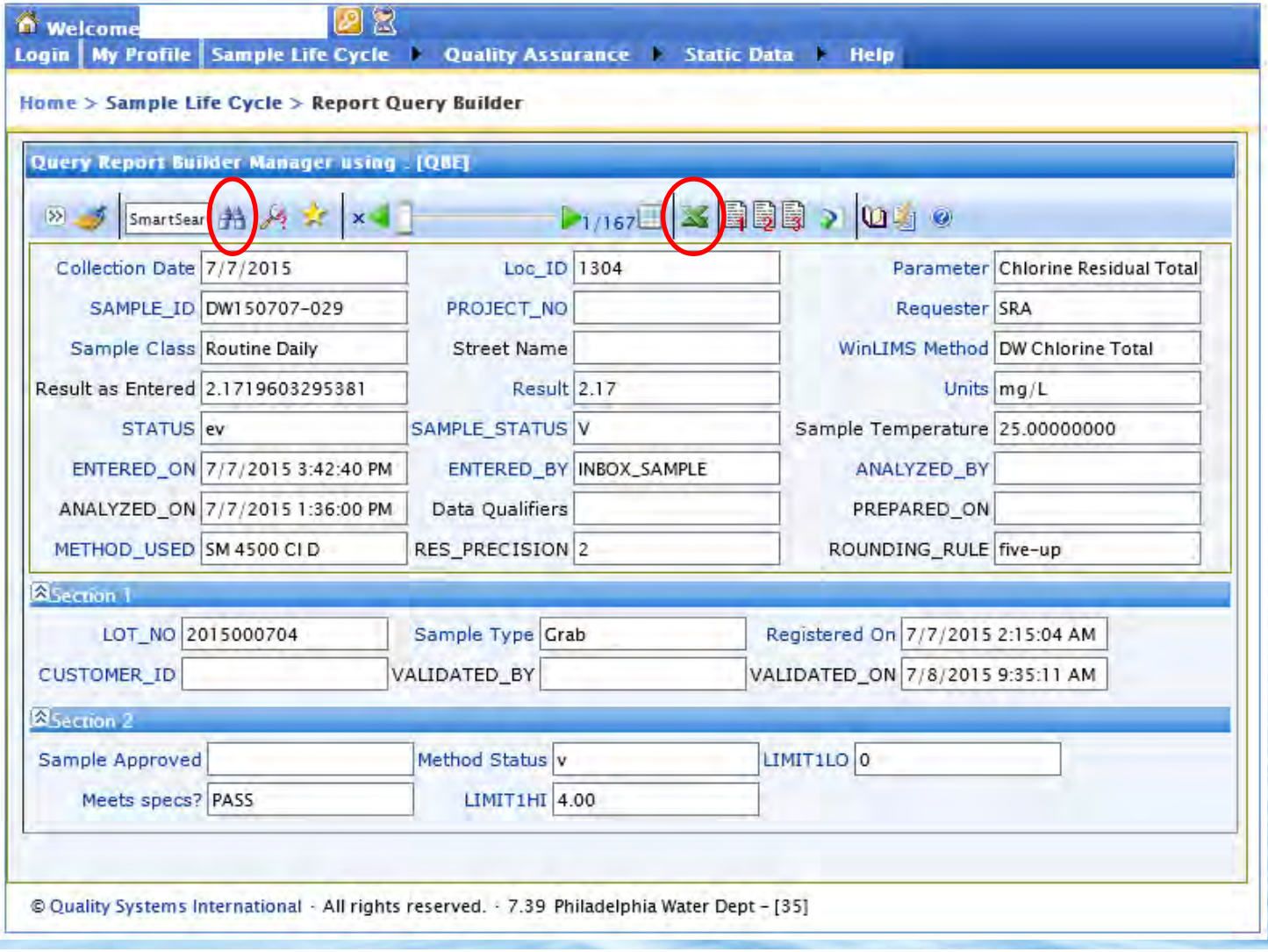
- *Privately Owned Building Water Quality Monitoring Panel*



How Are Data Generated From These Processes Managed & Utilized?

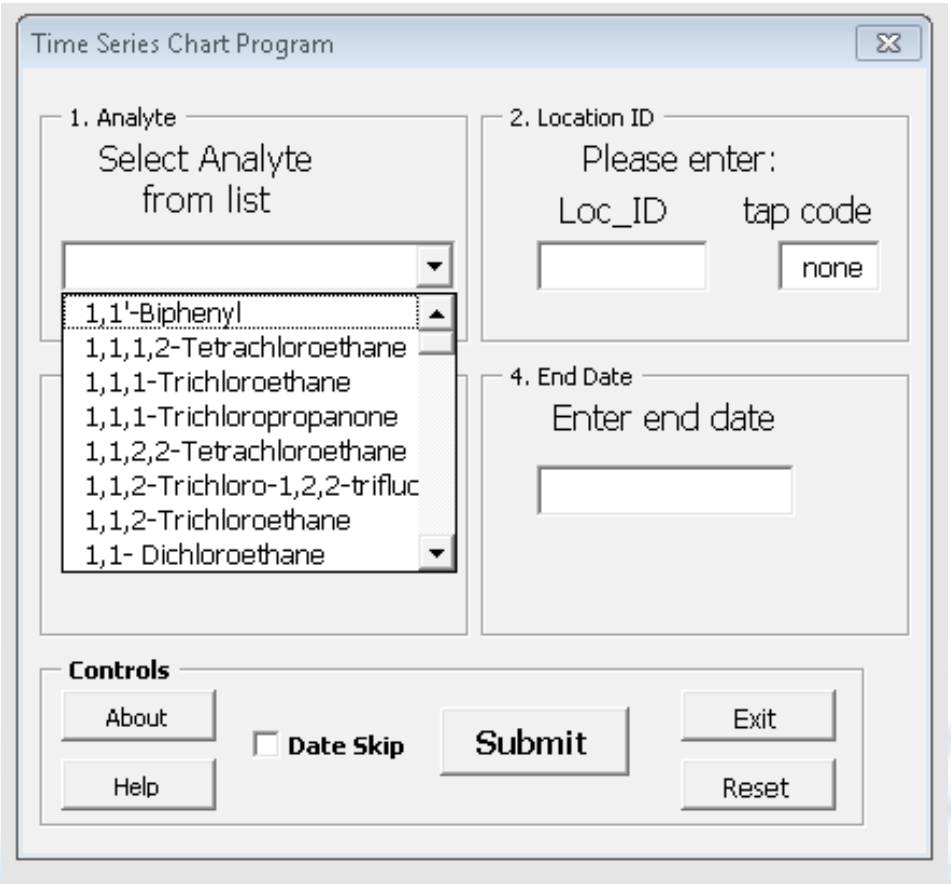
Data Management - LIMS

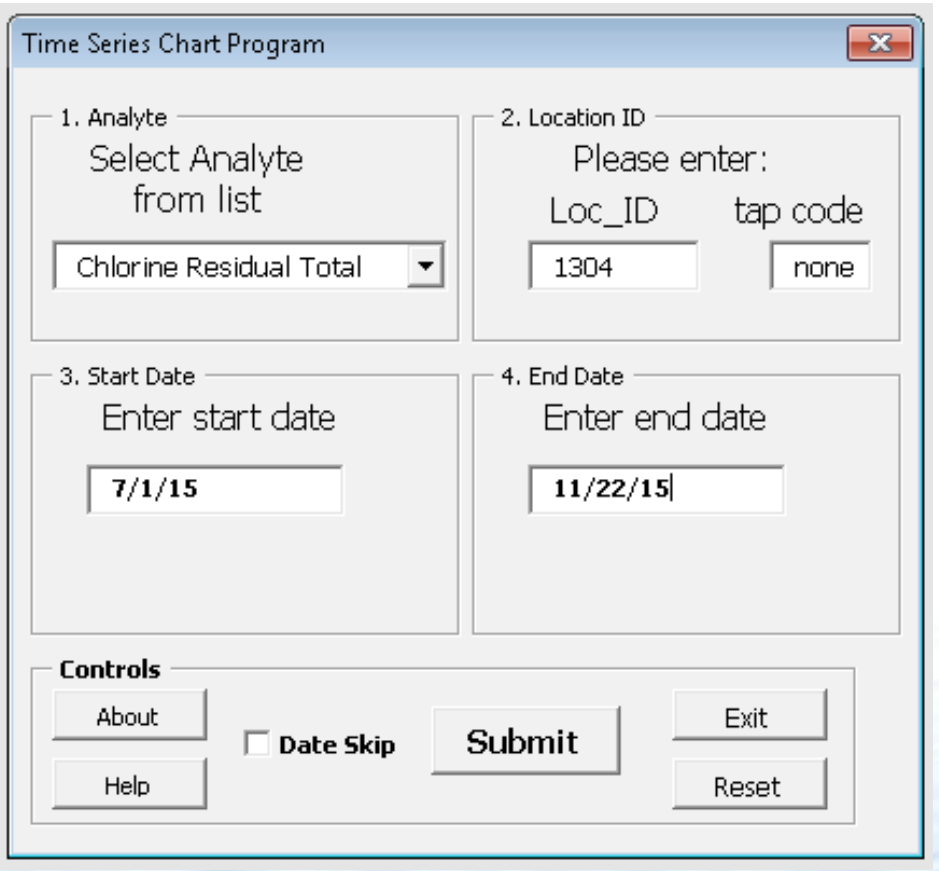
- Laboratory Information Management System houses all analytical testing and grab sample results
  - ➢ data can be exported to excel for further analysis



Data Management – Time Series Program

- Microsoft VBA program developed by BLS IT
  - Extracts analytical information from LIMS and displays via time series





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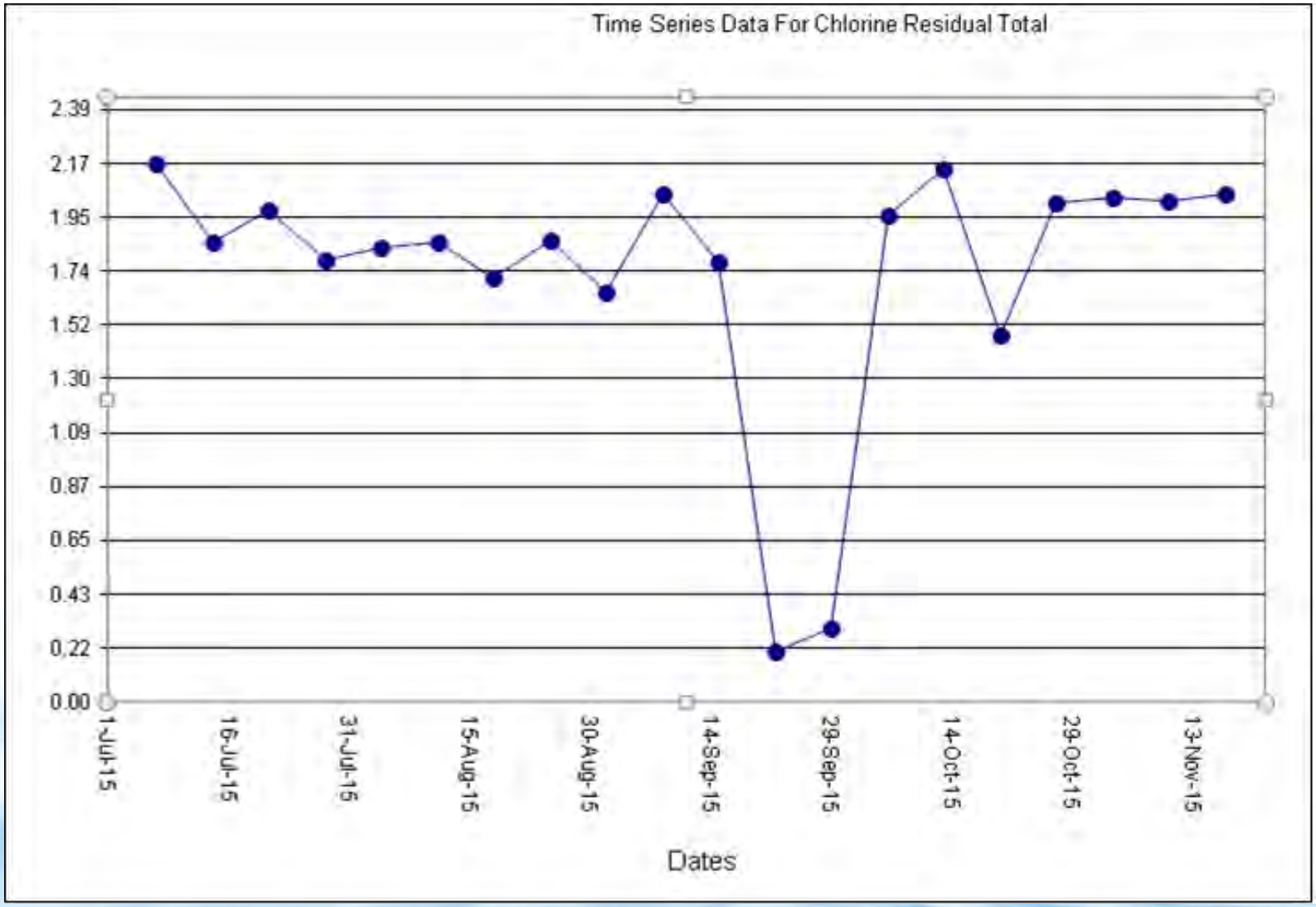


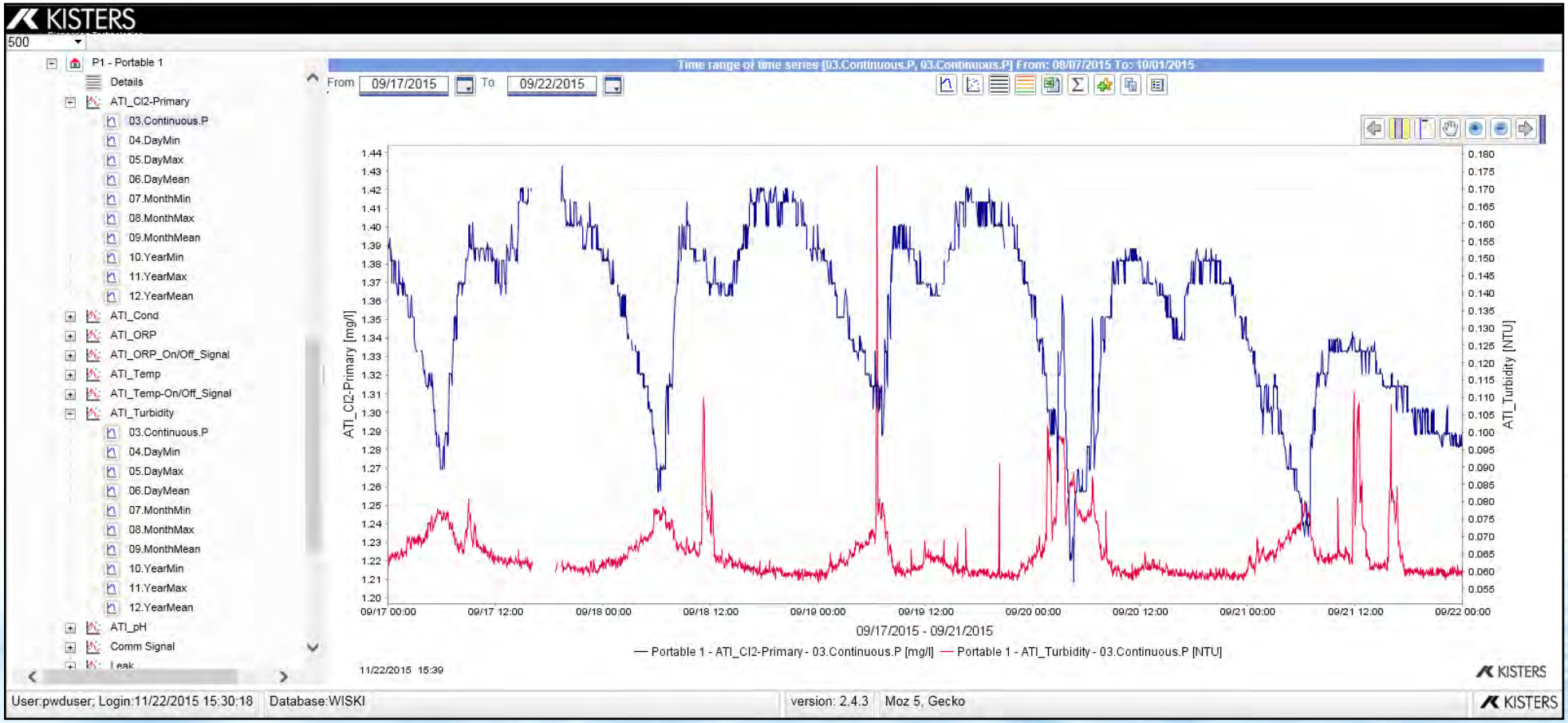
Data Management – Time Series Program

- Microsoft VBA program developed by BLS IT
  - Pulls analytical information from LIMS and displays via time series

	A	B	C	D	E	F	G
1	SAMPLE_ID	DATE1	NRESULT	SUBMITTE	PA_NAME	SRESULT	PARAM_UNITS
2	DW150707-029	7/7/2015	2.17		Chlorine Residual Total		mg/L
3	DW150714-029	7/14/2015	1.85		Chlorine Residual Total		mg/L
4	DW150721-029	7/21/2015	1.98		Chlorine Residual Total		mg/L
5	DW150728-029	7/28/2015	1.78		Chlorine Residual Total		mg/L
6	DW150804-029	8/4/2015	1.83		Chlorine Residual Total		mg/L
7	DW150811-029	8/11/2015	1.85		Chlorine Residual Total		mg/L
8	DW150818-029	8/18/2015	1.71		Chlorine Residual Total		mg/L
9	DW150825-029	8/25/2015	1.86		Chlorine Residual Total		mg/L
10	DW150901-029	9/1/2015	1.65		Chlorine Residual Total		mg/L
11	DW150908-029	9/8/2015	2.05		Chlorine Residual Total		mg/L
12	DW150915-029	9/15/2015	1.77		Chlorine Residual Total		mg/L
13	DW150922-029	9/22/2015	0.20		Chlorine Residual Total		mg/L
14	DW150929-029	9/29/2015	0.30		Chlorine Residual Total		mg/L
15	DW151006-029	10/6/2015	1.96		Chlorine Residual Total		mg/L
16	DW151013-029	10/13/2015	2.15		Chlorine Residual Total		mg/L
17	DW151020-029	10/20/2015	1.48		Chlorine Residual Total		mg/L
18	DW151027-029	10/27/2015	2.01		Chlorine Residual Total		mg/L
19	DW151103-029	11/3/2015	2.03		Chlorine Residual Total		mg/L
20	DW151110-029	11/10/2015	2.02		Chlorine Residual Total		mg/L
21	DW151117-029	11/17/2015	2.05		Chlorine Residual Total		mg/L
22							
23							
24							
25							
26							

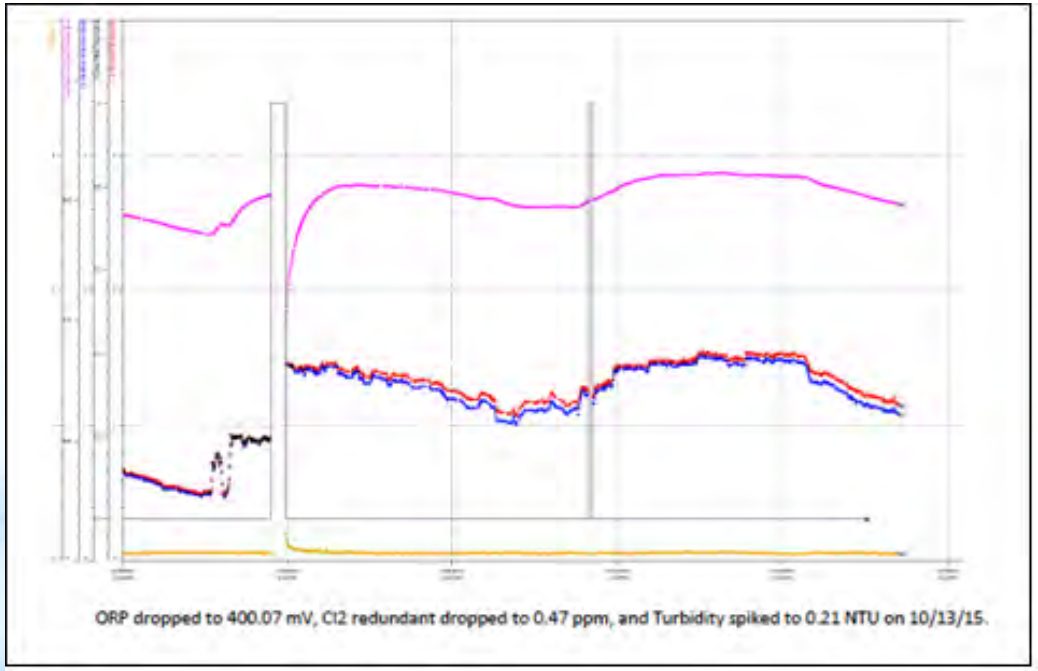
Data Management – WISKI Time Series Program

- Time Series program storing data from on-line sensors
  - Stores data imported from SCADA, which can be exported for analysis
  - Desktop and web applications



Daily Monitoring Reports

- Reports, compiled daily summarizing any anomalous trends from on-line sensor data stored in the WISKI database
  - Allows the WQ staff to understand, in real time and historically, trends at on-line locations
  - Communicates to the On-line group potential maintenance may be needed
  - On-line group informs all BLS WQ staff regarding daily maintenance and updates



ORP dropped to 400.07 mV, Cl2 redundant dropped to 0.47 ppm, and Turbidity spiked to 0.21 NTU on 10/13/15.

Below is a summary of today's alarms 10/23/2015

On-line Water Quality Monitoring

1719: Has a low primary Cl2 of **0.67** ppm, and a low redundant Cl2 of **0.74** ppm.
2502: Has a low primary Cl2 of **0.72** ppm, and a low redundant Cl2 of **0.73** ppm.
7401: Has a low redundant Cl2 of **0.90** ppm, and the primary Cl2 is **1.02** ppm.
7502: No flow

Comments:
2718: pH left offline for repairs (8/19/15).
7302: Site offline during repairs (10/19/15).

Trigger Levels

- Operational Strategy documents dictate levels of acceptable disinfectant residual within distribution and at storage locations
  - Trigger levels may change pending minimum disinfectant residual requirements

Chlorine Residual Trigger Values (mg/L) and Response Actions				
Area	**Normal**	**Triggers Monitoring**	**Triggers Enhanced Monitoring/Load Control Contact**	**Triggers Immediate Site Investigation/ Load Control Contact**
Distribution System (not including reservoirs, tanks, standing pipes)	≥ 1.00	< 1.00	< 0.50	< 0.20
Reservoir/Tank/Standpipe	≥ 1.50	< 1.50	< 1.50	< 1.00

Trigger Levels

Chlorine Residual Trigger Values (mg/L) and Response Actions				
Area	**Normal**	**Triggers Monitoring**	**Triggers Enhanced Monitoring/Load Control Contact**	**Triggers Immediate Site Investigation/ Load Control Contact**
Distribution System (not including reservoirs, tanks, standing pipes)	≥ 1.00	< 1.00	< 0.50	< 0.20
Reservoir/Tank/Standpipe	≥ 1.50	< 1.50	< 1.50	< 1.00

- Voice/email notification (from Inorganic Laboratory to WQ group)
- Level of monitoring will also be based on review of on-line trends (if available), HPC data and other water quality parameters

Trigger Levels

Chlorine Residual Trigger Values (mg/L) and Response Actions				
Area	**Normal**	**Triggers Monitoring**	**Triggers Enhanced Monitoring/Load Control Contact**	**Triggers Immediate Site Investigation/ Load Control Contact**
Distribution System (not including reservoirs, tanks, standing pipes)	≥ 1.00	< 1.00	< 0.50	< 0.20
Reservoir/Tank/Standpipe	≥ 1.50	< 1.50	< 1.50	< 1.00

- Voice/email notification (from Inorganic Laboratory to WQ group)
- Distribution samples will also be analyzed for Nitrite and Ammonia
- On-line trends (if available), HPC data and other water quality parameters will be reviewed
- BLS will conduct site visit and perform local investigation
- Load Control will be notified to initiate a hydraulic investigation and/or flushing

Trigger Levels

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Area	**Normal**	**Triggers Monitoring**	**Triggers Enhanced Monitoring/Load Control Contact**	**Triggers Immediate Site Investigation/ Load Control Contact**
Distribution System (not including reservoirs, tanks, standing pipes)	≥ 1.00	< 1.00	< 0.50	< 0.20
Reservoir/Tank/Standpipe	≥ 1.50	< 1.50	< 1.50	< 1.00

- Personal notification (from Inorganic Laboratory to WQ group)
- Distribution samples will also be analyzed for Nitrite and Ammonia
- On-line trends (if available), HPC data and other water quality parameters will be reviewed
- Immediate actions: either same day or next day site investigation and/or hydraulic investigation and/or flushing

Trigger Levels Recap

- WQ Research & Monitoring team extensively monitors all locations
- If trigger levels are exceeded, the team is notified
- Triggers Monitoring
  - voice or e-mail communications
  - If available, review on-line trends, HPC data and other parameters
- Triggers Enhanced Monitoring/Load Control Contact
  - Voice or email communications
  - Distribution samples will also be analyzed for Nitrite and Ammonia
  - If available, review on-line trends, HPC data and other parameters
  - BLS will conduct site visit and perform local investigation
  - Load Control will be notified to initiate a hydraulic investigation and/or flushing

Trigger Levels Recap

- Triggers Immediate Site Investigation/Load Control Contact
  - Personal Communications
  - Distribution samples will also be analyzed for Nitrite and Ammonia
  - If available, review on-line trends, HPC data and other parameters
  - Immediate actions: either same day or next day site investigation and/or hydraulic investigation and/or flushing

Trigger Levels – SRA WQ Group Meetings

- WQ Research & Monitoring team meets regularly to review water quality trends within the distribution system and at storage facilities
- Meetings are intended to plan for remedial actions in response to water quality deterioration
- Actions include, but are not limited to:
  - Site investigations
  - Adjusting sampling protocols
  - Sample tap or dedicated sampler tap maintenance
- Meetings are more frequent during the summer season, as water quality deteriorates more rapidly in warmer weather
- Utilize Microsoft VBA Programs , incorporating defined trigger levels to identify sites exceeding triggers

Trigger Levels – Microsoft VBA Program 1

- Data from LIMS
- Makes the *Distribution System Anomalies* list if, for any location:
  - Total CL_2 < 1.00 mg/L
  - HPC is detected
  - Turbidity > 0.300 NTU
  - Pre-scheduled routine sample was not collected
  - Any parameter(s) not tested

PHILADELPHIA WATER DEPARTMENT - BUREAU OF LABORATORY SERVICES

DISTRIBUTION SYSTEM - ANOMALIES

Summary of Recent Instances - Low Chlorine, High HPC, or High Turbidity

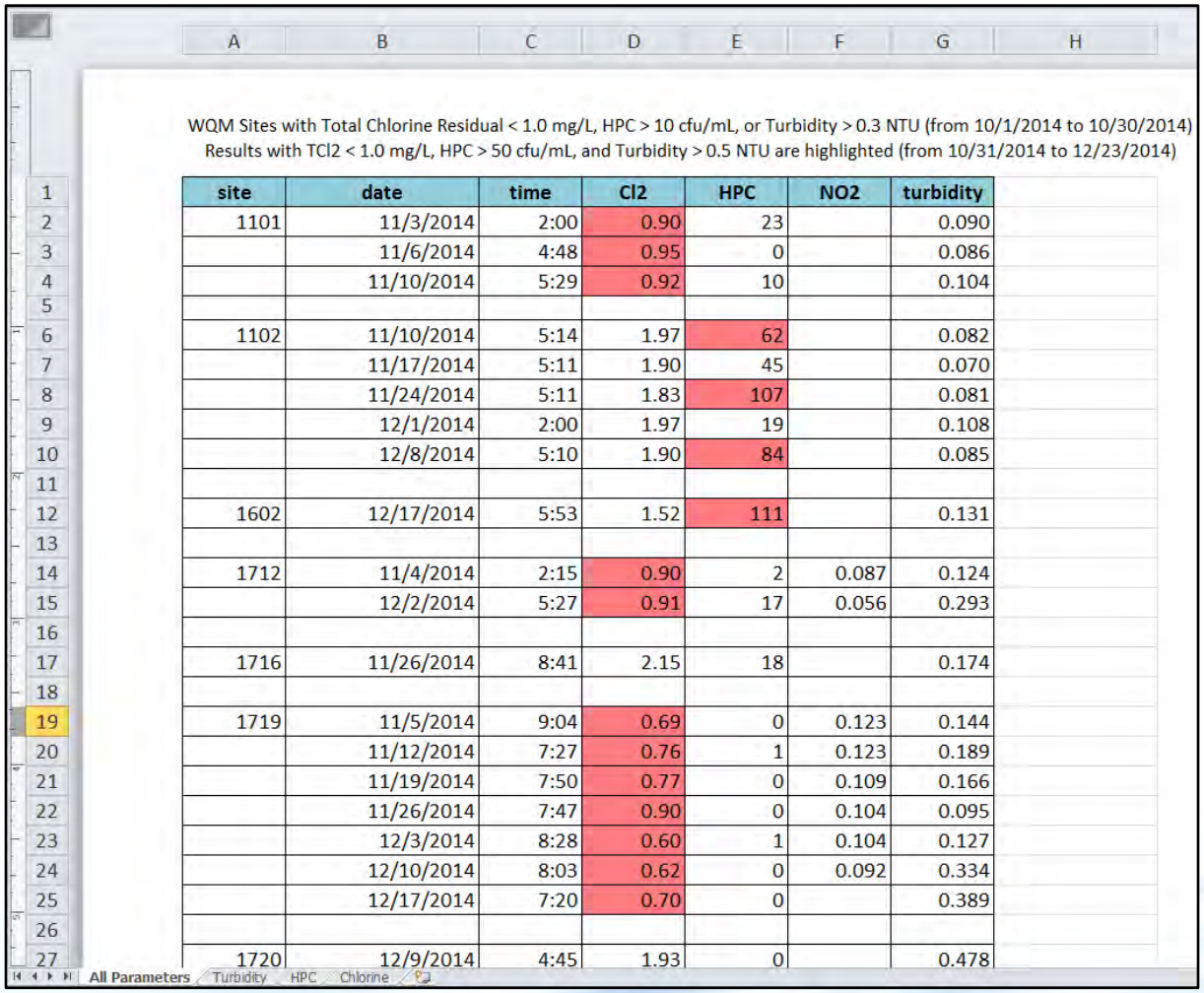
Period covered by this report: 11/17/2014 to 11/18/2014

Identifying Information				Analytes		
Sample Date	Loc_ID	Tap code	Disinf code	HPC	Chlorine Res	Turbidity
11/17/14	7302			4	2.03	0.078
11/17/14	1102		P	45	1.90	0.070
11/17/14	3904			4	0.75 *	0.231
11/17/14	2703			2	1.00	0.191
11/17/14	1603		P	0	0.55 *	0.077
11/17/14	3907		P	7	1.56	0.101
11/18/14	1711			NS	NS	NS
11/18/14	2707		P	7	2.02	0.416 *
11/18/14	1305		P	2	1.75	0.091
11/18/14	1720		P	4	2.10	0.280
11/18/14	2704		P	2	1.50	0.138
11/18/14	7502			3	1.49	0.086
11/18/14	1716			2	2.07	0.199

Page 1

*Indicates anomalous value

Trigger Levels – Microsoft VBA Program 2



WQM Sites with Total Chlorine Residual < 1.0 mg/L, HPC > 10 cfu/mL, or Turbidity > 0.3 NTU (from 10/1/2014 to 10/30/2014)
Results with TCl2 < 1.0 mg/L, HPC > 50 cfu/mL, and Turbidity > 0.5 NTU are highlighted (from 10/31/2014 to 12/23/2014)

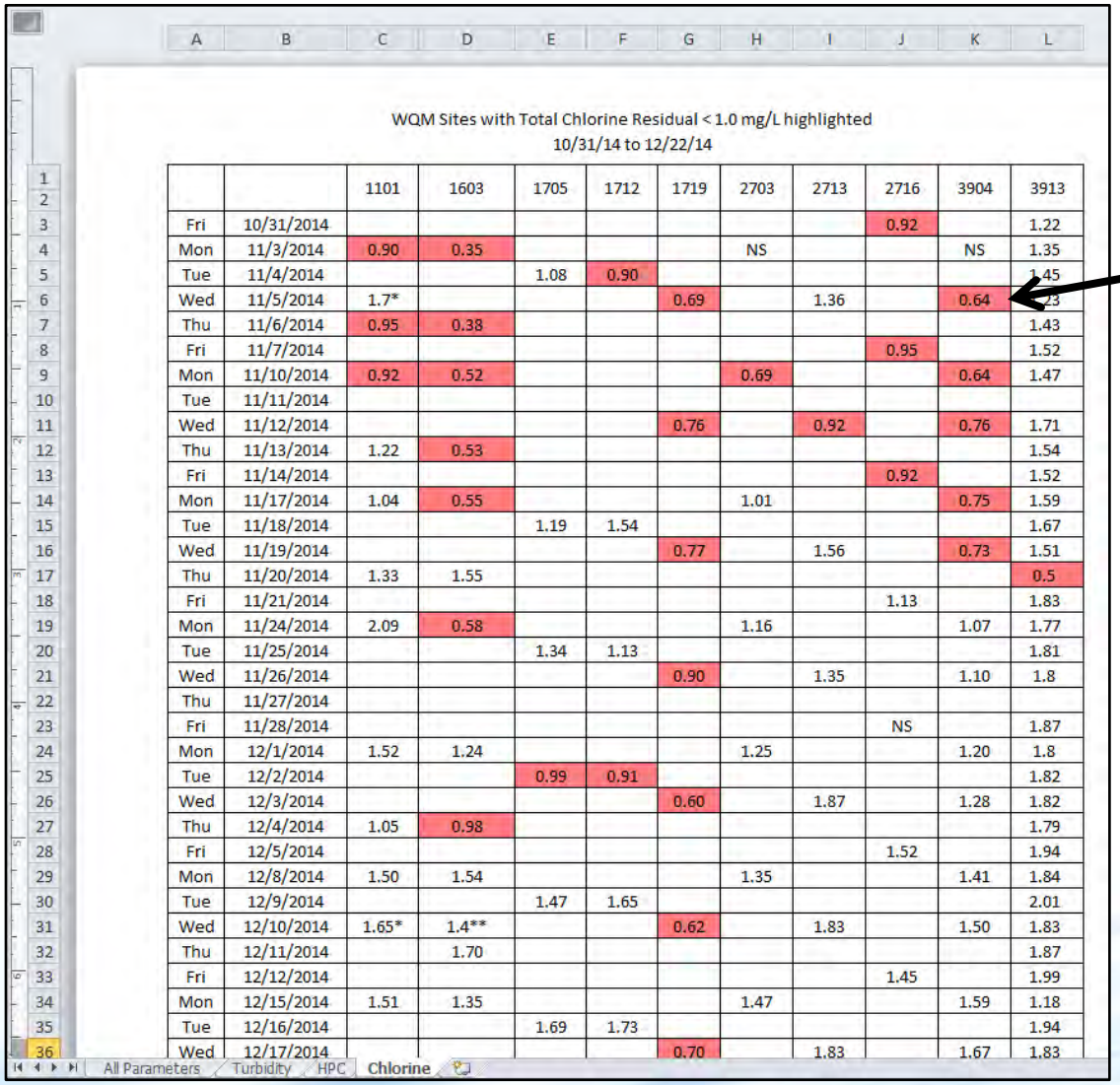
site	date	time	Cl2	HPC	NO2	turbidity
1101	11/3/2014	2:00	0.90	23		0.090
	11/6/2014	4:48	0.95	0		0.086
	11/10/2014	5:29	0.92	10		0.104
1102	11/10/2014	5:14	1.97	62		0.082
	11/17/2014	5:11	1.90	45		0.070
	11/24/2014	5:11	1.83	107		0.081
	12/1/2014	2:00	1.97	19		0.108
	12/8/2014	5:10	1.90	84		0.085
1602	12/17/2014	5:53	1.52	111		0.131
1712	11/4/2014	2:15	0.90	2	0.087	0.124
	12/2/2014	5:27	0.91	17	0.056	0.293
1716	11/26/2014	8:41	2.15	18		0.174
1719	11/5/2014	9:04	0.69	0	0.123	0.144
	11/12/2014	7:27	0.76	1	0.123	0.189
	11/19/2014	7:50	0.77	0	0.109	0.166
	11/26/2014	7:47	0.90	0	0.104	0.095
	12/3/2014	8:28	0.60	1	0.104	0.127
	12/10/2014	8:03	0.62	0	0.092	0.334
	12/17/2014	7:20	0.70	0		0.389
1720	12/9/2014	4:45	1.93	0		0.478

All Parameters | Turbidity | HPC | Chlorine

Appears on this list if:
Cl_2 < 1.00 mg/L,
HPC > 10 MPN/mL,
Turbidity > 0.300 NTU

- Similar structure to VBA program 1, but provides a tabular time-series analysis for each site per parameter set on the anomalies list...

Trigger Levels – Microsoft VBA Program 2



WQM Sites with Total Chlorine Residual < 1.0 mg/L highlighted
10/31/14 to 12/22/14

		1101	1603	1705	1712	1719	2703	2713	2716	3904	3913
Fri	10/31/2014								0.92		1.22
Mon	11/3/2014	0.90	0.35				NS			NS	1.35
Tue	11/4/2014			1.08	0.90						1.45
Wed	11/5/2014	1.7*				0.69		1.36		0.64	23
Thu	11/6/2014	0.95	0.38								1.43
Fri	11/7/2014								0.95		1.52
Mon	11/10/2014	0.92	0.52				0.69			0.64	1.47
Tue	11/11/2014										
Wed	11/12/2014					0.76		0.92		0.76	1.71
Thu	11/13/2014	1.22	0.53								1.54
Fri	11/14/2014								0.92		1.52
Mon	11/17/2014	1.04	0.55				1.01			0.75	1.59
Tue	11/18/2014			1.19	1.54						1.67
Wed	11/19/2014					0.77		1.56		0.73	1.51
Thu	11/20/2014	1.33	1.55								0.5
Fri	11/21/2014								1.13		1.83
Mon	11/24/2014	2.09	0.58				1.16			1.07	1.77
Tue	11/25/2014			1.34	1.13						1.81
Wed	11/26/2014					0.90		1.35		1.10	1.8
Thu	11/27/2014										
Fri	11/28/2014								NS		1.87
Mon	12/1/2014	1.52	1.24				1.25			1.20	1.8
Tue	12/2/2014			0.99	0.91						1.82
Wed	12/3/2014					0.60		1.87		1.28	1.82
Thu	12/4/2014	1.05	0.98								1.79
Fri	12/5/2014								1.52		1.94
Mon	12/8/2014	1.50	1.54				1.35			1.41	1.84
Tue	12/9/2014			1.47	1.65						2.01
Wed	12/10/2014	1.65*	1.4**			0.62		1.83		1.50	1.83
Thu	12/11/2014		1.70								1.87
Fri	12/12/2014								1.45		1.99
Mon	12/15/2014	1.51	1.35				1.47			1.59	1.18
Tue	12/16/2014			1.69	1.73						1.94
Wed	12/17/2014					0.70		1.83		1.67	1.83

All Parameters | Turbidity | HPC | Chlorine

Result is highlighted if Cl_2 < 1.00 mg/L

- And site specific time-series data for specific parameter(s) of concern

How Does Philadelphia Water Proceed When Trigger Levels Are Exceeded?

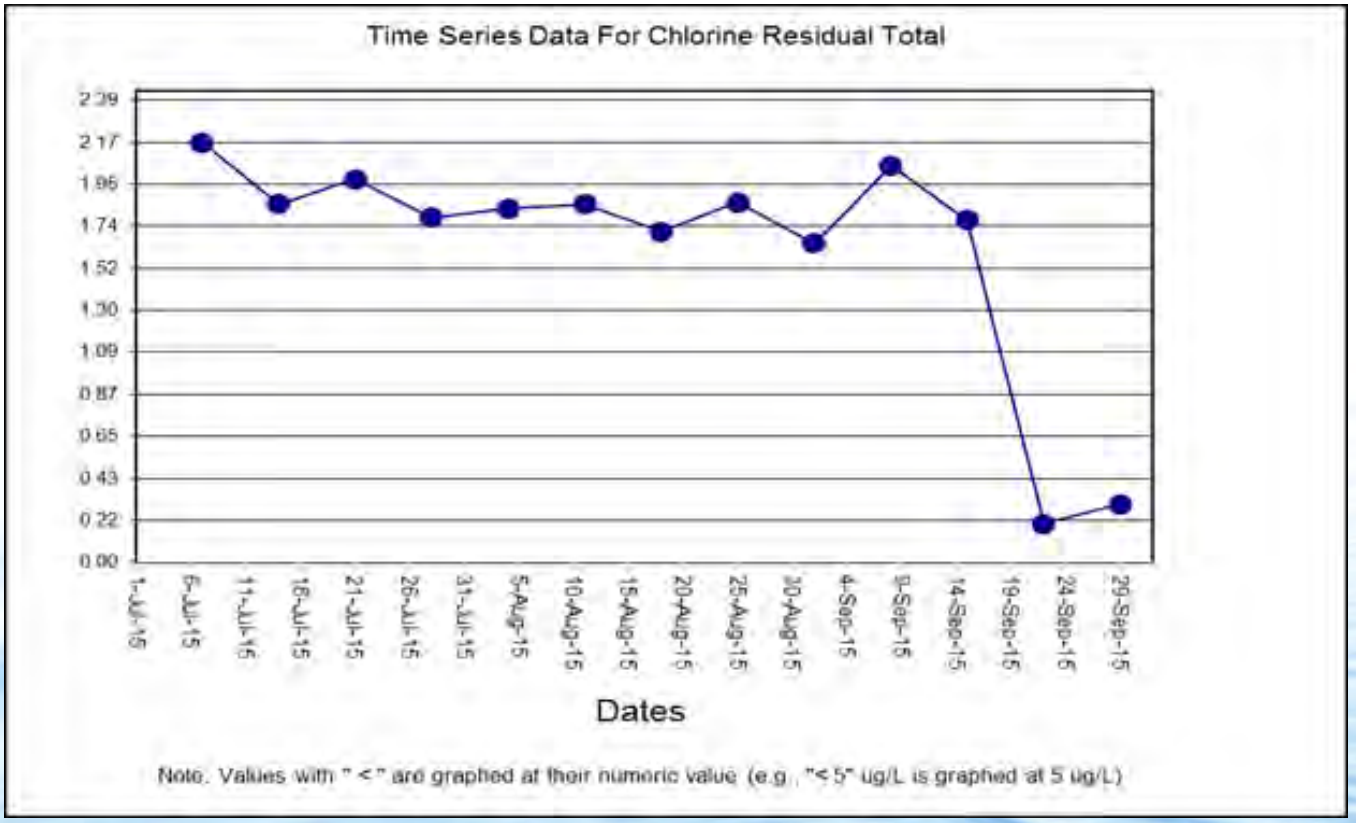
Through Investigation and Remedial Action

(some may be a "simple, quick remediation", others can be more prolonged or recurring)

Case Study 1 – Routine Sampling Station

Sudden Cl_2 drop, Significant Presence of HPC

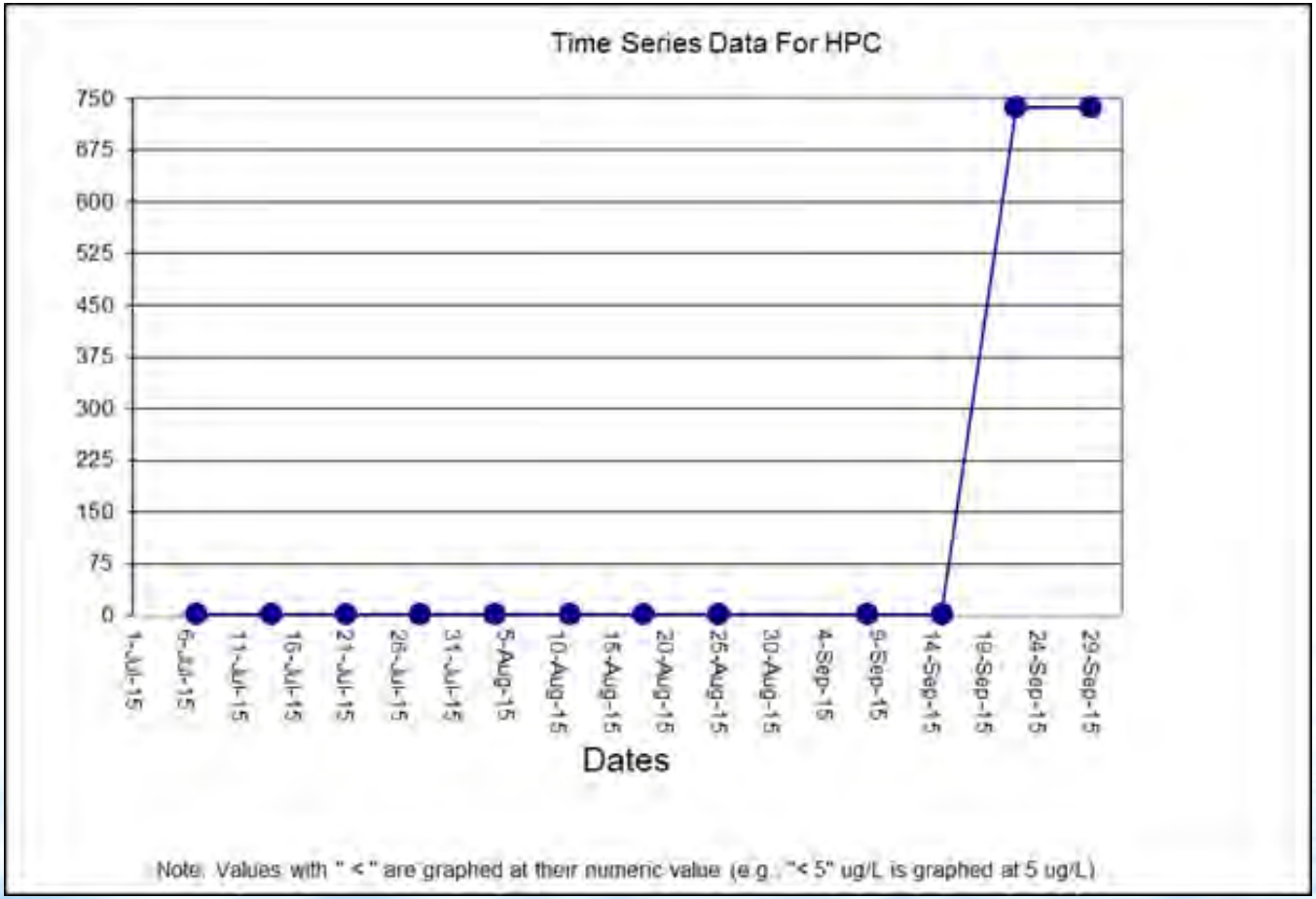
- Anomaly programs identified routine samples collected from a routine sampling station (close to WTP district entry point) with low disinfectant residuals and elevated levels of heterotrophic bacteria
- Time series total chlorine residual data



Case Study 1 – Routine Sampling Station

Sudden Cl_2 drop, Significant Presence of HPC

- Time series HPC data



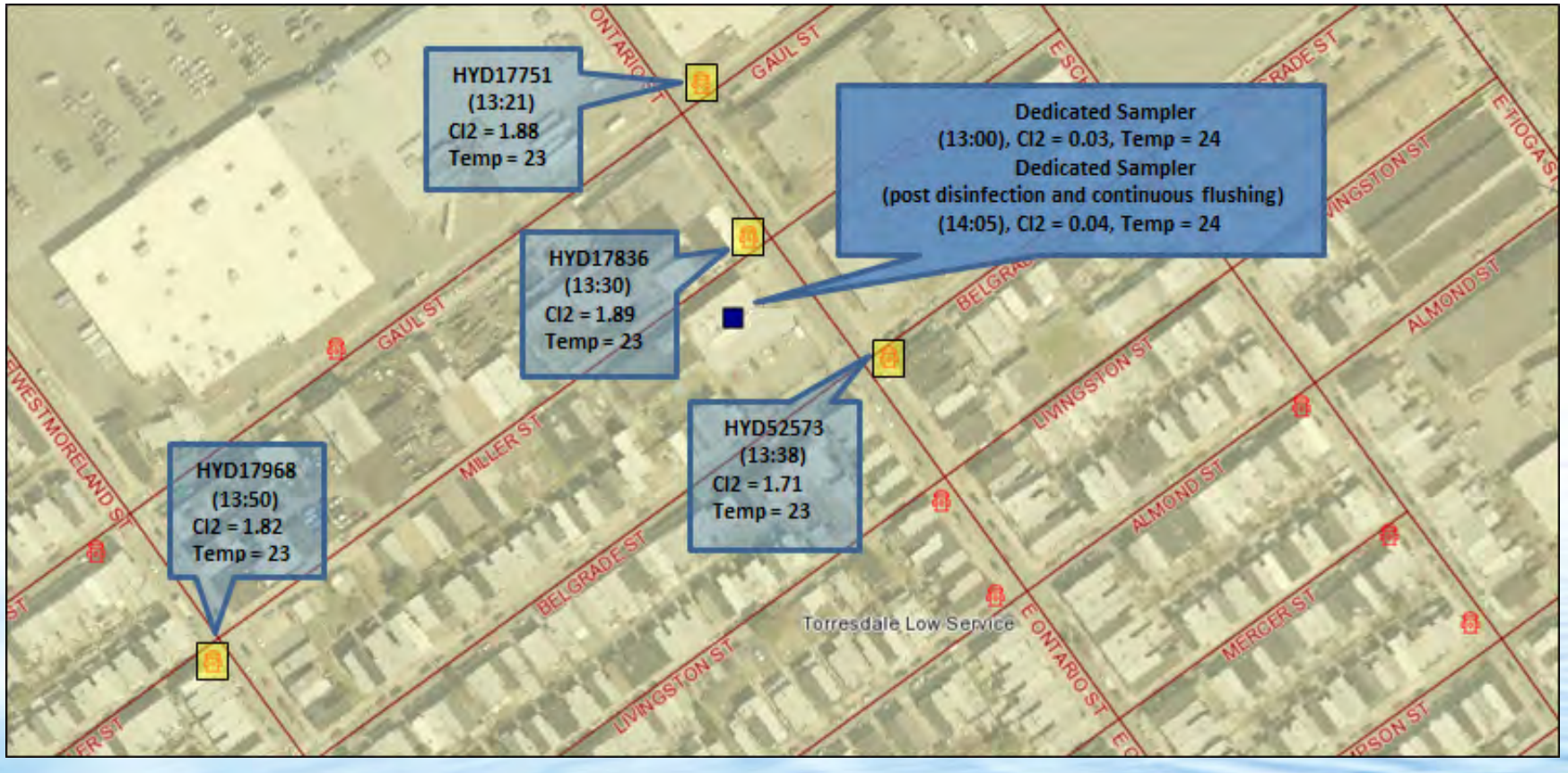
Case Study 1 – Routine Sampling Station

Sudden Cl_2 drop, Significant Presence of HPC

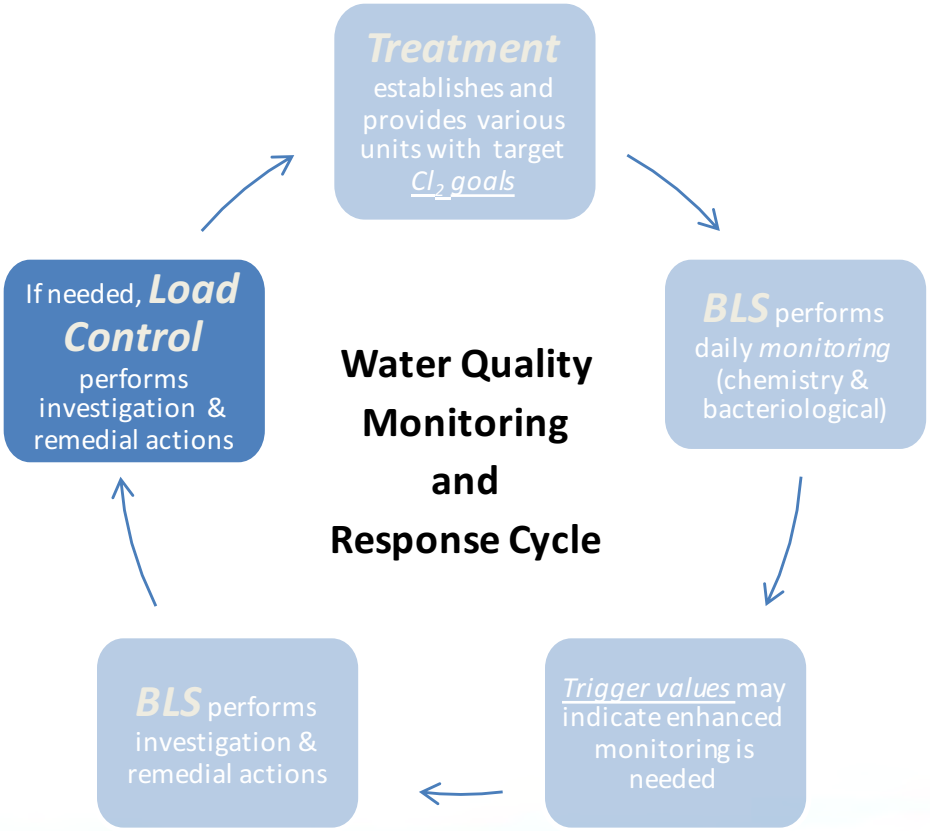
- Prompted BLS to initiate a site and hydrant investigation
  - On-site total chlorine residual analysis
- Hydrants for testing selected using Hydraulic Modeling
  - pipe and flow characteristics are incorporated into the model
  - helps identify the likely flow and direction of flow when the routine samples were collected

Case Study 1 – Routine Sampling Station
Sudden Cl_2 drop, Significant Presence of HPC

- BLS on-site investigation (total chlorine residual results)
  - Hydrant chlorine levels showed normal total chlorine levels
  - Routine location chlorine levels were low



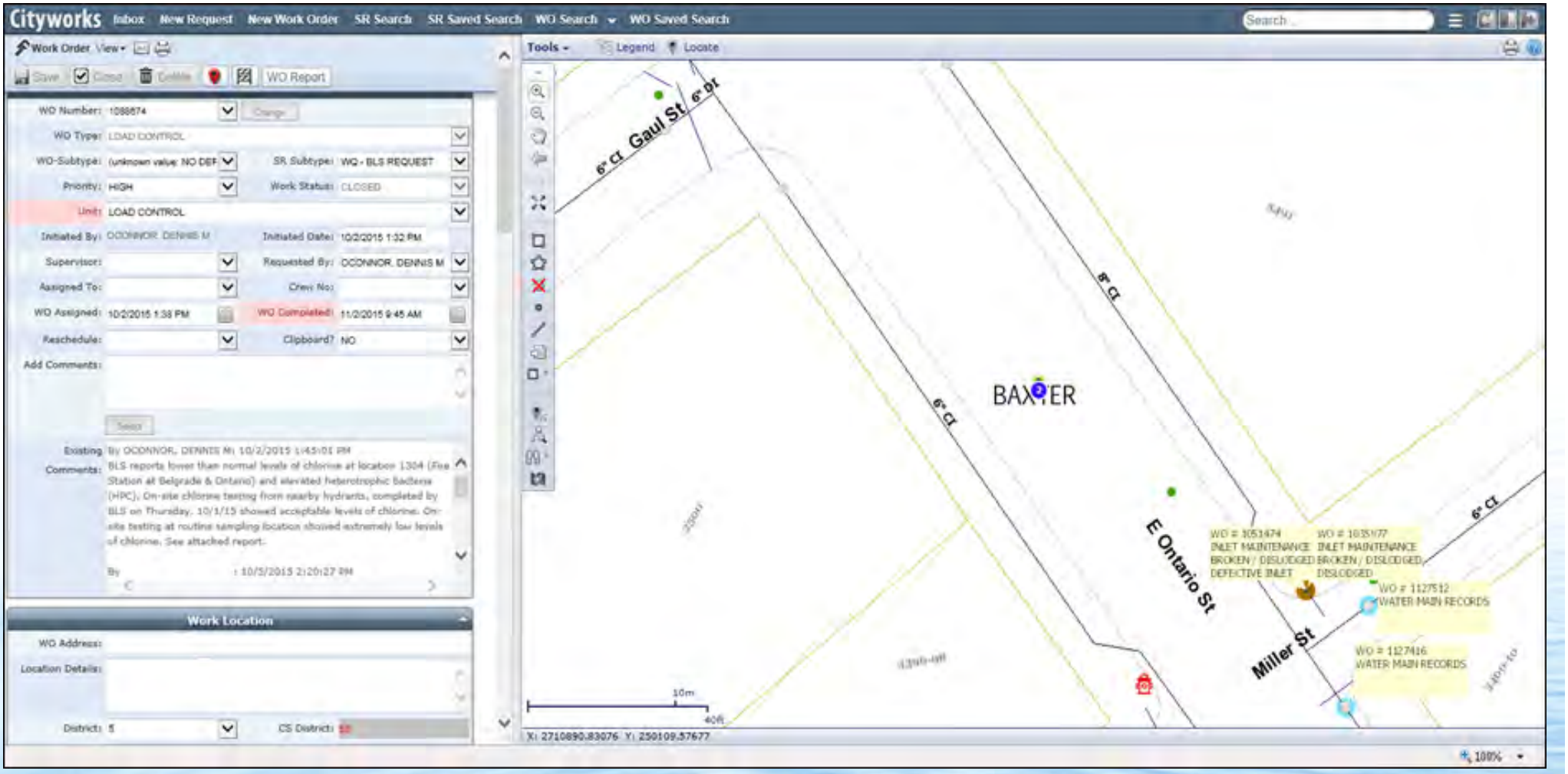
Case Study 1 – Routine Sampling Station
Response to Declining Water Quality – Load Control



- *Continual, cyclical effort among various Philadelphia Water units:*
  - Load Control
    - Hydraulic investigations & remedial actions
      - Valve inspection, valve operation, flushing and water movement operations
      - Aggressively monitors water age and flushes to promote turnover

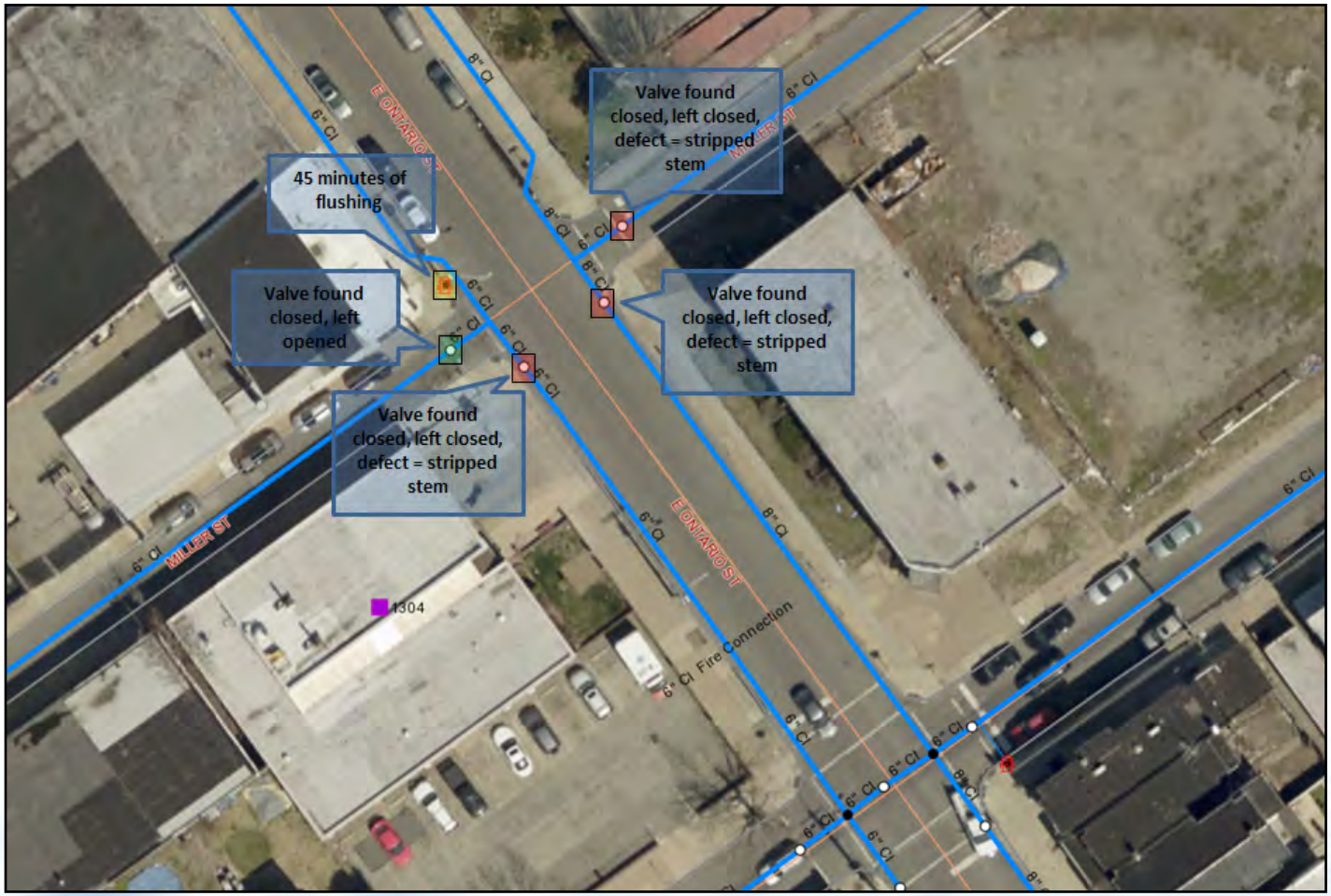
Case Study 1 – Routine Sampling Station
Sudden Cl_2 drop, Significant Presence of HPC

- Work Order submitted to Load Control via CityWorks (ArcGIS)
  - public asset work order management system
  - displays work orders in the nearby area



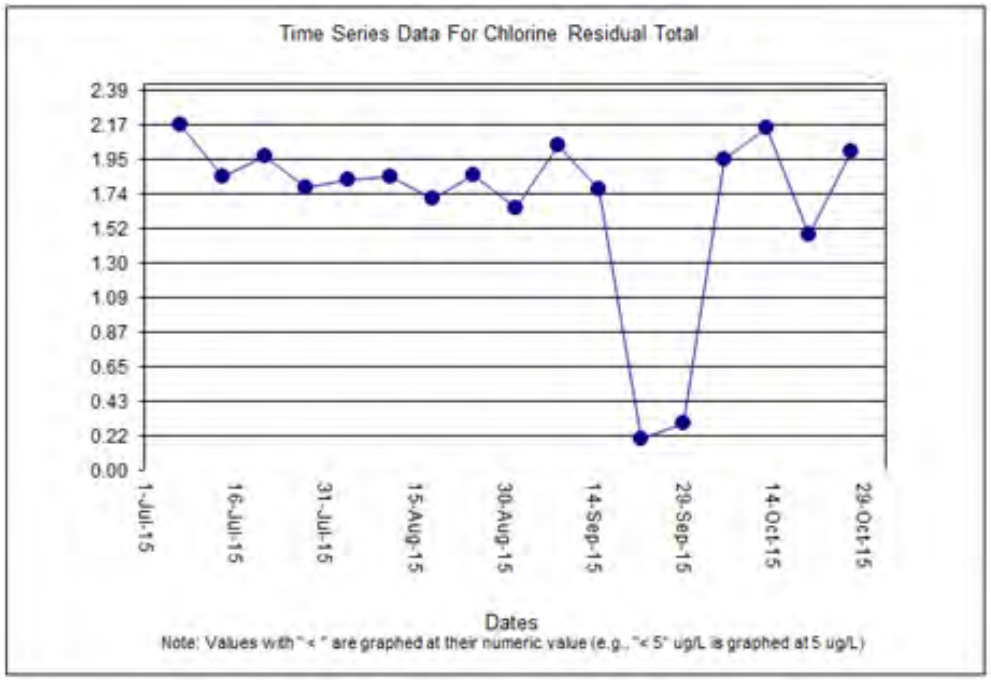
Case Study 1 – Routine Sampling Station
Sudden Cl_2 drop, Significant Presence of HPC

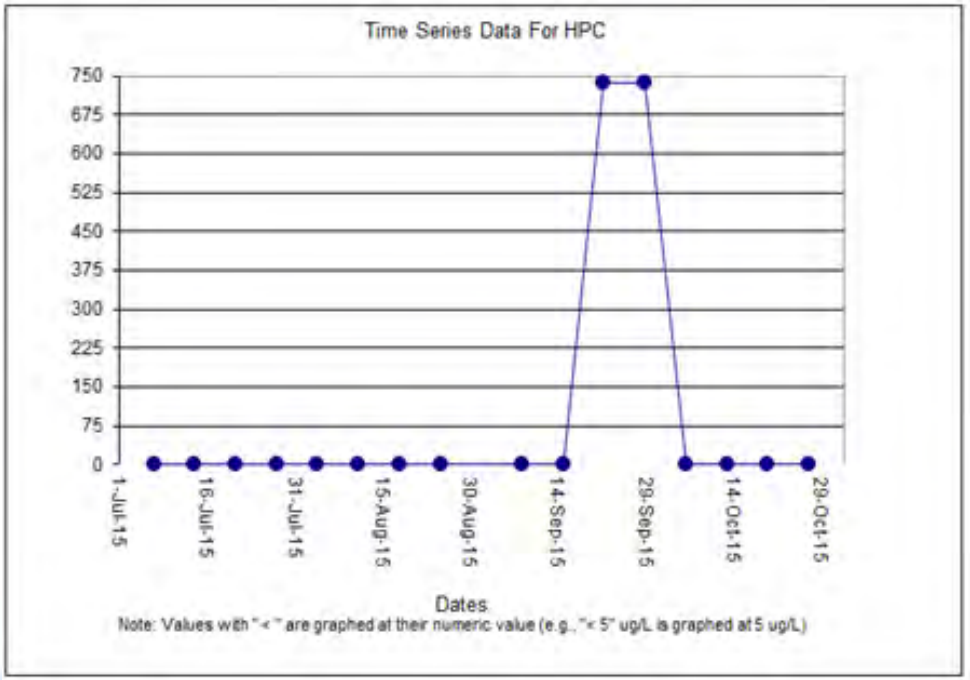
- Findings
  - 3 broken (closed) valves, left closed
  - 1 valve closed, left opened
- Remedial action
  - ~ 1hour of flushing
- Result
  - Total chlorine residual at routine sample tap improved from 0.25 to 1.1 mg/L
  - Broken valves replaced



Case Study 1 – Routine Sampling Station
Sudden Cl_2 drop, Significant Presence of HPC

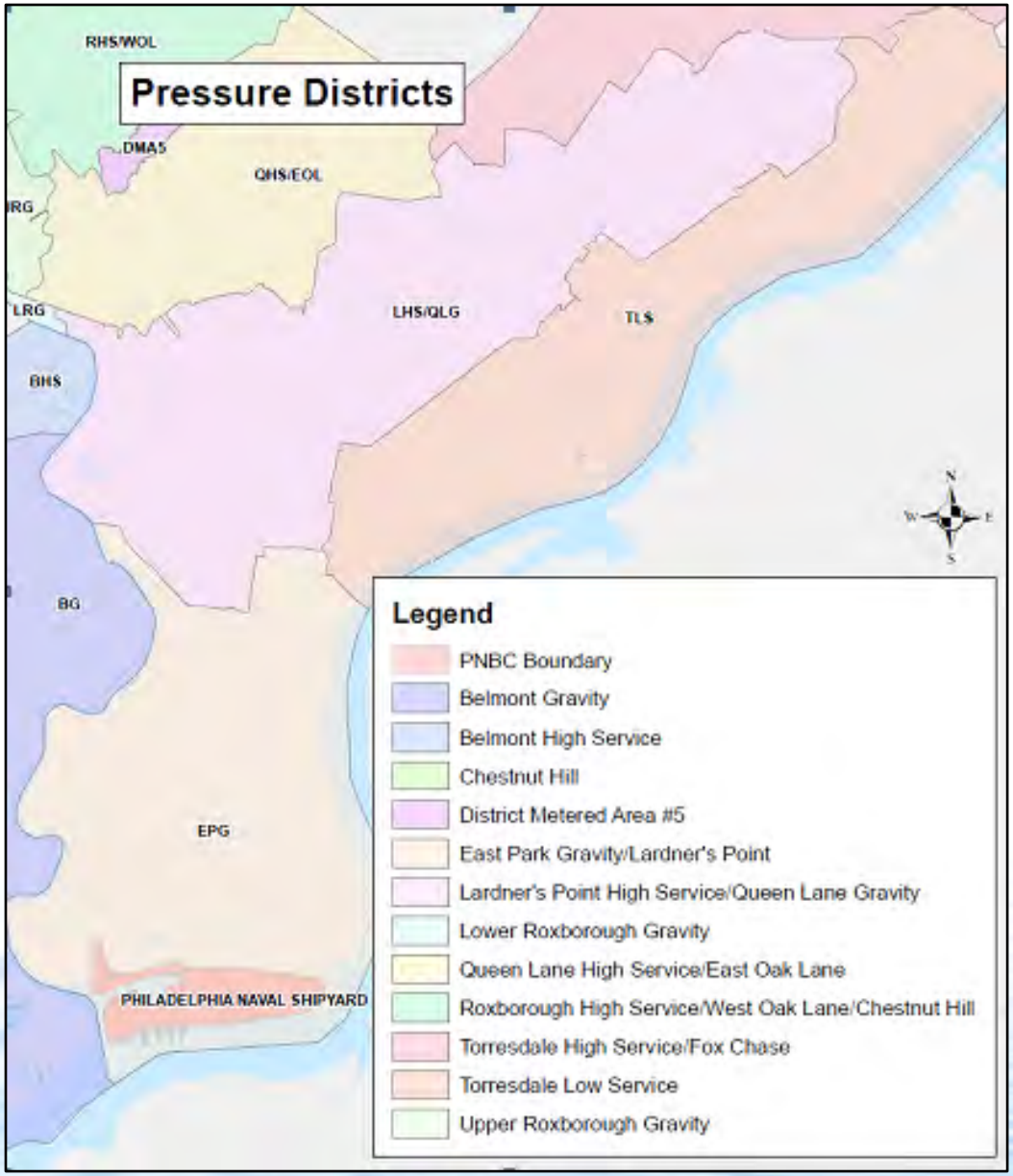
- Routine Samples following investigation and corrective action





Case Study 2 – Pressure District 13 (Low Cl_2)

- Located at the bottom of the distribution system
- Pressure District receives water from two different treatment plants
- Water systems (potable, sewer, and storm) transferred to Philadelphia Water during FY 2008-2009
  - Old, oversized water systems
  - New construction
  - Unknown piping and water main configurations



Case Study 2 – Pressure District 13 (Low Cl_2)

- Low Cl_2 throughout the Pressure District 13 prompted multiple investigations by BLS and Load Control
  - attempt to better understand hydraulics
- WQ monitoring station (grab & online) was adjusted to better reflect “water from the main”

Case Study 2 – Pressure District 13 (Low Cl_2)

- Investigations found the following challenges in Pressure District 13:
  - Extensive network of oversized cast iron water mains
    - Some old water mains were replaced or decommissioned, some still exist
  - High Water Age
  - Low usage
  - Nitrification events
- Remedial action (despite water main replacement)
  - Continuous seasonal flushing program
    - Typically flush > 0.5 MGD
  - Rigorous additional monitoring

2014 Chlorine Residual Targets- Water Temperature Dependent				
Distribution Storage Influent mg/l Goal	**Entry Point mg/l Goal**	**Water Temp Distribution Storage online**	**Storage Effluent Online TCL mg/l Goal ≥ 1.50 mg/l**	**Pressure District 13 Influent Online TCL mg/l Goal ≥ 1.00 mg/l**
2	2.2	56F/13.3 C		
2.2	2.2	64F/ 17.7 C		
2.3	2.3	69F/ 20.6 C		
2.4	2.4	74F/23.3 C		
2.5	2.5*	78F/ 25.6 C		
2.6	2.6	81F/ 27.2 C		
2.7	2.7	84F/ 29.4 C		

Note: Increased Residual Goal to 2.5 on June 27, 2014 78 F

2015 Chlorine Residual Targets- Water Temperature Dependent				
Distribution Storage Influent mg/l Goal	**Entry Point mg/l Goal**	**Water Temp Distribution Storage online**	**Storage Effluent Online TCL mg/l Goal ≥ 1.50 mg/l**	**Pressure District 13 Influent Online TCL mg/l Goal ≥ 1.00 mg/l**
2	2.2	50 F/13.3 C		
2.2	2.2	55 F/ 17.7 C		
2.3	2.3	58 F/ 20.6 C		
2.4	2.4	64 F/23.3 C		
2.5	2.5	70 F/ 25.6 C		
2.6	2.6	75 F/ 27.2 C		
2.7	2.7	80 F/ 29.4 C		

Note: Increased Residual Goal to 2.5 on June 27, 2014 78 F

- Treatment establishes goals for targeted chlorine levels in Pressure District 13
- Load Control aggressively monitors water age and addresses this through flushing

Through the continual Water Quality Monitoring & Response Cycle…

- Various units among Philadelphia Water communicate more effectively
- Philadelphia Water has improved the response and mitigation associated with declining water quality
  - Decreased the number of sampling locations with low CL_2
- Has progressively better met the Partnership for Safe Water Distribution System Disinfectant goal
  - Chloraminated systems, 95% of monthly samples ≥ 0.50 mg/L and ≤ 4.0 mg/L
- Although Cl_2 is the "surrogate" monitoring parameter, this monitoring and response cycle extends to other parameters like HPC, turbidity, and other water quality parameters

Percent of Grab Samples < 0.5 mg/L CL2 Residual - PWD Partnership Distribution System Sites - by Month												
% of Grab Samples < 0.5 mg/L	0.00	0.00	0.00	0.00	0.12	0.54	3.96	4.66	6.89	4.66	1.83	0.00
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2007											
% of Grab Samples < 0.5 mg/L	0.00	0.00	0.00	0.13	0.00	0.38	3.77	7.38	6.32	4.63	0.75	0.13
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2008											
% of Grab Samples < 0.5 mg/L	0.00	0.00	0.14	0.00	0.00	0.14	0.53	4.84	5.99	1.27	0.16	0.14
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2009											
% of Grab Samples < 0.5 mg/L	0.00	0.00	0.00	0.00	0.15	0.41	4.40	6.15	8.85	3.49	1.76	0.26
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2010											
% of Grab Samples < 0.5 mg/L	0.00	0.00	0.00	0.00	0.70	0.54	1.52	3.19	4.21	1.93	0.75	0.16
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2011											
% of Grab Samples < 0.5 mg/L	0.00	0.00	0.13	0.14	0.52	0.99	4.11	7.24	9.58	4.08	0.46	0.31
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2012											
% of Grab Samples < 0.5 mg/L	0.00	0.00	0.40	0.12	0.00	0.00	0.99	3.29	4.75	2.48	0.91	0.00
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2013											
% of Grab Samples < 0.5 mg/L	0.14	0.00	0.00	0.00	0.00	0.00	0.98	2.79	3.93	3.16	0.32	0.00
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2014											
% of Grab Samples < 0.5 mg/L	0.00	0.00	0.00	0.00	0.00	0.63	2.04	3.52	3.42	1.34		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year	2015											

Key
> 5.0 % * Fails Partnership Goal
4.0 - 4.99 %
3.0 - 3.99 %
0.0 - 2.99 %

Questions?

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