Discussion Request with EGLE - City of Benton Harbor Water System

June 3, 2022

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EGLE

EGLE Presentation Agenda

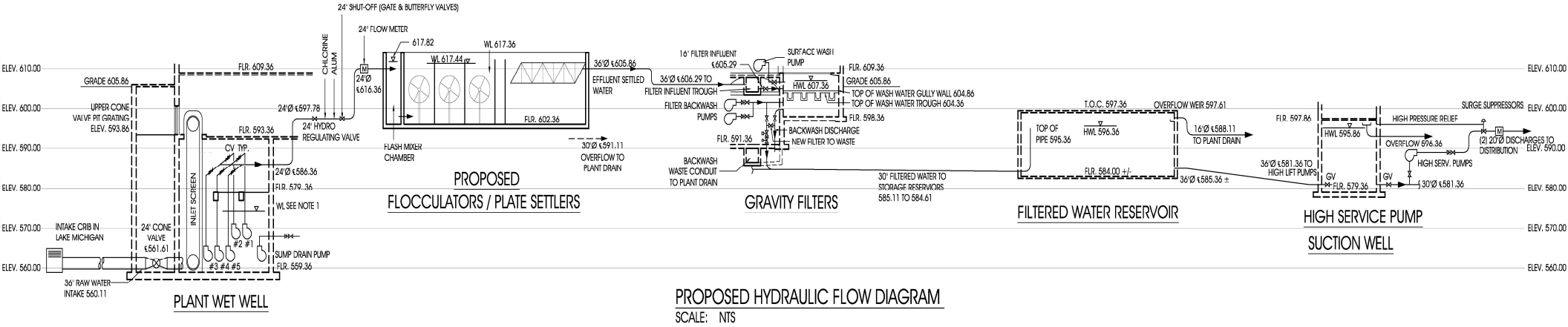
- Overview of water system
- Surface Water Treatment Rule (SWTR) compliance
- Disinfection practices and compliance
- Microbial indicators
- Status of Violations and Significant Deficiencies

Technical, Managerial, & Financial Capacity is Imperative

- Lack of TMF Capacity impacts the city's capability to sustainably comply with Act 399
- Lack of TMF Capacity has a compounding effect
- Lack of TMF capacity prevents correction of everything all at once
- EGLE's approach is to help city prioritize corrective actions
- Progress and improvements are happening
- EGLE required a TMF study to be done (pending)

Treatment Process

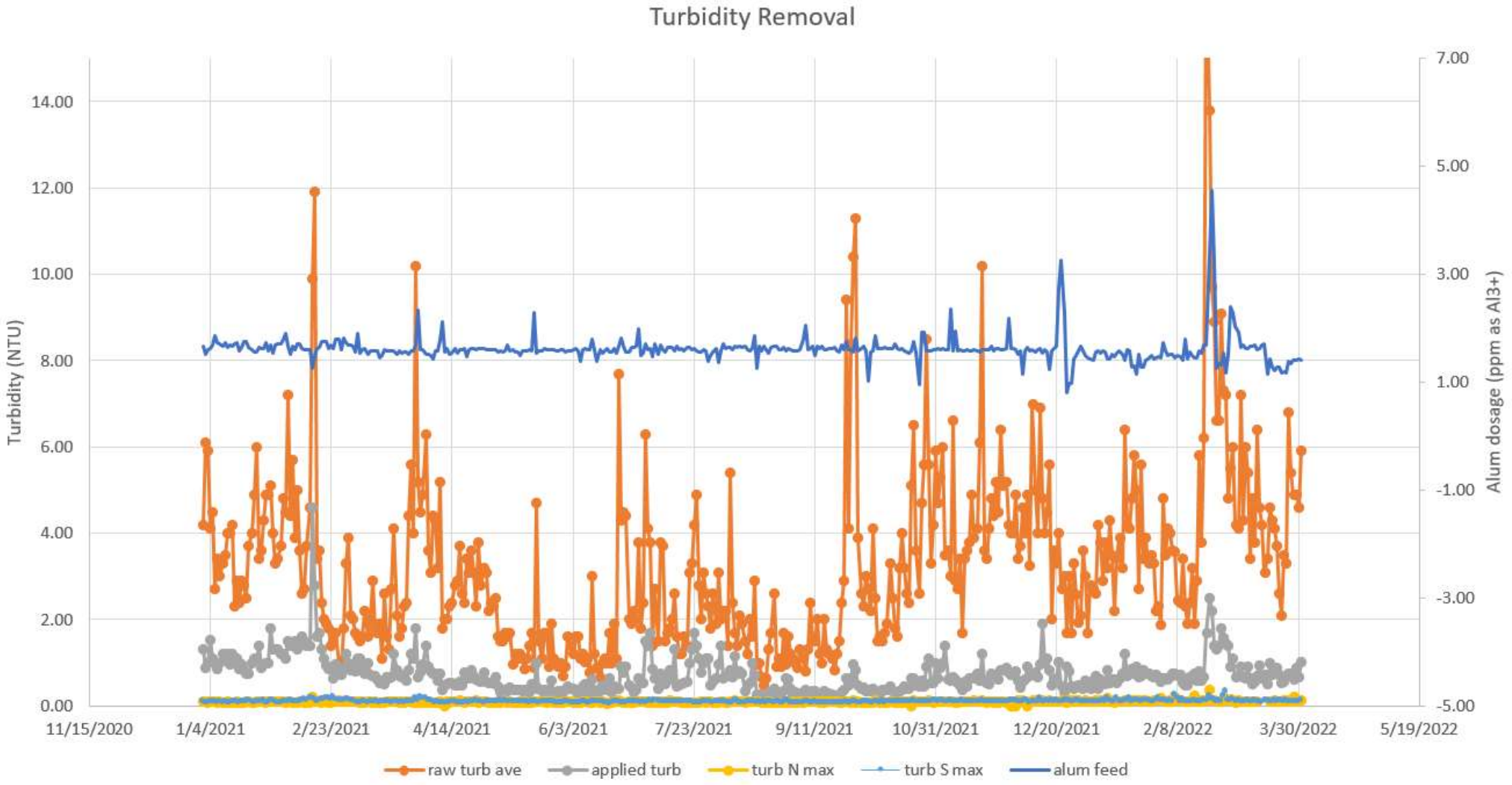
- “Follow the flow”



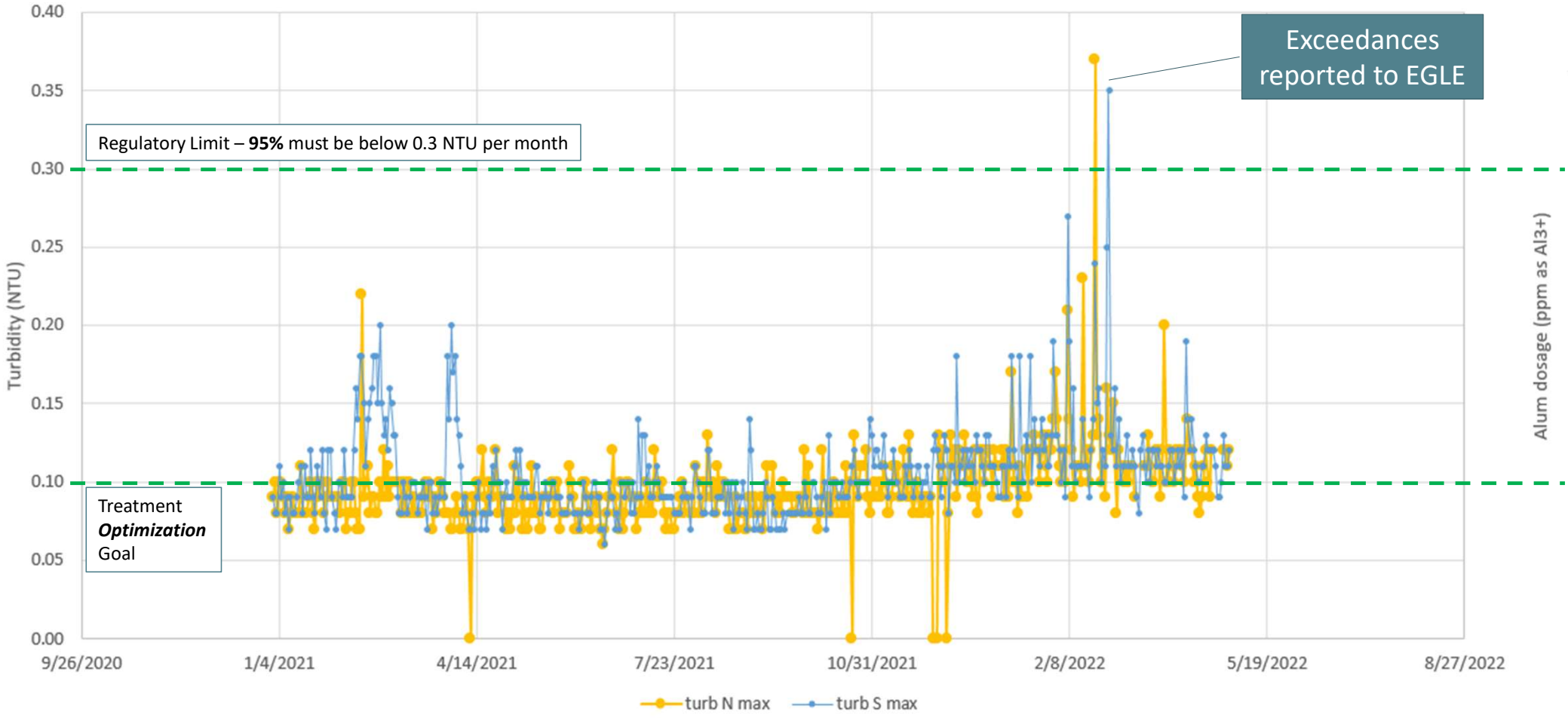
SWTR Compliance

Pathogen	Required Log removal/inactivation	Removal Credit for Conventional Treatment	Remaining Needed for inactivation by Disinfection (CT)
Giardia	3-log (99.9%)	2.5-log	0.5-log
Viruses	4-log (99.99%)	0-log	4-log
Cryptosporidium	2-log (99%)	2-log (Bin 1)	0-log

- Credits are awarded for conventional treatment operated in compliance with Act 399.
- CT compliance is focused on 0.5-log Giardia (more difficult than virus)


Turbidity Removal
Turbidity (NTU)
Alum dosage (ppm as Al3+)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
7.00
5.00
3.00
1.00
-1.00
-3.00
-5.00
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
raw turb ave
applied turb
turb N max
turb S max
alum feed

Combined Filter Turbidity



Turbidimeter Progress

- Lack of recordkeeping and calibration - 2018
- Revocation of certificate - 2020
- New operations increased confidence:
  - Updated SOPs
  - Calibration
  - Maintenance
  - Verification
  - Recordkeeping

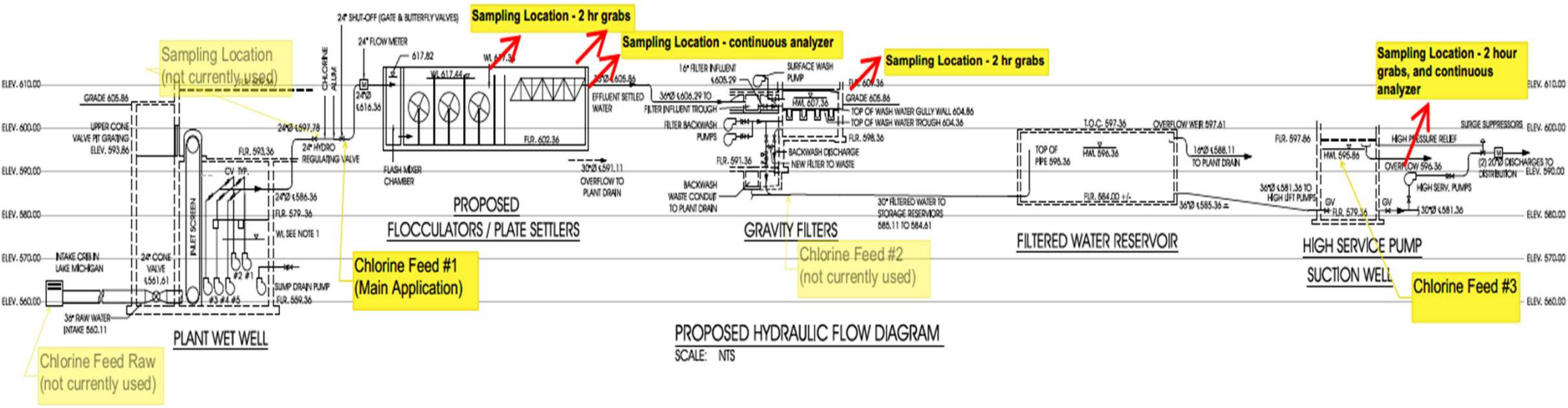
EGLE

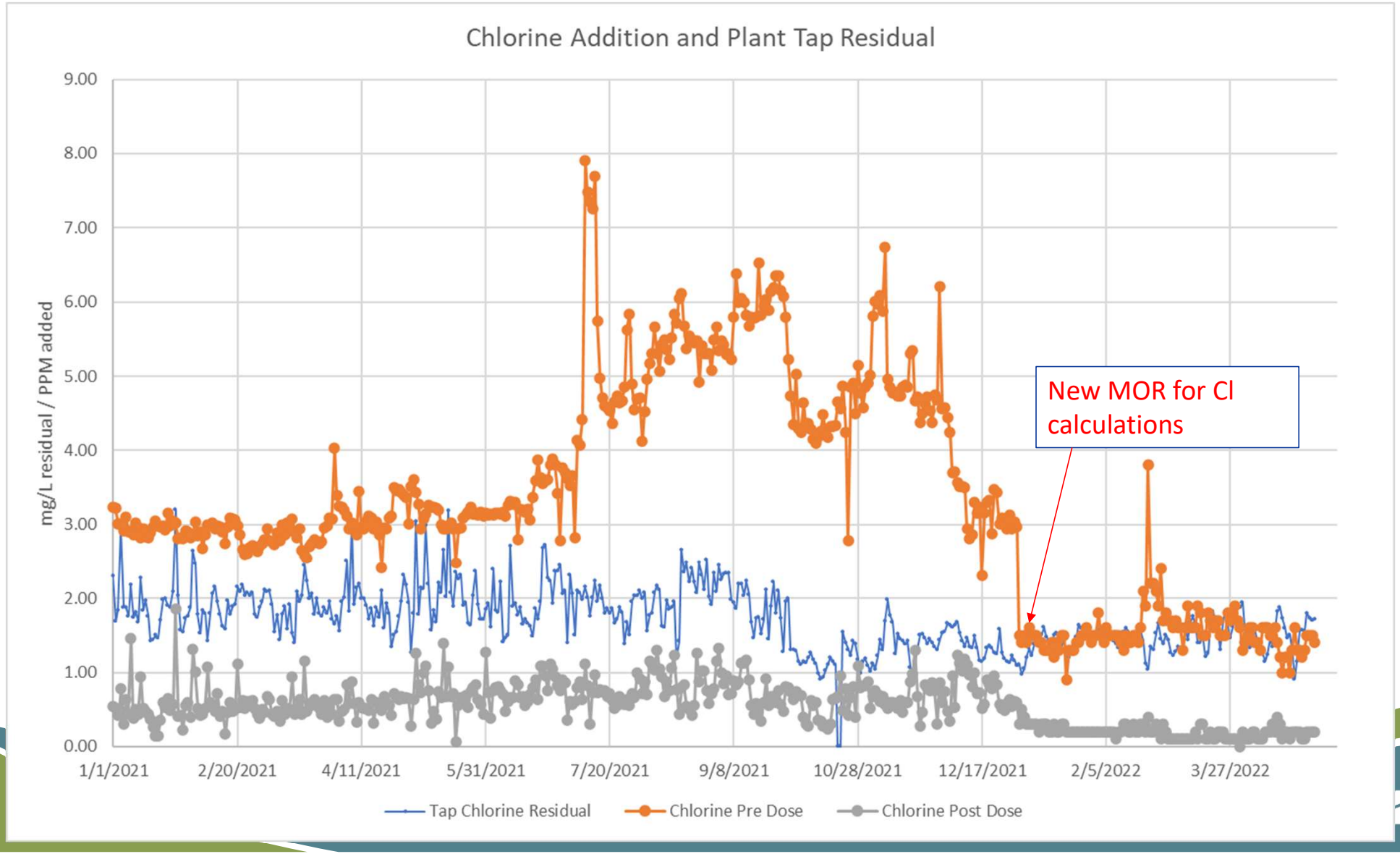
CT Compliance Determinations

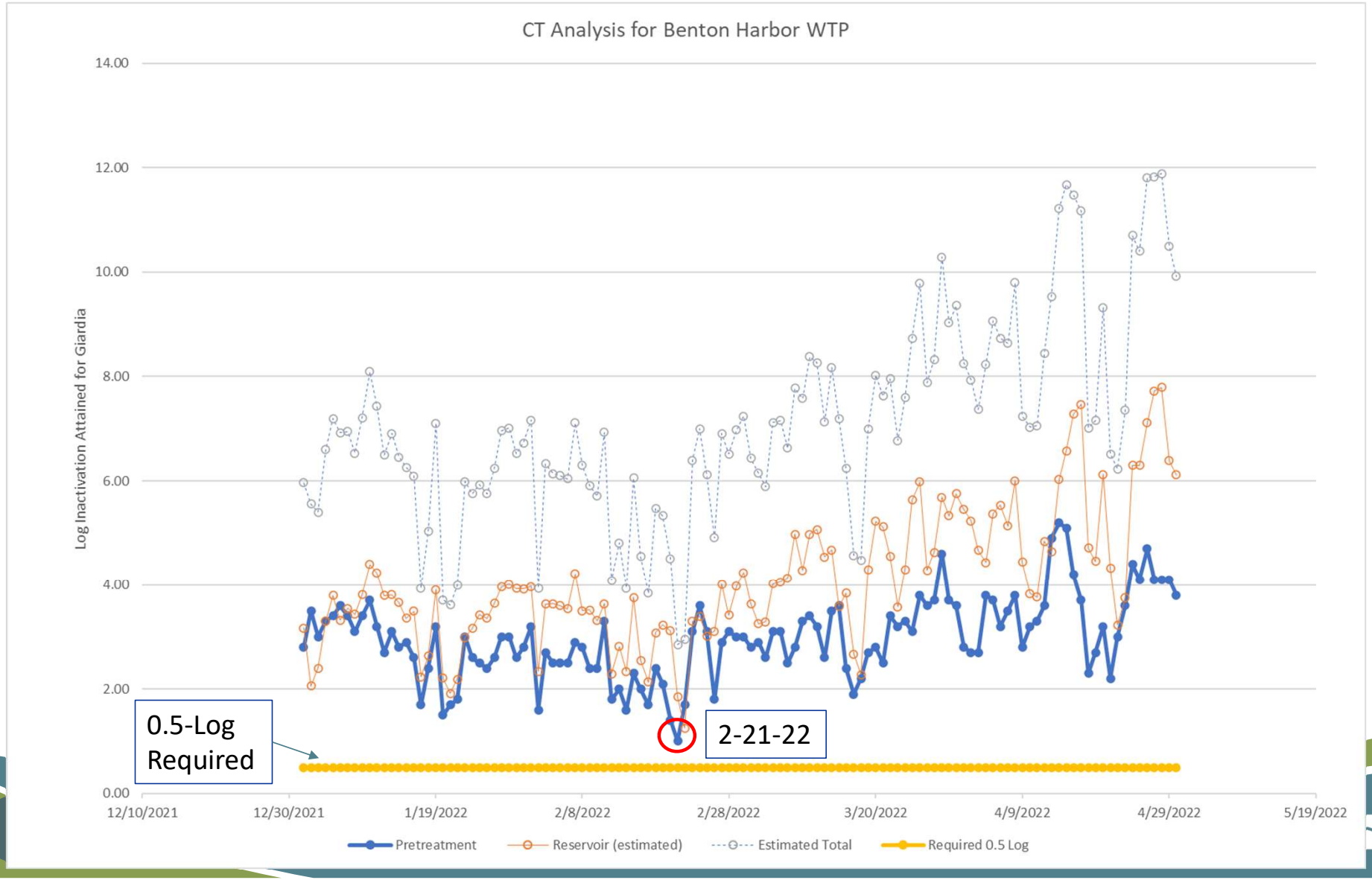
- Goal: 0.5-log inactivation for Giardia
- Previous CT compliance – worst case calculations, theoretical
  - WTP must operate within those parameters
  - EGLE now asks surface water plants to conduct and report daily calcs
- Reaction to discovery
  - 3/24/2022 letter – minor deficiency
  - Compliance determination for 2022 based on pre-treatment alone

CT Issue Discussion

EGLE and EPA learned of a misunderstanding of chlorine application




Chlorine Addition and Plant Tap Residual
mg/L residual / PPM added
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1/1/2021
2/20/2021
4/11/2021
5/31/2021
7/20/2021
9/8/2021
10/28/2021
12/17/2021
2/5/2022
3/27/2022
New MOR for Cl calculations
Tap Chlorine Residual
Chlorine Pre Dose
Chlorine Post Dose

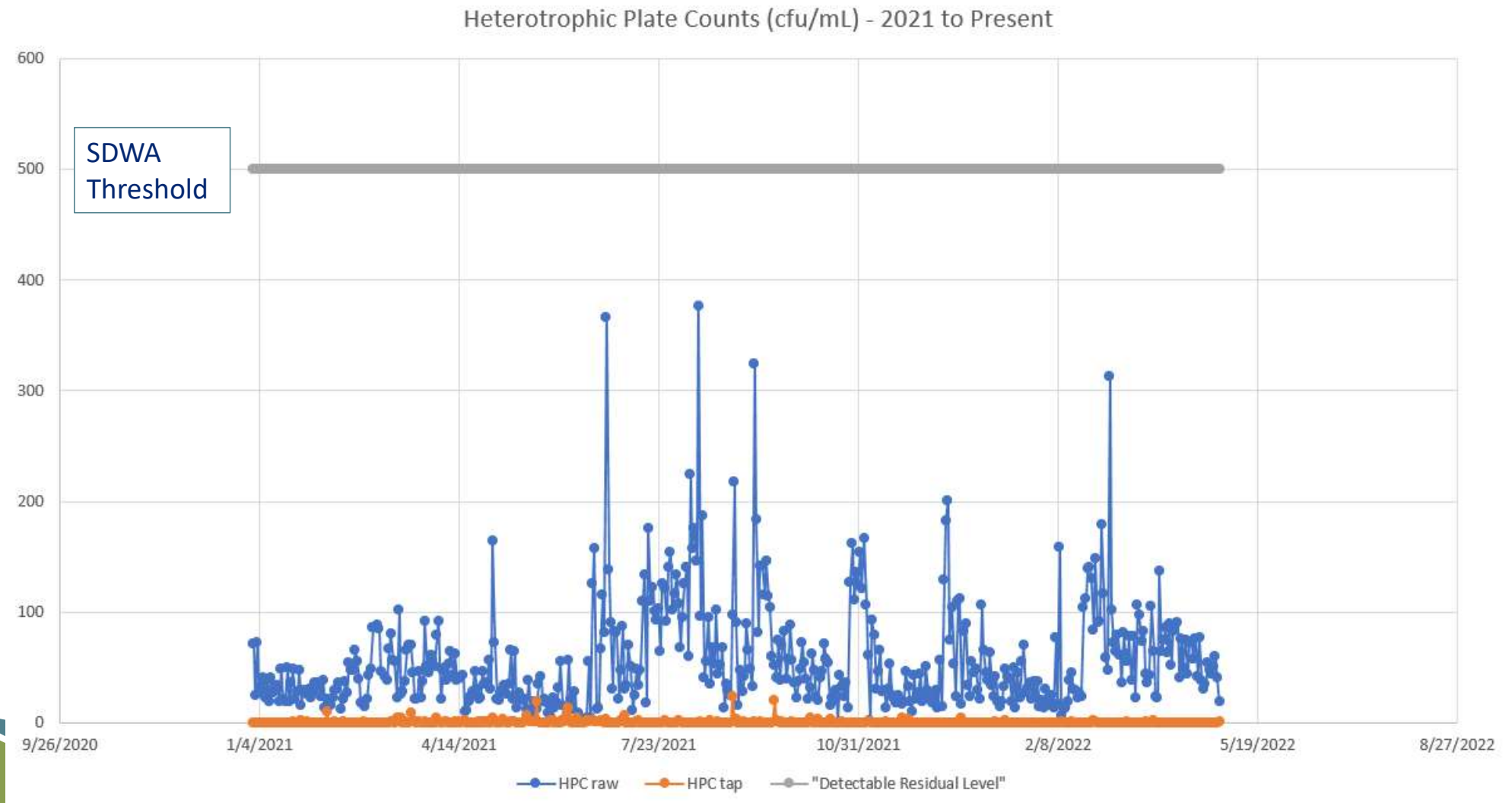

CT Analysis for Benton Harbor WTP
Log Inactivation Attained for Giardia
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
12/10/2021
12/30/2021
1/19/2022
2/8/2022
2/28/2022
3/20/2022
4/9/2022
4/29/2022
5/19/2022
0.5-Log Required
2-21-22
Pretreatment
Reservoir (estimated)
Estimated Total
Required 0.5 Log

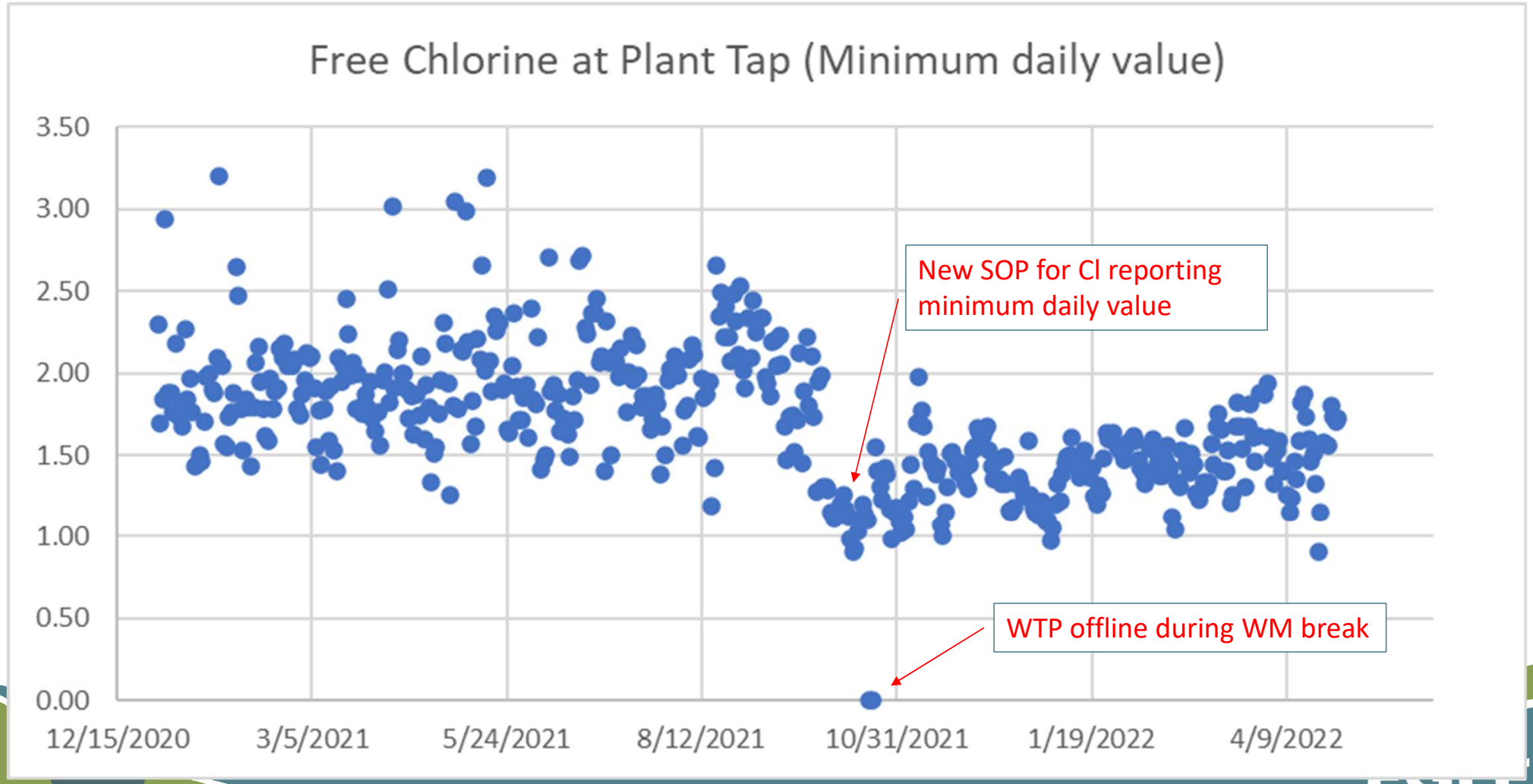
CT spot check – 2/21/2022

- Spot check on 2/21/2022 - pretreatment CT credit:
  - Raw water flow rate of *3452 gpm*
  - pH 8.0, Temp 3.0 degrees C
  - Flocculation chlorine residual = *0.98 mg/L*
  - Plate Settlers chlorine residual = *1.04 mg/L*
  - *Log Inactivation in pre-treatment only* ***= 1.0-log***
    - *Required to get 0.5-log*

Bacteriological Safety

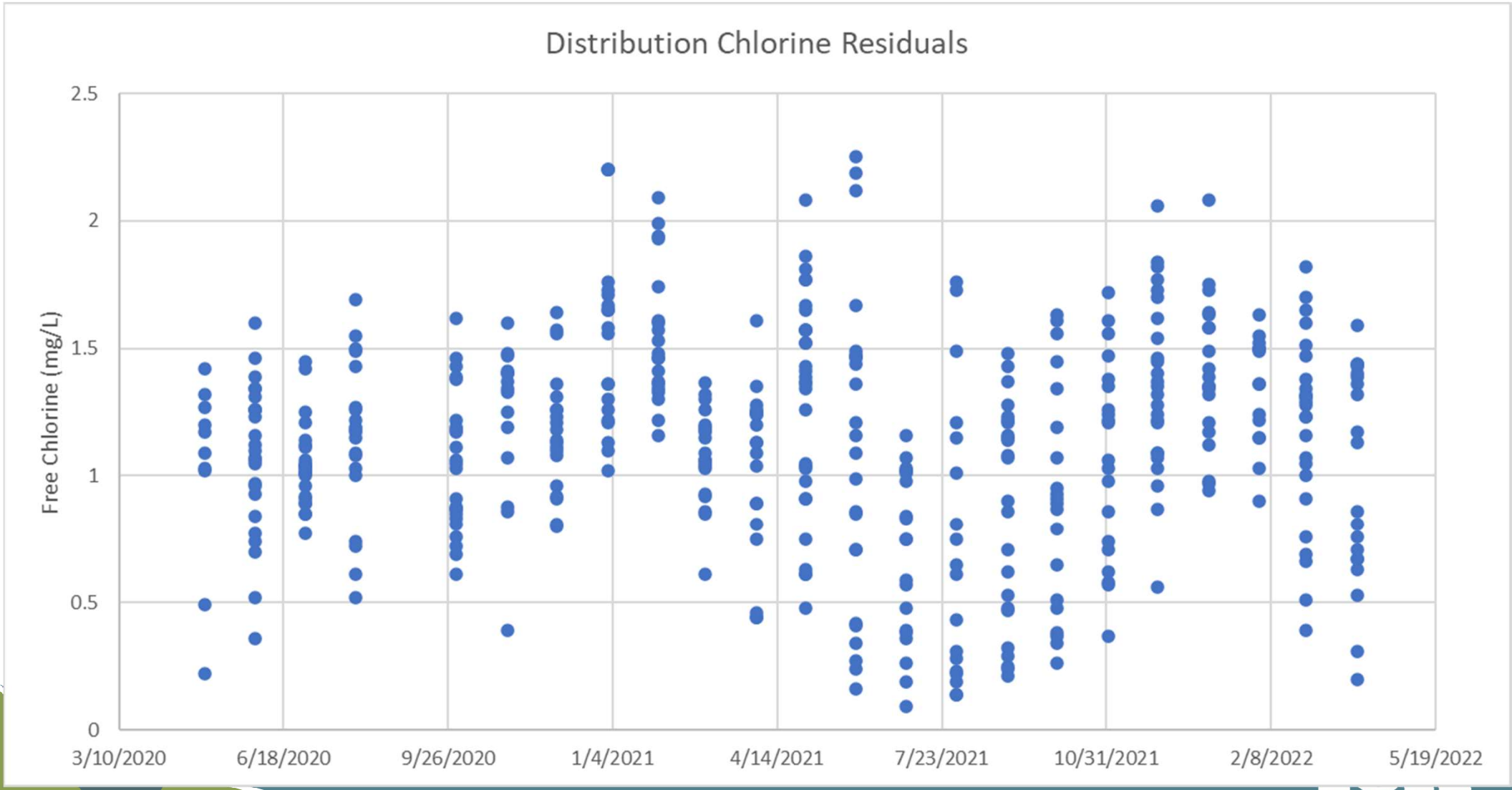
- EGLE's review of bacteriological safety of water:
  - LT2: bin classification based on source water sampling
  - Heterotrophic bacteria sampling
  - Chlorine residuals at WTP and distribution
  - Total coliform in distribution (weekly)
  - Total coliform at plant tap (daily)

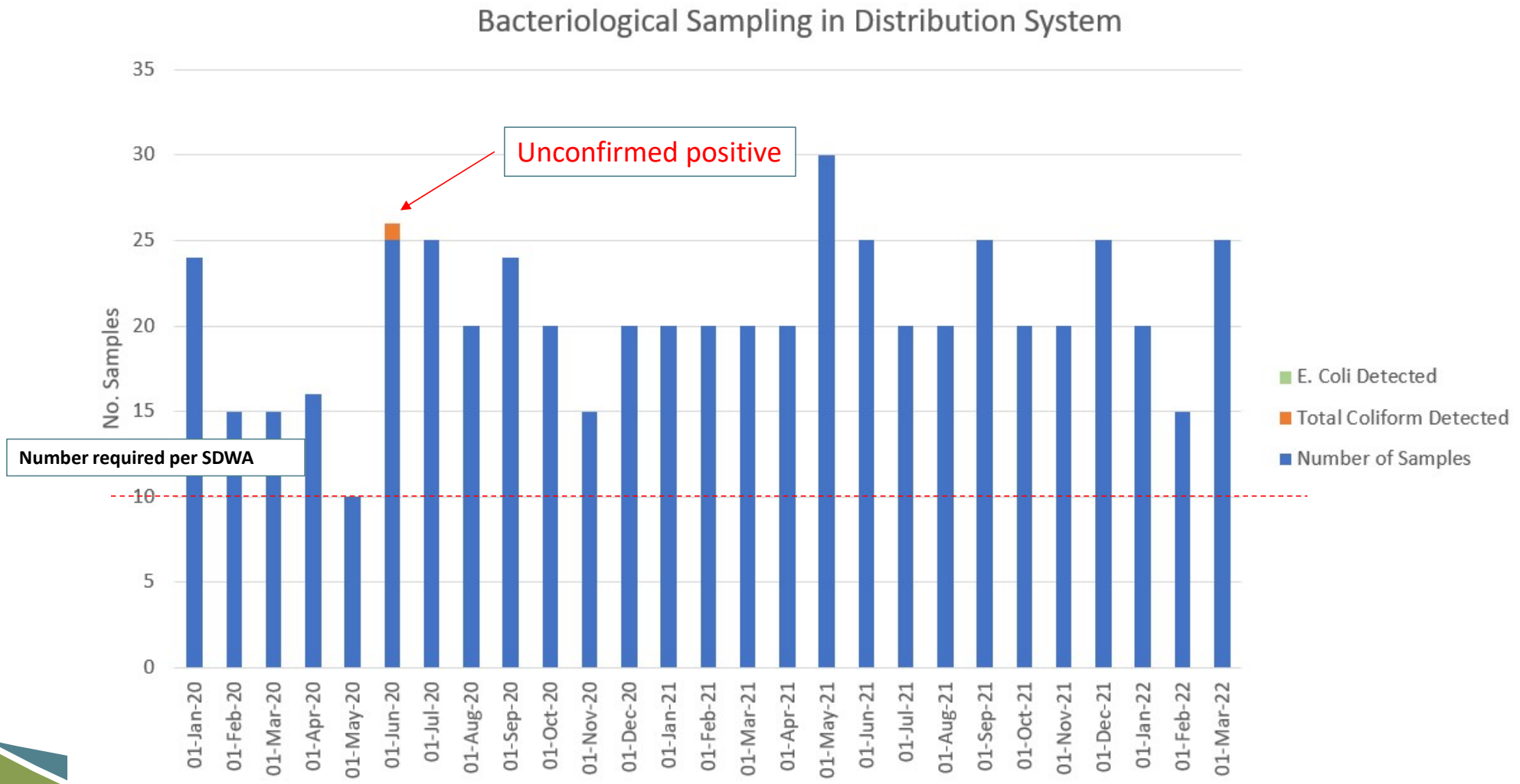

Heterotrophic Plate Counts (cfu/mL) - 2021 to Present
SDWA Threshold
600
500
400
300
200
100
0
9/26/2020
1/4/2021
4/14/2021
7/23/2021
10/31/2021
2/8/2022
5/19/2022
8/27/2022
HPC raw
HPC tap
"Detectable Residual Level"


Free Chlorine at Plant Tap (Minimum daily value)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
12/15/2020
3/5/2021
5/24/2021
8/12/2021
10/31/2021
1/19/2022
4/9/2022
New SOP for Cl reporting minimum daily value
WTP offline during WM break

Disinfectant Residual Monitoring

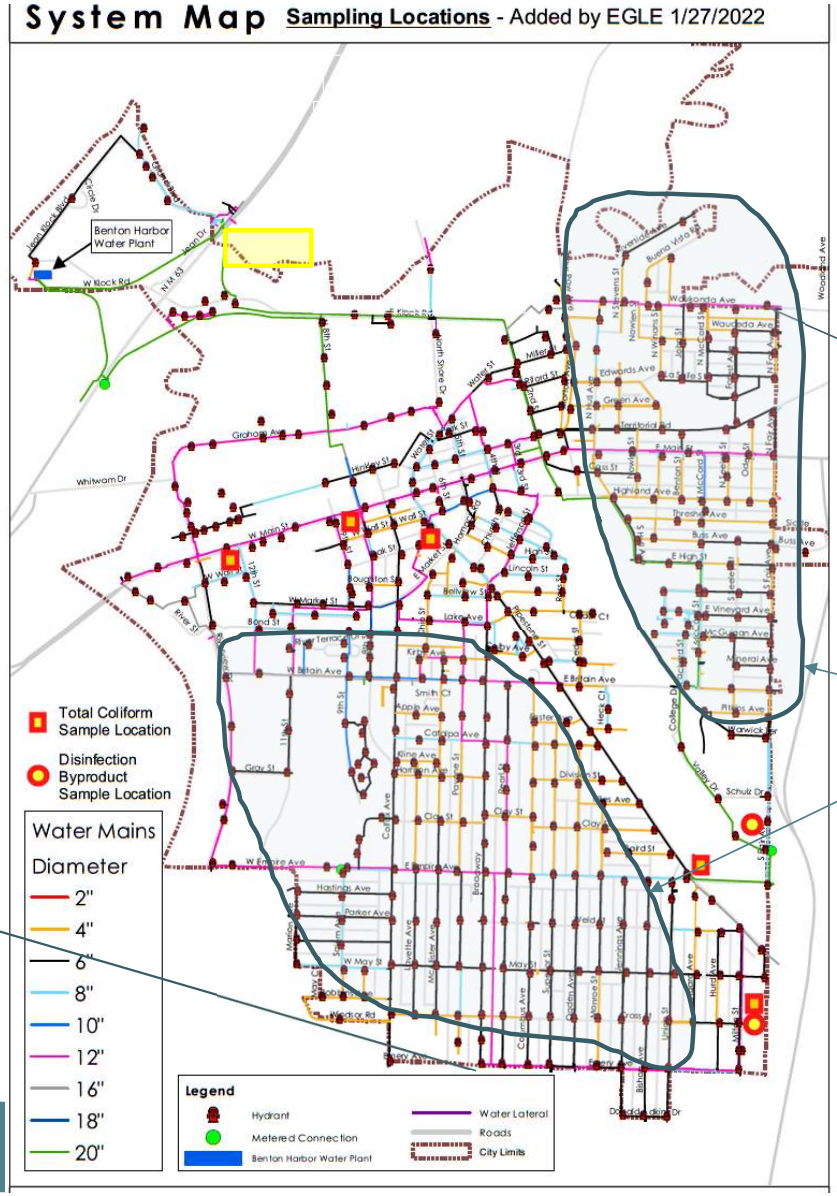
- **2018:** significant deficiency for non-working chlorine analyzer at EPTDS.
  - **Correction**: installed new analyzer in a more visible location by 8/12/2019
- **9/9/2020:** VN for new analyzer, reading in error
  - **Correction:** fixed, back online 9/21/20
- **9/21/2021:** significant deficiency, again reading in error
  - **Correction**: fixed, back online 9/23/2021
    - Installed redundant analyzer recently
    - Alarm w/ callout for low/high readings (0.8/3.0 mg/L, respectively)


Distribution Chlorine Residuals
Free Chlorine (mg/L)
2.5
2
1.5
1
0.5
0
3/10/2020
6/18/2020
9/26/2020
1/4/2021
4/14/2021
7/23/2021
10/31/2021
2/8/2022
5/19/2022


Bacteriological Sampling in Distribution System
Unconfirmed positive
Number required per SDWA
No. Samples
35
30
25
20
15
10
5
0
01-Jan-20
01-Feb-20
01-Mar-20
01-Apr-20
01-May-20
01-Jun-20
01-Jul-20
01-Aug-20
01-Sep-20
01-Oct-20
01-Nov-20
01-Dec-20
01-Jan-21
01-Feb-21
01-Mar-21
01-Apr-21
01-May-21
01-Jun-21
01-Jul-21
01-Aug-21
01-Sep-21
01-Oct-21
01-Nov-21
01-Dec-21
01-Jan-22
01-Feb-22
01-Mar-22
E. Coli Detected
Total Coliform Detected
Number of Samples

Distribution Sampling

2021 Sanitary Survey – **Required Action** to update SSP's to be representative of distribution System



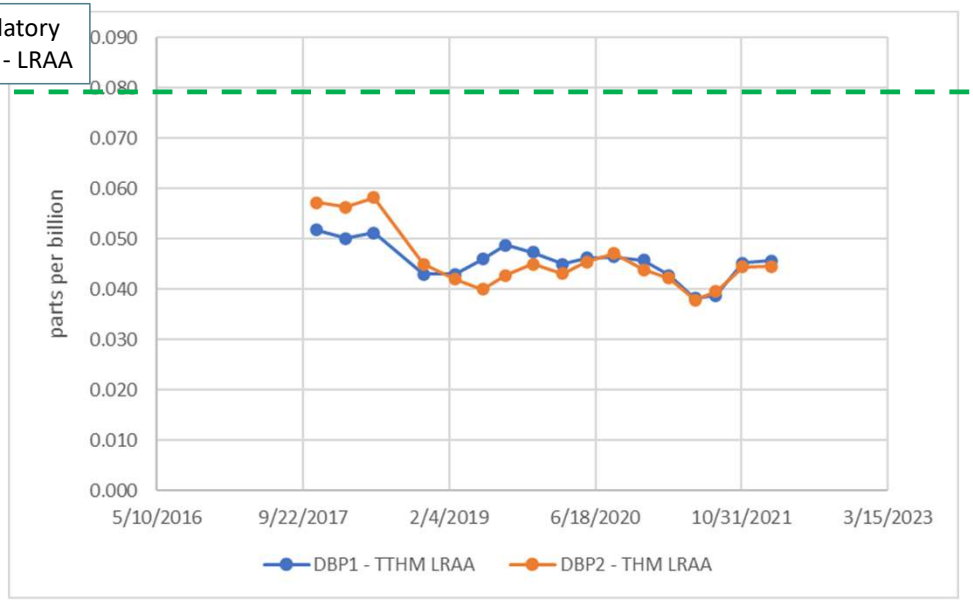
EGLE Spot Check
Free Cl2: 0.87 mg/L
on 10/13/21

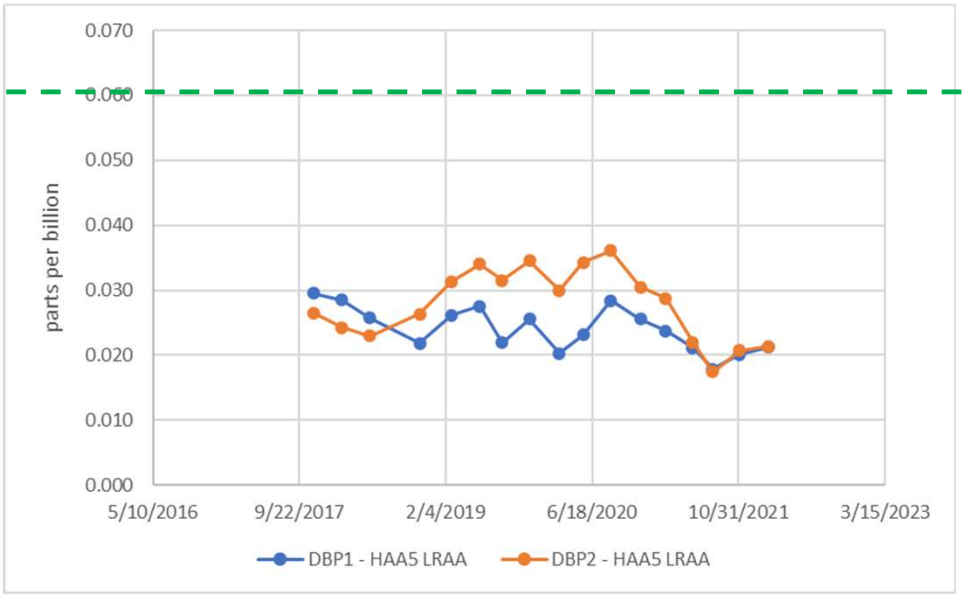
Under-represented areas for sampling

EGLE Spot Check
Free Cl2: 0.73 mg/L
on 10/13/2021

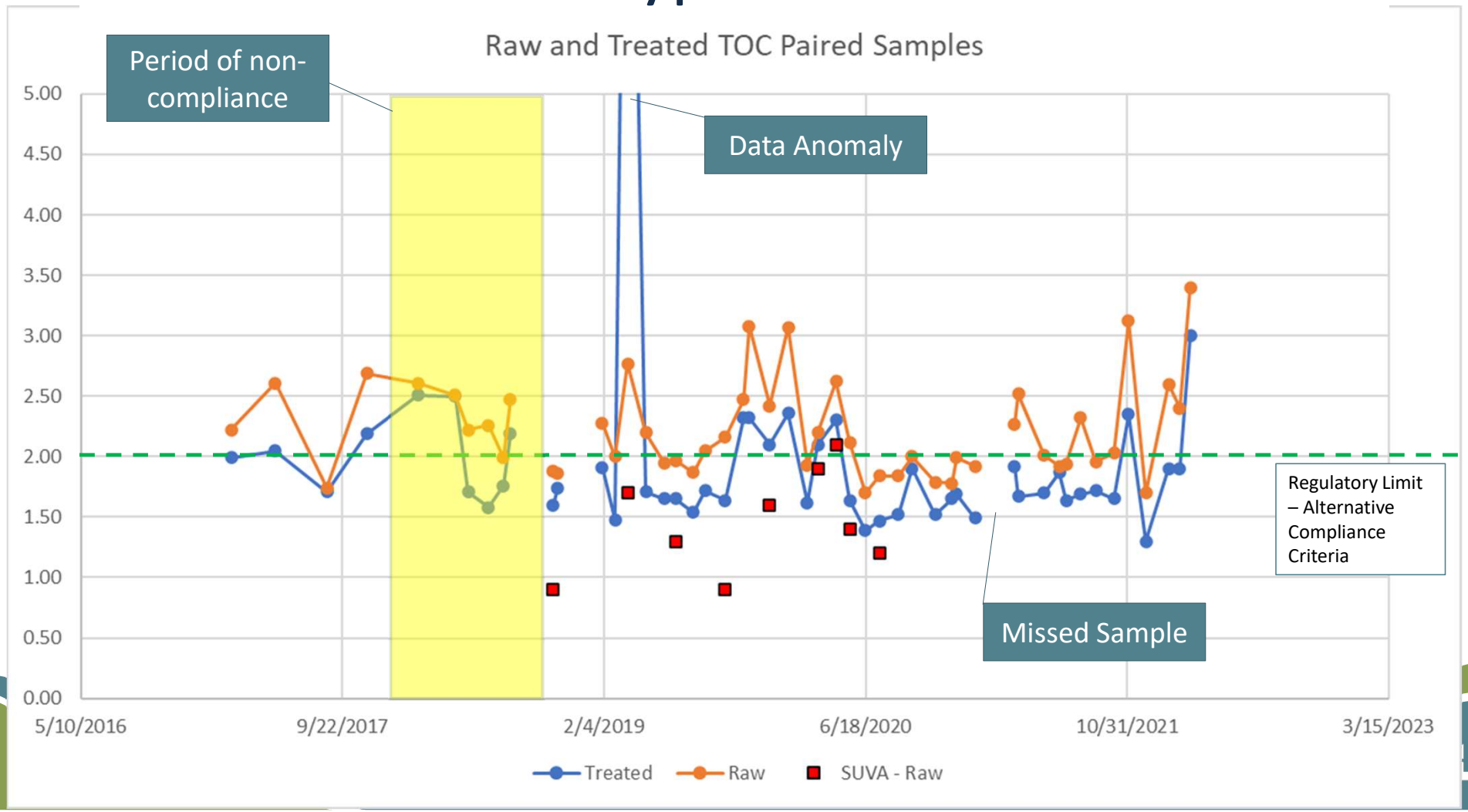
Disinfection Byproducts

Regulatory Limit - LRAA





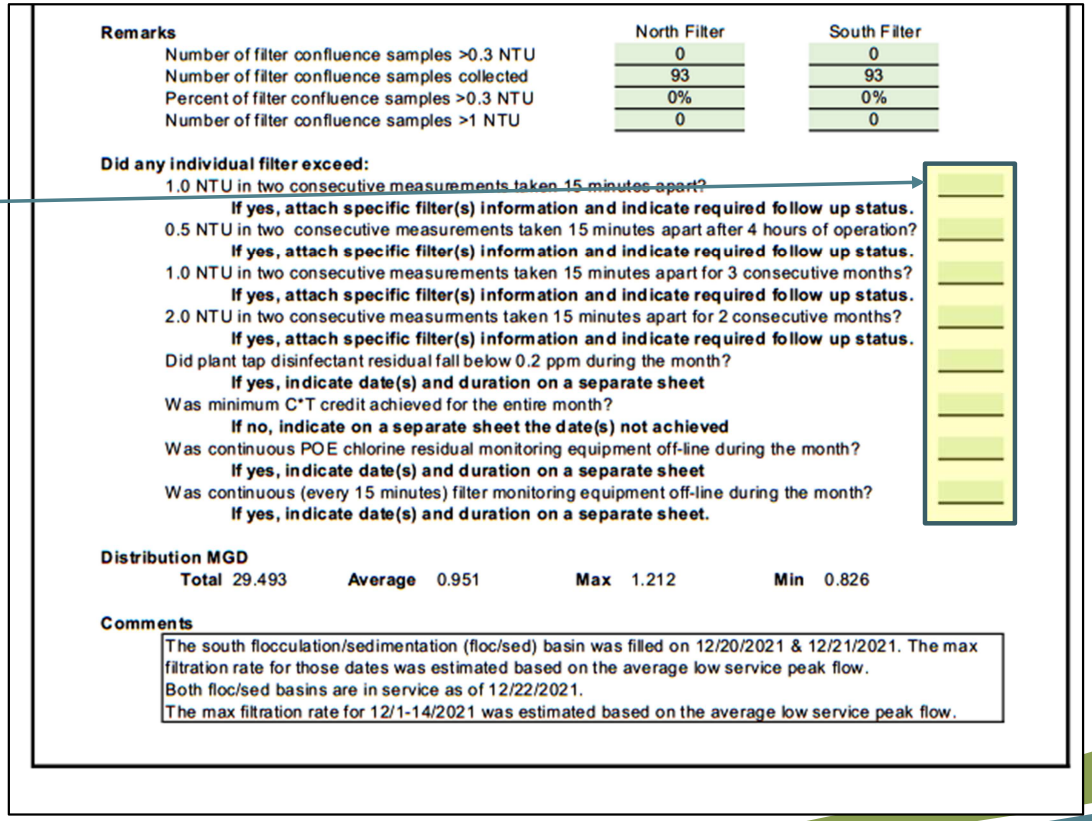
Disinfection Byproduct Precursors



2021 Significant Deficiency (MOR issues)

- Previous MOR:
  - Pre-filling front page
  - Inaccurate calculations
  - CT calculation not included

MOR submittal by 2/10/2022: resolved significant deficiency



Remarks

	North Filter	South Filter
Number of filter confluence samples >0.3 NTU	0	0
Number of filter confluence samples collected	93	93
Percent of filter confluence samples >0.3 NTU	0%	0%
Number of filter confluence samples >1 NTU	0	0

Did any individual filter exceed:

1.0 NTU in two consecutive measurements taken 15 minutes apart?
If yes, attach specific filter(s) information and indicate required follow up status.
0.5 NTU in two consecutive measurements taken 15 minutes apart after 4 hours of operation?
If yes, attach specific filter(s) information and indicate required follow up status.
1.0 NTU in two consecutive measurements taken 15 minutes apart for 3 consecutive months?
If yes, attach specific filter(s) information and indicate required follow up status.
2.0 NTU in two consecutive measurments taken 15 minutes apart for 2 consecutive months?
If yes, attach specific filter(s) information and indicate required follow up status.
Did plant tap disinfectant residual fall below 0.2 ppm during the month?
If yes, indicate date(s) and duration on a separate sheet
Was minimum C*T credit achieved for the entire month?
If no, indicate on a separate sheet the date(s) not achieved
Was continuous POE chlorine residual monitoring equipment off-line during the month?
If yes, indicate date(s) and duration on a separate sheet
Was continuous (every 15 minutes) filter monitoring equipment off-line during the month?
If yes, indicate date(s) and duration on a separate sheet.

Distribution MGD

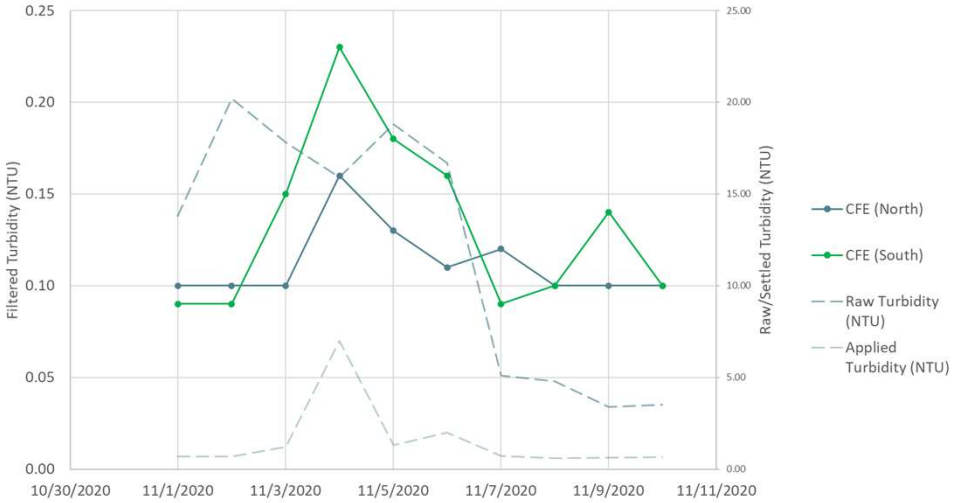
Total 29.493 **Average** 0.951 **Max** 1.212 **Min** 0.826

Comments

The south flocculation/sedimentation (floc/sed) basin was filled on 12/20/2021 & 12/21/2021. The max filtration rate for those dates was estimated based on the average low service peak flow.
Both floc/sed basins are in service as of 12/22/2021.
The max filtration rate for 12/1-14/2021 was estimated based on the average low service peak flow.

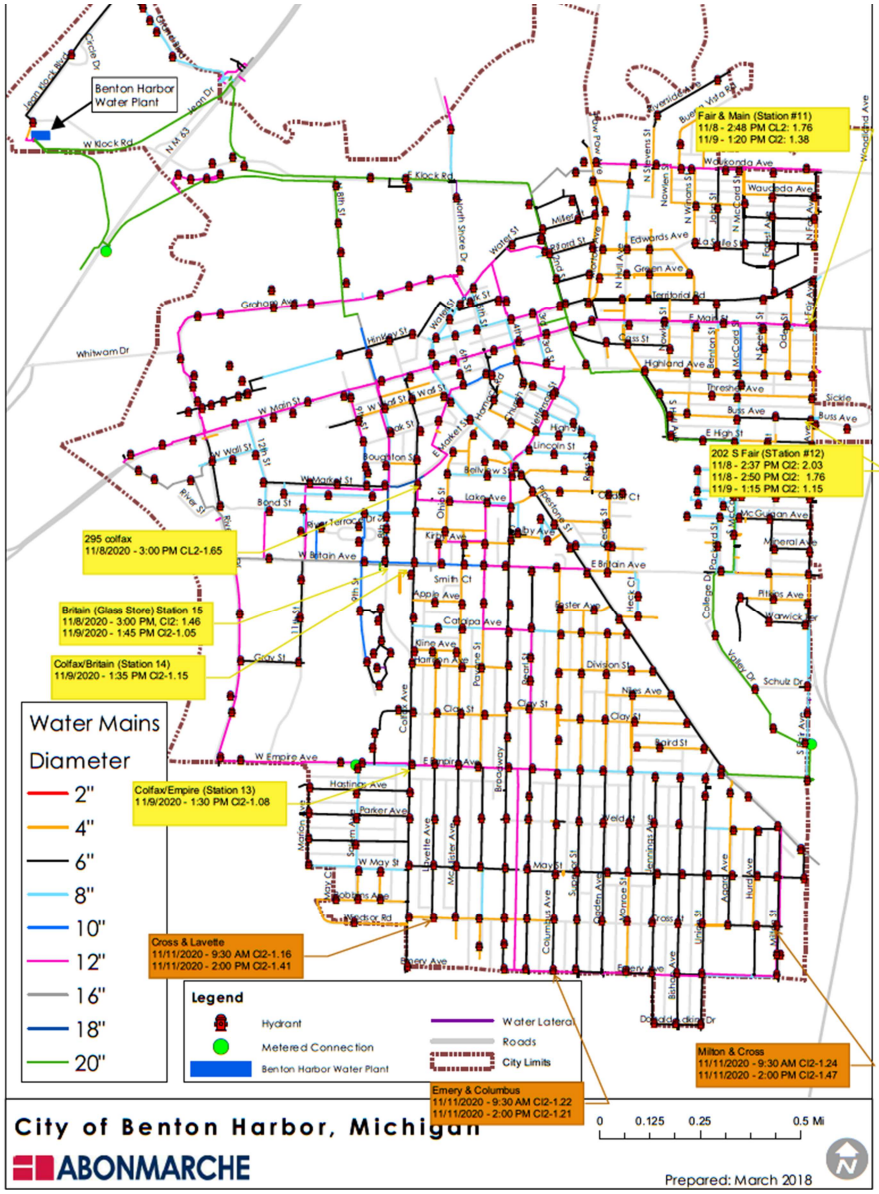
Event Response: November 2020

- 11/4/2020 – WTP noted high turbidity after a few hours of start-up
- Neglected to start Alum feed (required to be continuously fed)
- Max CFE turbidity: 0.23 NTU
- City did not notify EGLE immediately
- EGLE insisted issuing an advisory on 11/5/2020



November 2020 Response

- Increase chlorination at water plant
- Flushing hydrants: Nov 8, 9
  - 5 locations, 5 hours ea.
- Flushing hydrants: Nov 11
  - 3 locations, 5 hours ea.
- WQP sample Nov 9



November 2020 Response

Crypto & Giardia sampling (11/6/20)

Location	Crypto	Giardia
Raw	ND	ND
Plant tap	ND	ND
B&Z	ND	ND
Blue Water Thermal	ND	ND
Water Tower (LeRoys)	ND	ND

Bacteriological Sampling

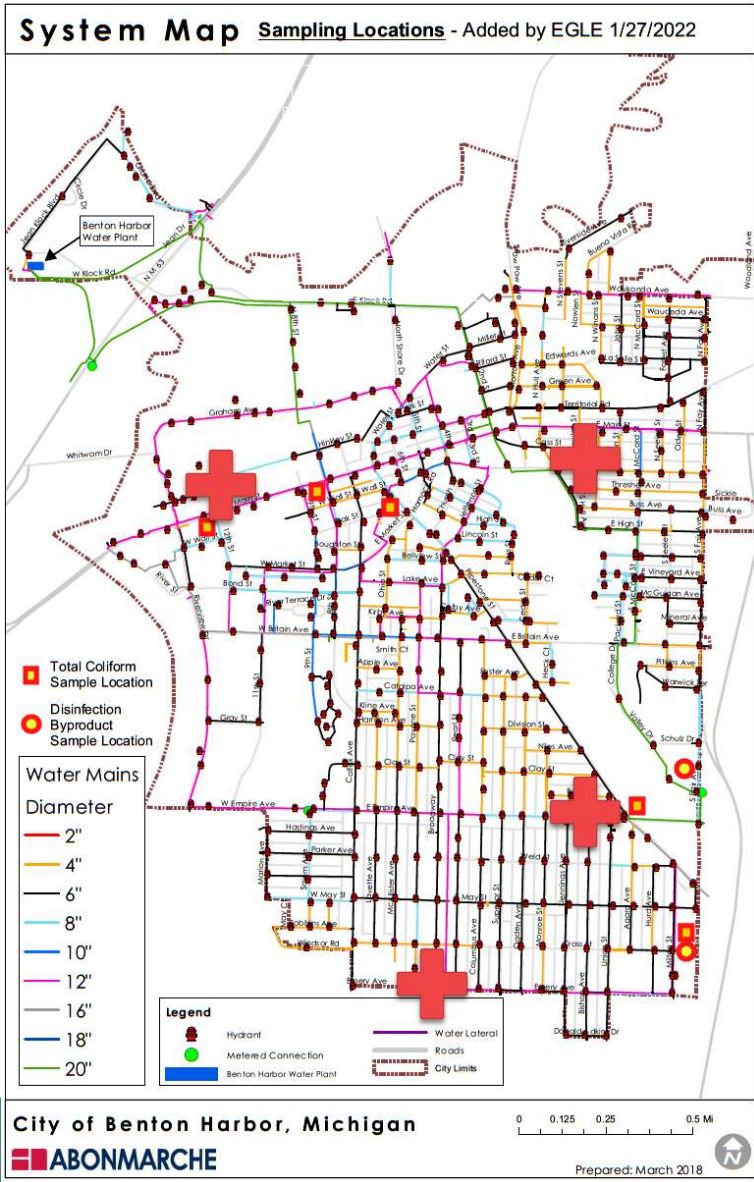
Date	Location	TC Detected?	Free Chlorine
11/8/2020	Britain (Glass store)	No	1.46
11/8/2020	202 S Fair	No	2.03
11/8/2020	295 Colfax	No	1.65
11/8/2020	S Fair	No	1.76
11/8/2020	Fair & Main	No	1.76
11/9/2020	Britain (Glass store)	No	1.05
11/9/2020	Colfax & Britain	No	1.15
11/9/2020	Empire & Colfax	No	1.08
11/9/2020	S Fair	No	1.15
11/9/2020	Fair & Main	No	1.38
11/11/2020	Milton & Cross	No	1.24
11/11/2020	Emery & Columbus	No	1.22
11/11/2020	Cross & Lavette	No	1.16

Event Response: Depressurization

- Catastrophic main break in October 2021
  - **Response:**
    - EGLE onsite to observe repair and plant startup
    - Flushing: 20 hydrants, 15 minutes each (four quadrants, chlorine>1.0 mg/L)
    - Bacteriological Sampling, chlorine residuals
  - **Corrections**:
    - VFD on high service pumps
    - Better SCADA alarming
- Focus on coordinated public messaging during emergency

Event Response: Depressurization

Date	Location	TC Detected?	Free Chlorine
10/25/2021	Empire/Bishop	No	1.50
10/25/2021	Winans/Highland	No	1.47
10/25/2021	Whirlpool @ W Main	No	1.42
10/25/2021	Emery/Broadway	No	1.22
10/27/2021	B&Z	No	1.07
10/27/2021	Sunny Spot	No	0.65
10/27/2021	City Hall	No	1.56
10/27/2021	Wolfs Marine	No	1.34
10/27/2021	Bait Shed	No	1.63



Conclusions

- EGLE assessed microbial risk and SDWA compliance
- EGLE engaged the city when response activities were necessary
- EGLE required public communications when risk was elevated
- Findings have been documented
- Progress being made on sanitary survey findings
- Many challenges remain – primarily with TMF capacity