



# INCREASES IN FINISHED WATER RETENTION TIMES & EFFECTS ON WATER QUALITY

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CITY OF HILLSBORO

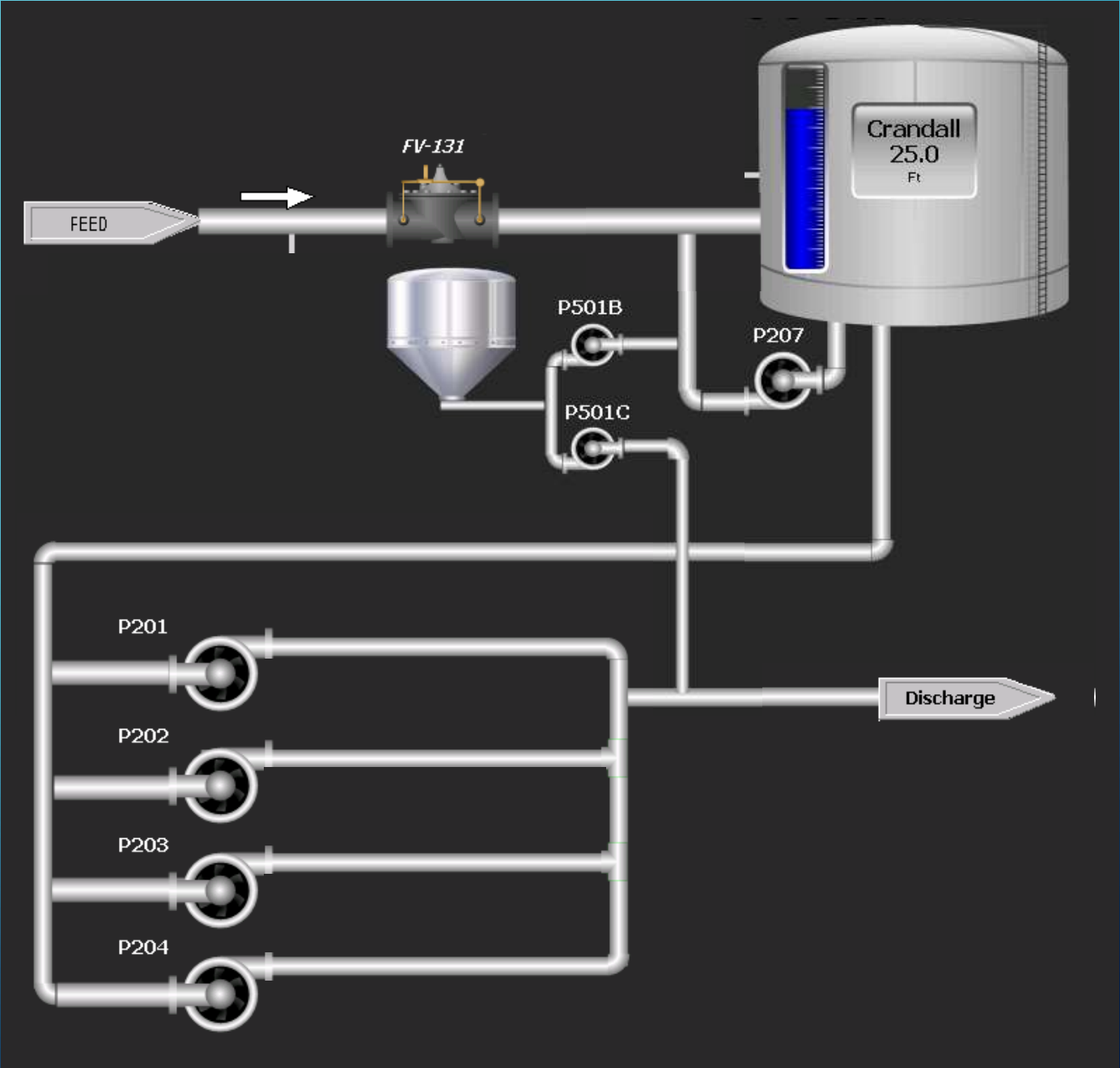
## OVERVIEW

- Built a new finished water reservoir - Crandall
- Retrofits to old reservoir – 24<sup>th</sup> Street
- Added Rechlorination and Recirculation
- Energy Trust of Oregon wants to reduce energy use in the state

## OVERVIEW

- Utilize pumping to move water from storage tank into distribution system
- Reservoir filling is done without pumps
- If avoid pumping for 2 back-to-back 30-day time periods receive grant money from Oregon

# CRANDALL RESERVOIR



# 24<sup>TH</sup> STREET RESERVOIR

- 6 MG
- Oldest reservoir in distribution system



# CRANDALL RESERVOIR

- 10 MG
- Newest reservoir in distribution system
- Won a bunch of awards!



# COMPLICATION – WATER QUALITY

- Long hold times could lead to drop in disinfectant residual
  - Free chlorine
- Using rechlorination and recirculation systems to boost residual could increase DBP levels
- 24<sup>th</sup> Street Reservoir is distribution system's DBP maximum site
- Concerns that a 30-day hold time would increase DBP formation and violate the MCL

## DBPS IN HILLSBORO

- Prior to 2008 multiple HAA5 violations
  - Corrected by decreasing pre-chlorination at WTP
  - Surface water source relatively high in organic content



## COMPLICATION – SYSTEM DEMANDS

- Storage capacity needed during summer
- Thus could not attempt to meet grant requirements during the high demand season

# DISINFECTION BY-PRODUCTS OVERVIEW

- DBPs comprised of
  - Total Trihalomethanes (TTHMs)
  - Five Haloacetic Acids (HAA5s)
- Compliance calculated by locational running annual average (LRAA)
  - TTHMs MCL = 0.08 mg/L
  - HAA5 MCL = 0.06 mg/L

# DISINFECTION BY-PRODUCTS INCREASE WITH

- Disinfectant concentrations
- Organic matter
- Residence time
- Temperature

## SOLUTION – HOLD TIMES

- Determined to do a series of trial runs
- Began with a hold time of 1 week
- Then successively increase hold time by 1 week until 30 days reached
- Then run another 30 day hold
- Did each reservoir at different times

## SOLUTION – DEVELOP A SAMPLING PLAN

- Collected samples from:
  - Inlet water when filling
  - Reservoir before and day after using recirculation and rechlorination
  - Distribution system the day after draining
  - At least once a week
- Set TTHM and HAA5 ‘trigger’ levels to ensure MCL compliance

# SOLUTION – WATER QUALITY ANALYSIS

- **TTHMs and HAA5s**
- **Total Organic Carbon (TOC)**
- UV254 (done in-house)
- **Chlorine Residual**
- Temperature and pH
- Use 4-day rush analysis for more timely decision making



# 24<sup>TH</sup> STREET RESERVOIR WATER QUALITY RESULTS

## 24<sup>TH</sup> STREET RESERVOIR

- Did not have issues with DBP formation
- Learned from process
- Tweaked the sampling plan
- Hillsboro was on reduced DBP monitoring, but no longer
- Had to report all DBPs collected and use in the LRAA



The background is a solid teal color with a subtle gradient. In the four corners, there are decorative white line-art elements that resemble circuit traces or data paths, with small circles at the end of the lines.

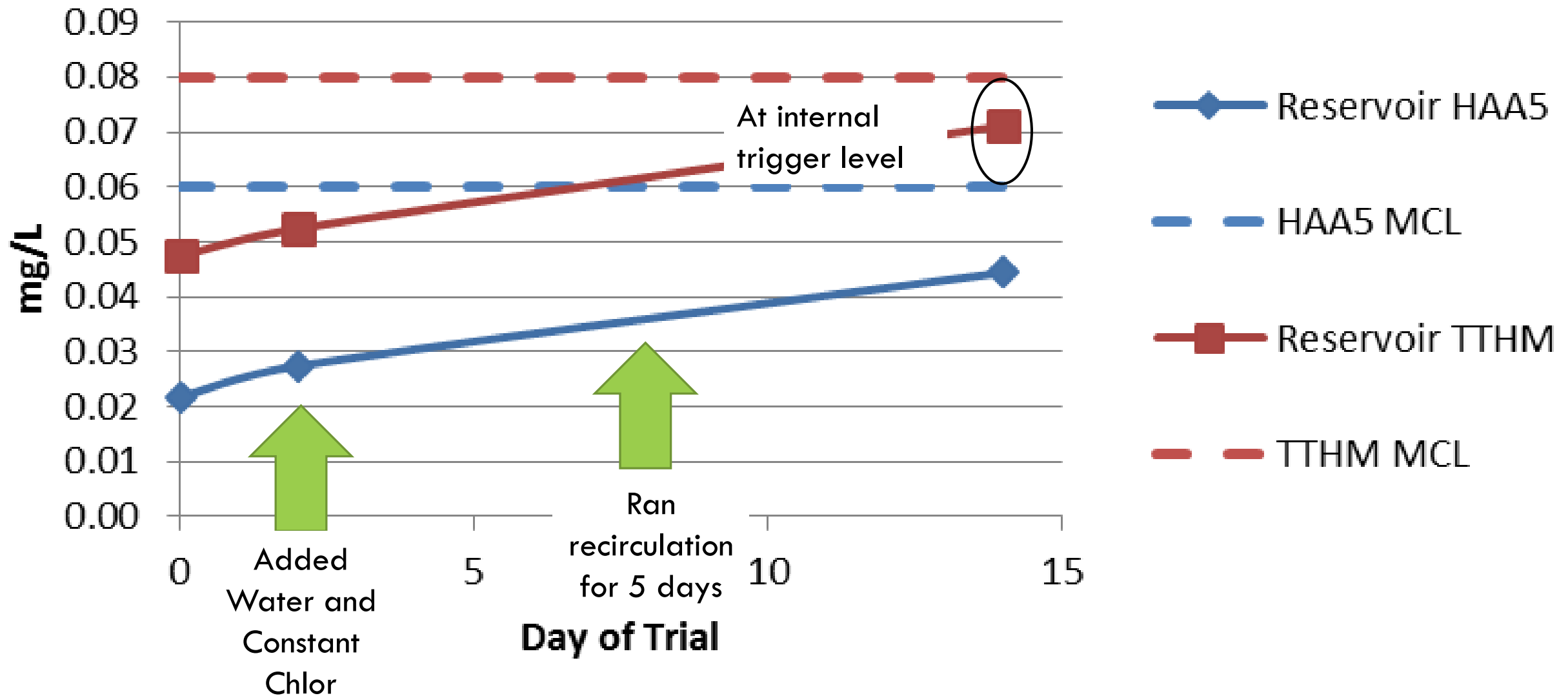
# CRANDALL RESERVOIR WATER QUALITY RESULTS

# CRANDALL RESERVOIR

- Since brand new to system
- Not 1 of 8 DBP monitoring sites
- Still wanted to maintain all samples below MCL
- Will use trial data to determine if it should be a monitoring site

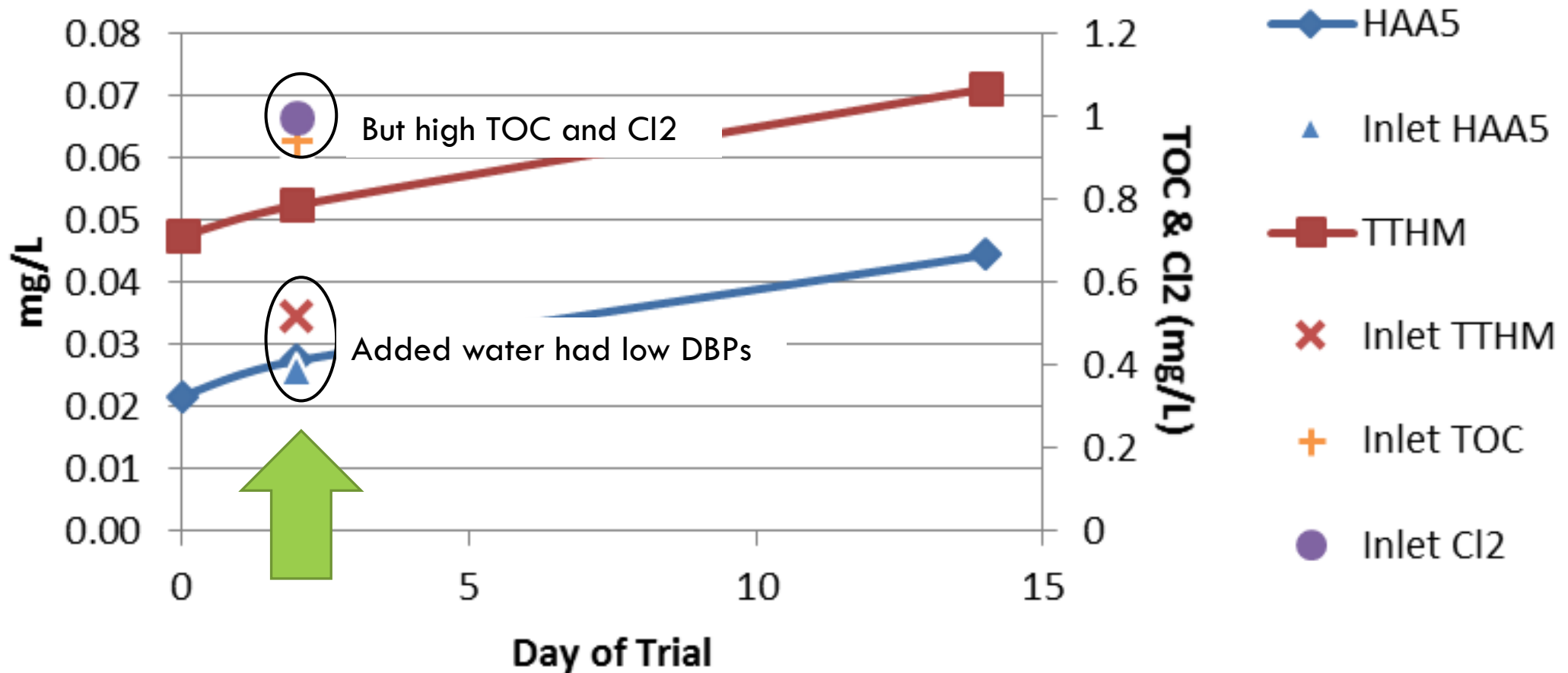
# Crandall Trial 1 DBPs

## 14 Day: 10/20 to 11/3/2014



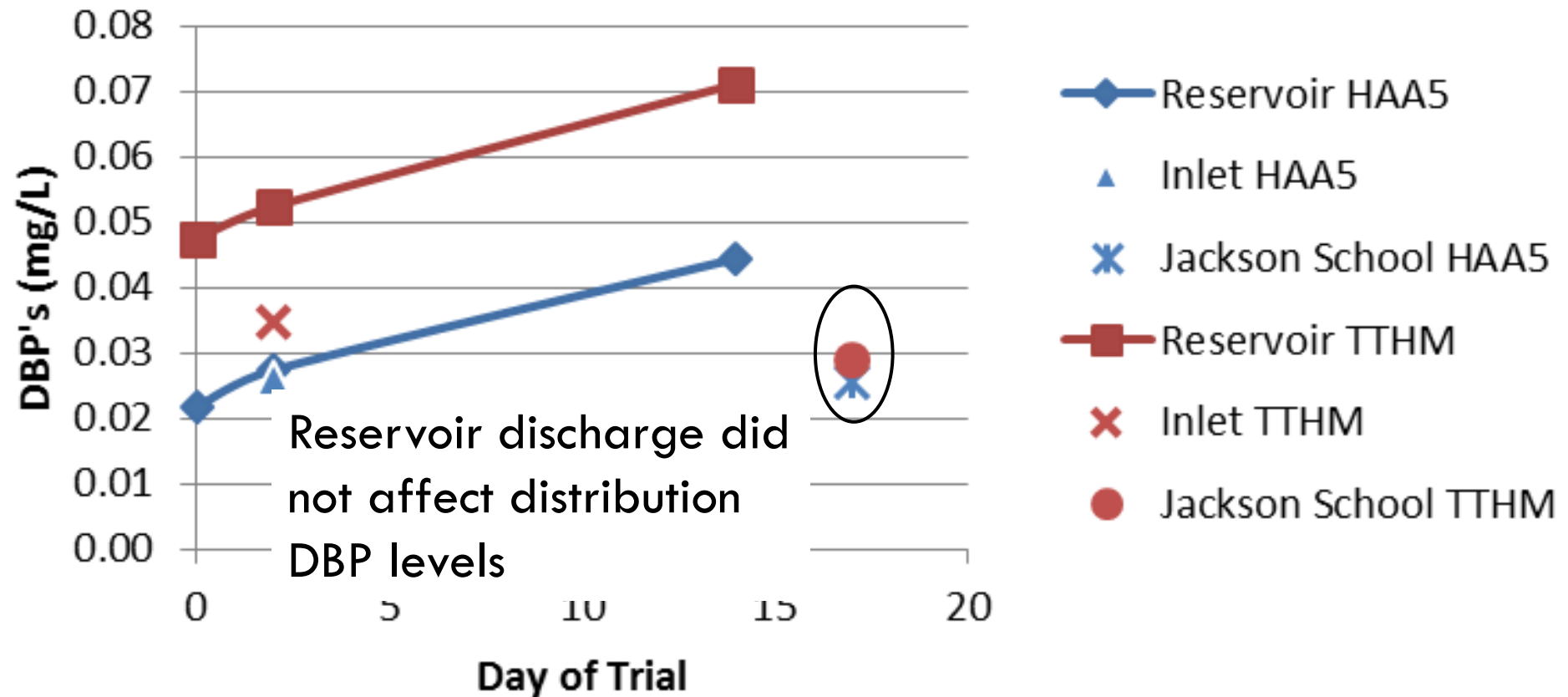
# WHAT WAS INCOMING WATER QUALITY?

## Crandall Trial 1 DBPs 14 Day: 10/20 to 11/3/2014



# WHAT HAPPENS TO DISTRIBUTION SYSTEM DBPs?

## Crandall Trial 1 DBPs 14 Day: 10/20 to 11/3/2014

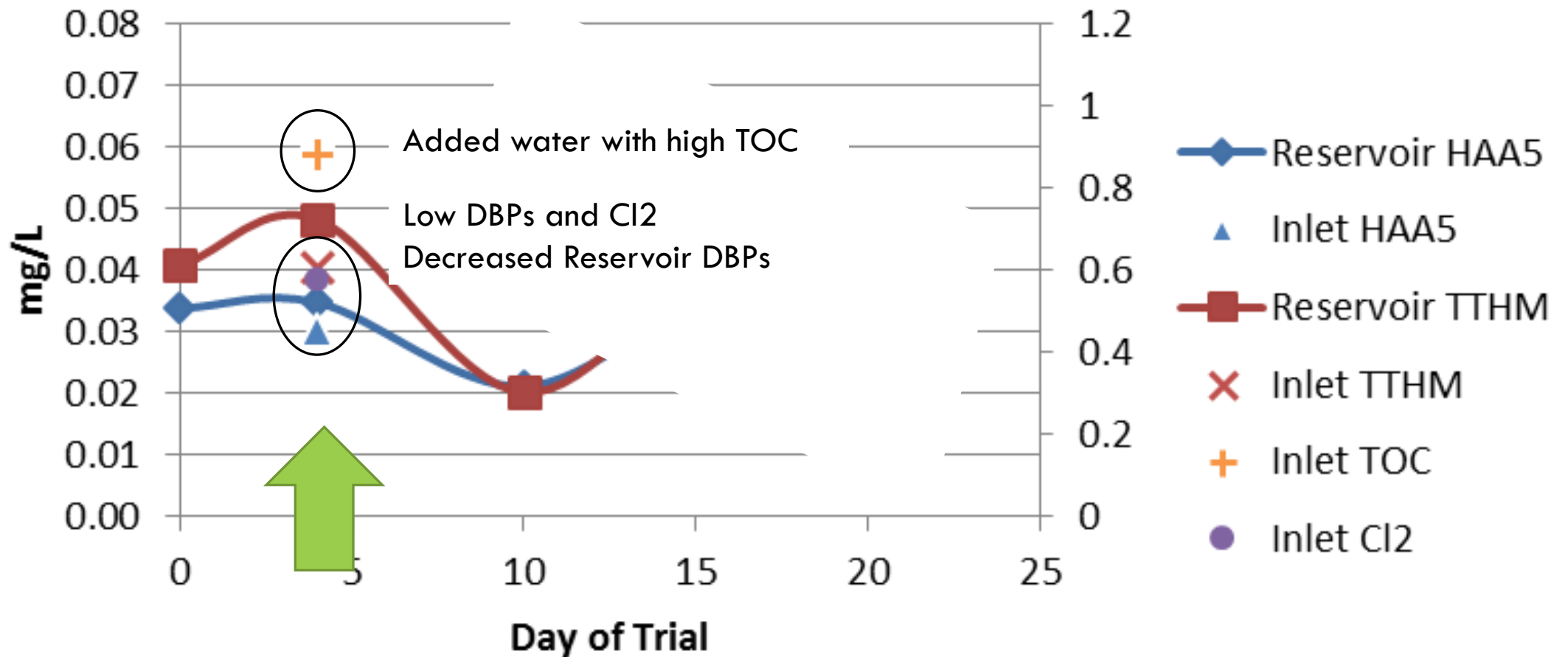


The background is a dark blue gradient. In the corners, there are white line-art graphics resembling circuit traces or data paths, with small circles at the end of the lines.

IN ALL TRIALS AFTER RESERVOIR DISCHARGE,  
DISTRIBUTION DBPS APPEARED UNAFFECTED

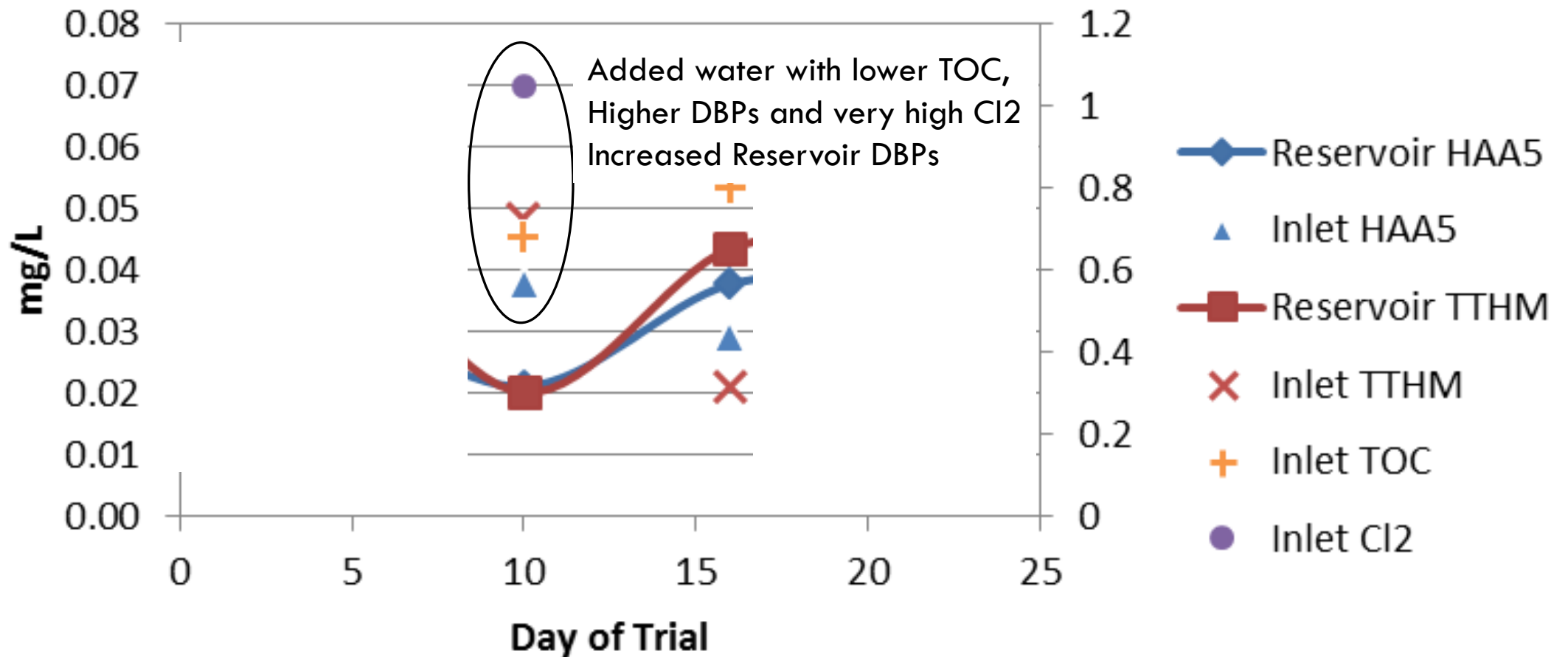
# WHAT WAS INCOMING WATER QUALITY?

## Trial 2 DBPs 21 Day Reservoir and Inlet



# WHAT WAS INCOMING WATER QUALITY?

## Trial 2 DBPs 21 Day Reservoir and Inlet





# WHAT HAVE WE LEARNED SO FAR?

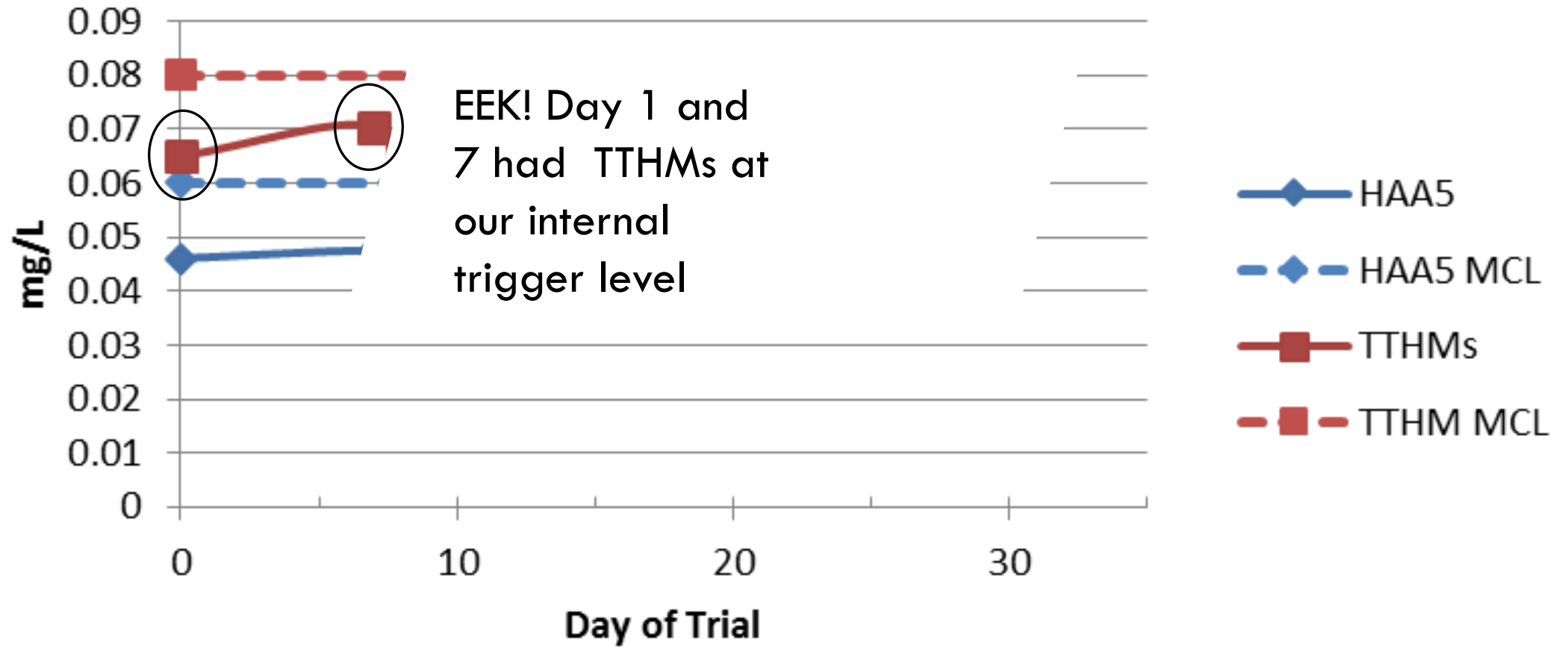
- Additions of water with
  - High TOC and Cl<sub>2</sub> lead to Increased DBPs
  - High TOC, low Cl<sub>2</sub>, low DBPs lead to Decreased DBPs
  - Low TOC, high Cl<sub>2</sub>, higher DPBs lead to Increased DBPs
- 
- Able to keep DBP levels under MCL

## TRIALS CONTINUED

- Did a second 21 day trial
- If successful and if two 30-day trials were not,
- Then partial grant funding could be awarded
  
- Then completed a 30-day trial
- By this point feeling really confident

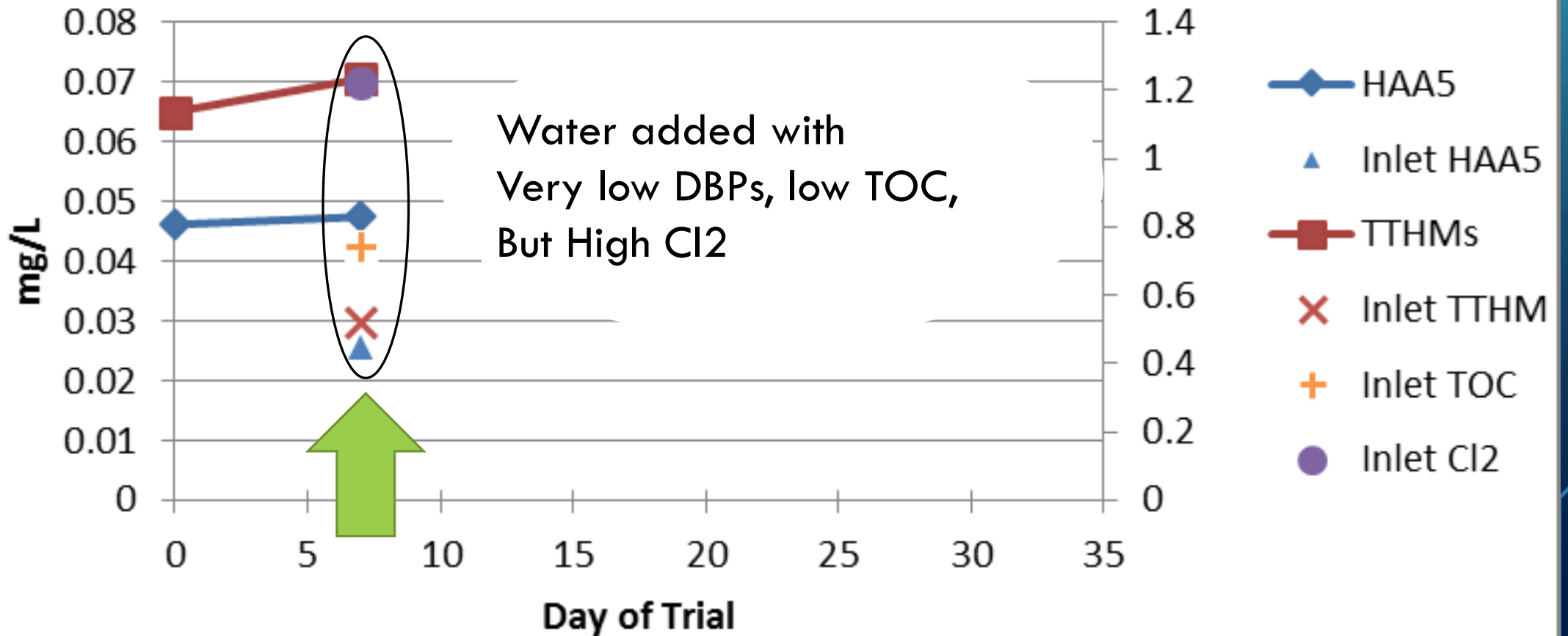
# 2<sup>ND</sup> 30-DAY TRIAL

## Crandall Trial 5 DBPs 2nd 30 Day: 3/25 to 4/24/2015



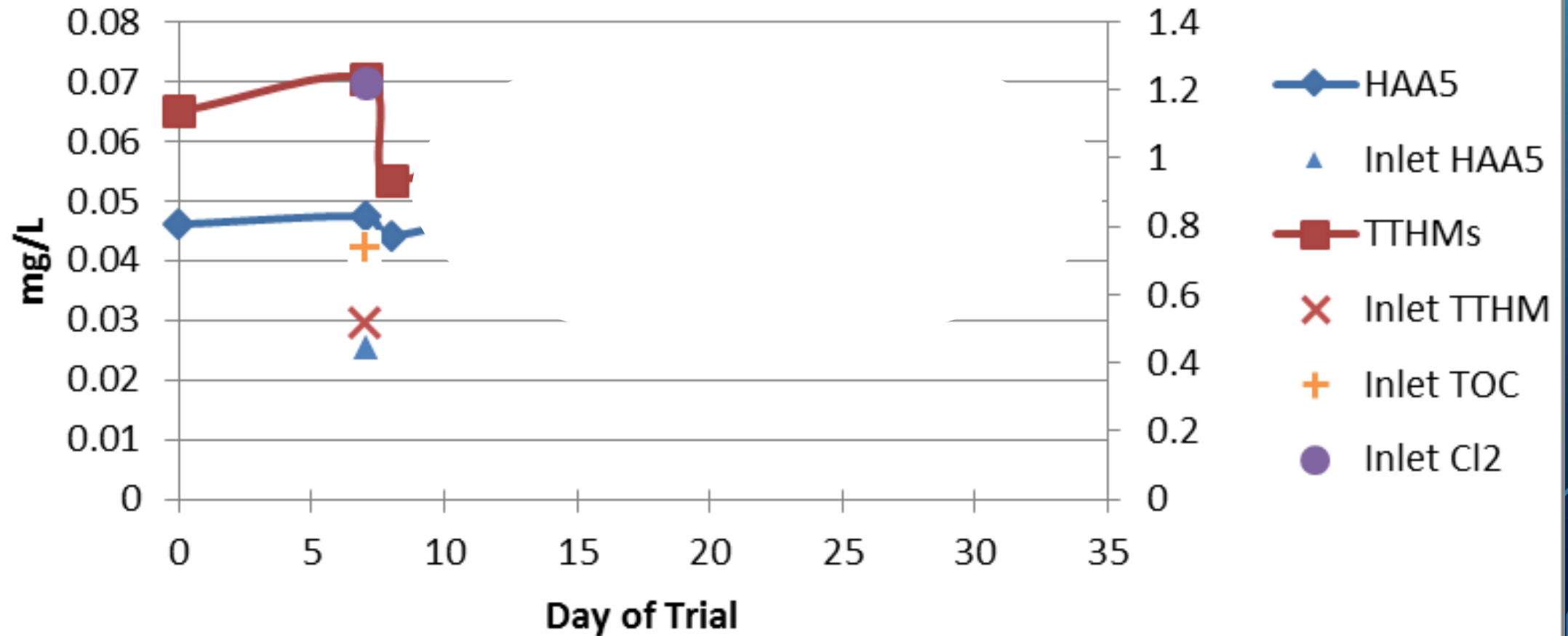
# INCOMING WATER QUALITY

## Crandall Trial 5 DBPs 2nd 30 Day: 3/25 to 4/24/2015



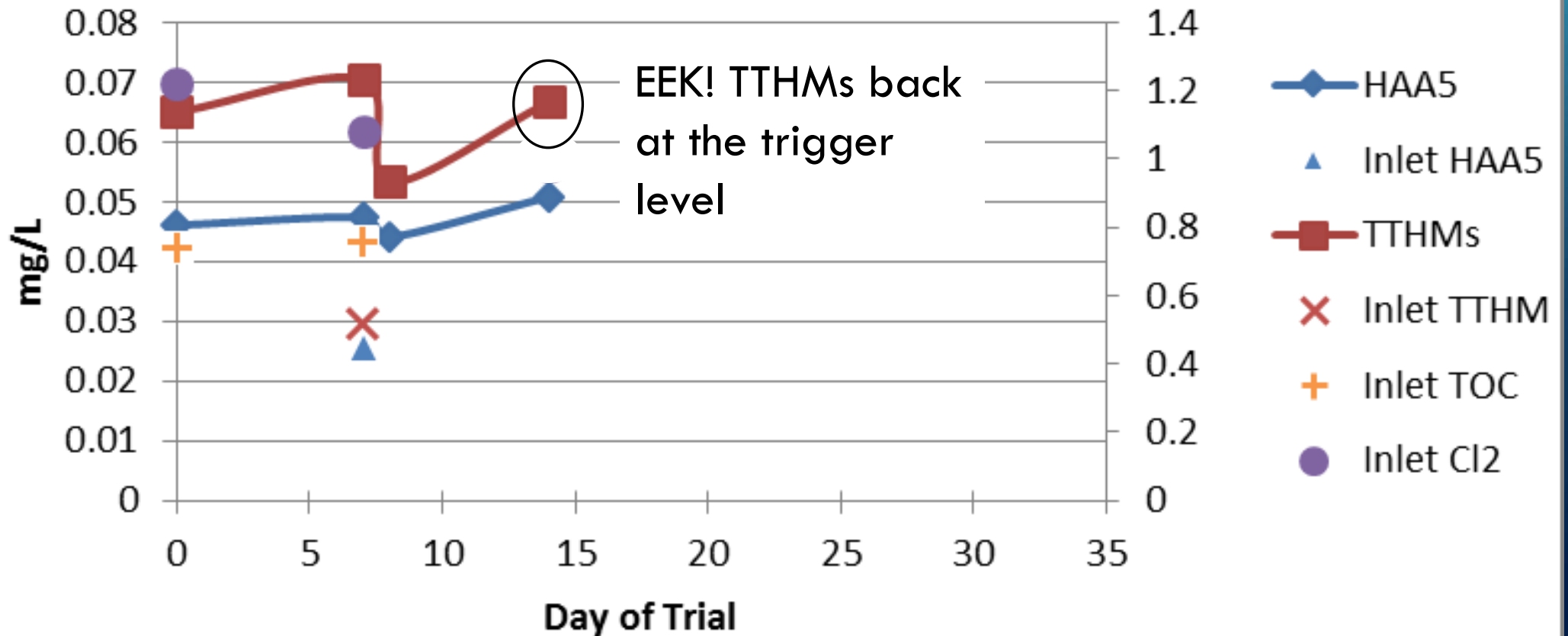
IT WORKED!

### Crandall Trial 5 DBPs 2nd 30 Day: 3/25 to 4/24/2015



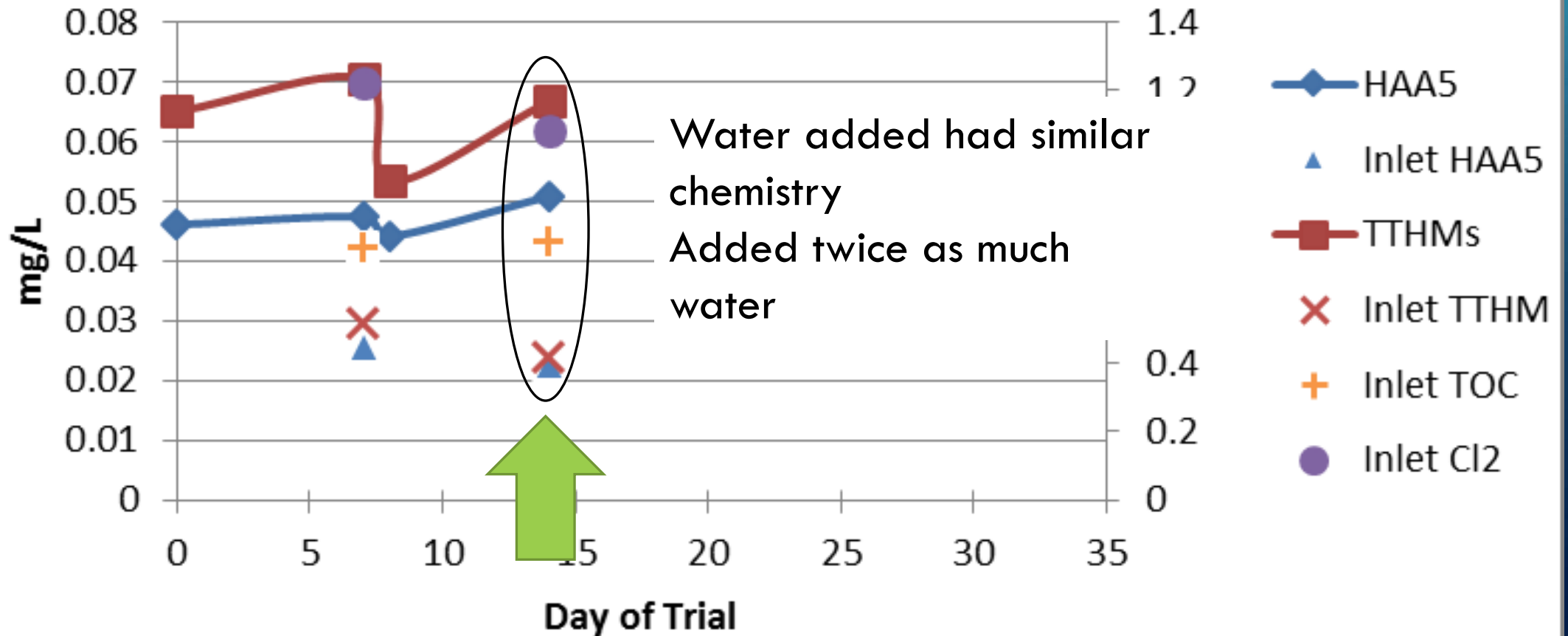
WAITED 1 WEEK

### Crandall Trial 5 DBPs 2nd 30 Day: 3/25 to 4/24/2015



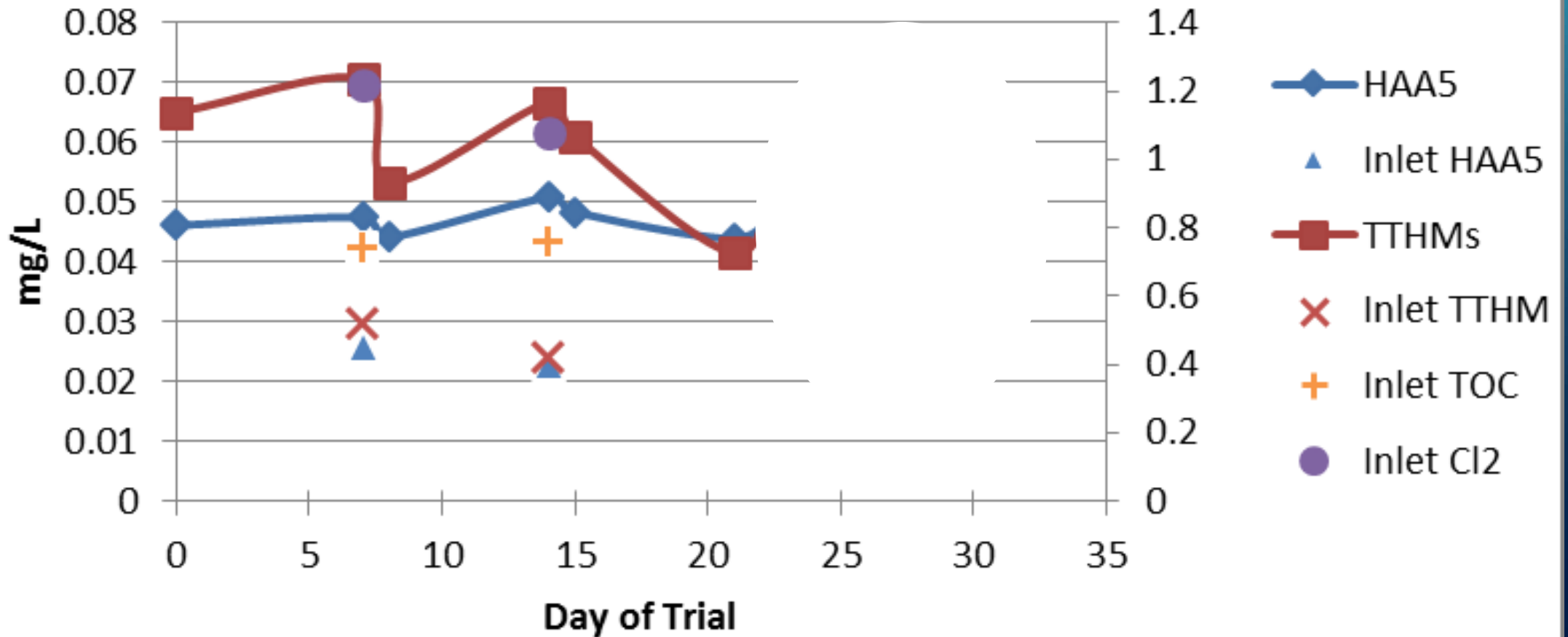
# ADD MORE WATER – WILL IT WORK AGAIN?

## Crandall Trial 5 DBPs 2nd 30 Day: 3/25 to 4/24/2015



IT WORKED AGAIN!

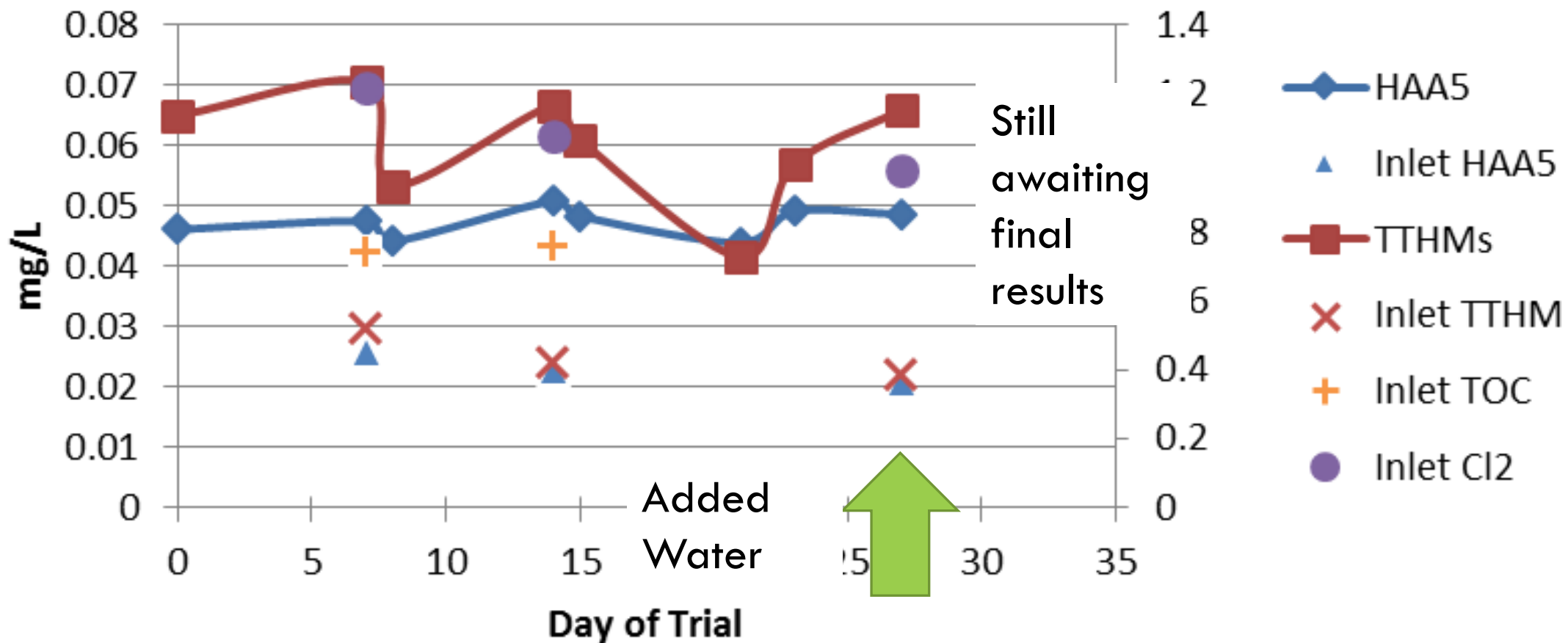
### Crandall Trial 5 DBPs 2nd 30 Day: 3/25 to 4/24/2015





# IT WORKED AGAIN!

## Crandall Trial 5 DBPs 2nd 30 Day: 3/25 to 4/24/2015



# ADDITIONS OF WATER WITH

- High TOC, high Cl<sub>2</sub>, low DBPs lead to Increased DBPs
  - High TOC, low Cl<sub>2</sub>, low DBPs lead to Decreased DBPs
  - Low TOC, high Cl<sub>2</sub>, higher DPBs lead to Increased DBPs
  - Low TOC, high Cl<sub>2</sub>, low DPBs lead to Decreased DBPs
- 
- Able to keep DBP levels under MCL
  - Reservoir discharge did not affect DBPs in Distribution System

## WHAT DID WE LEARN

- 24<sup>th</sup> Street Reservoir is 'seasoned' which may have contributed to easier trials
- Saw the DBP chemistry at work in the Distribution System and learned how we can balance storage and water quality

## WHAT DID WE LEARN

- Intangibles of working together
- 3 different groups in the Department working together
- Now greater understanding of how the all the pieces make the whole
- Played around with new Reservoir and Equipment

The background is a dark blue gradient. In the corners, there are white line-art patterns resembling circuit boards or neural networks, with lines connecting to small circles.

THE MONEY \$\$\$

# COSTS

- 24<sup>th</sup> Street Reservoir
  - Lab Analysis: \$6,350
- Crandall Reservoir
  - Lab Analysis: \$11,094
- No staff time or in-house materials included

# GRANT AWARD AMOUNTS

- 24<sup>th</sup> St received \$43,847
- Crandall likely to receive \$74,029
  
- Total Grant Award: \$117,876
- Net: \$100,432

The background is a solid teal color with a subtle gradient. In the corners, there are decorative white line-art elements resembling circuit traces or a network diagram, with small circles at the end of the lines.

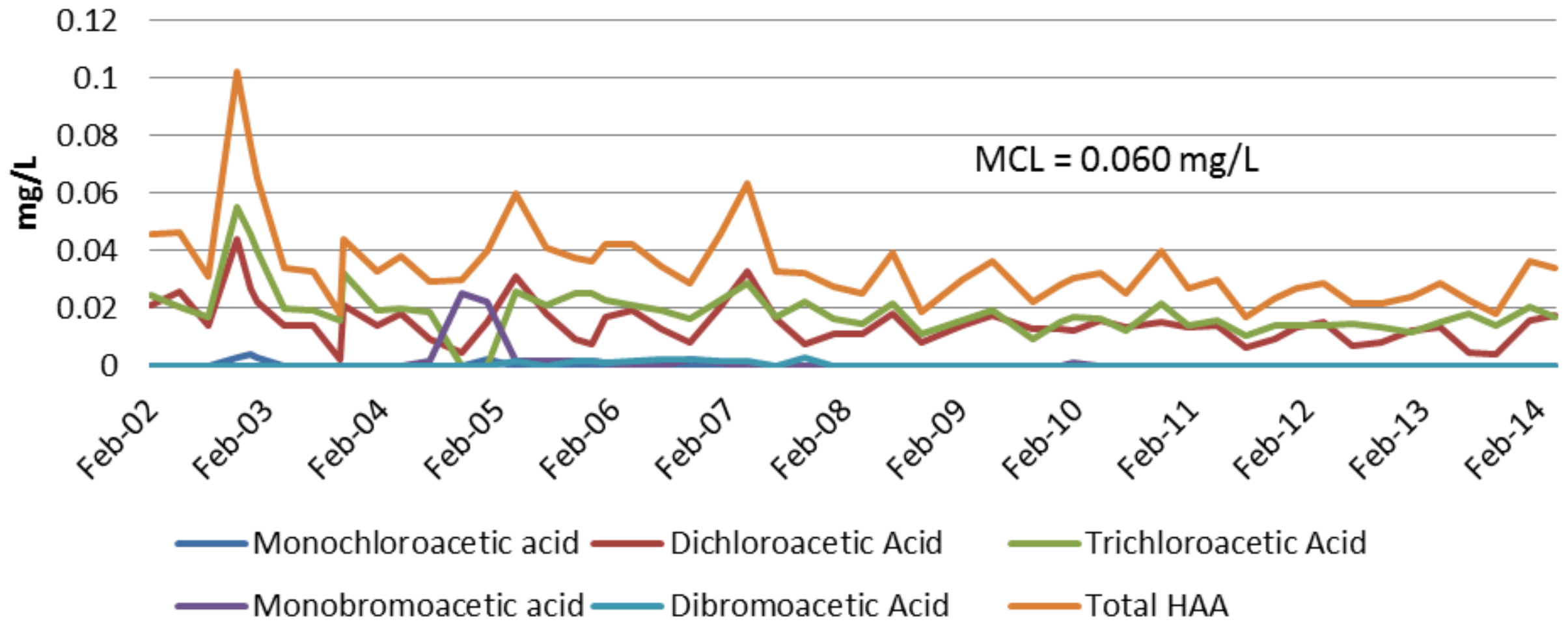
QUESTIONS?

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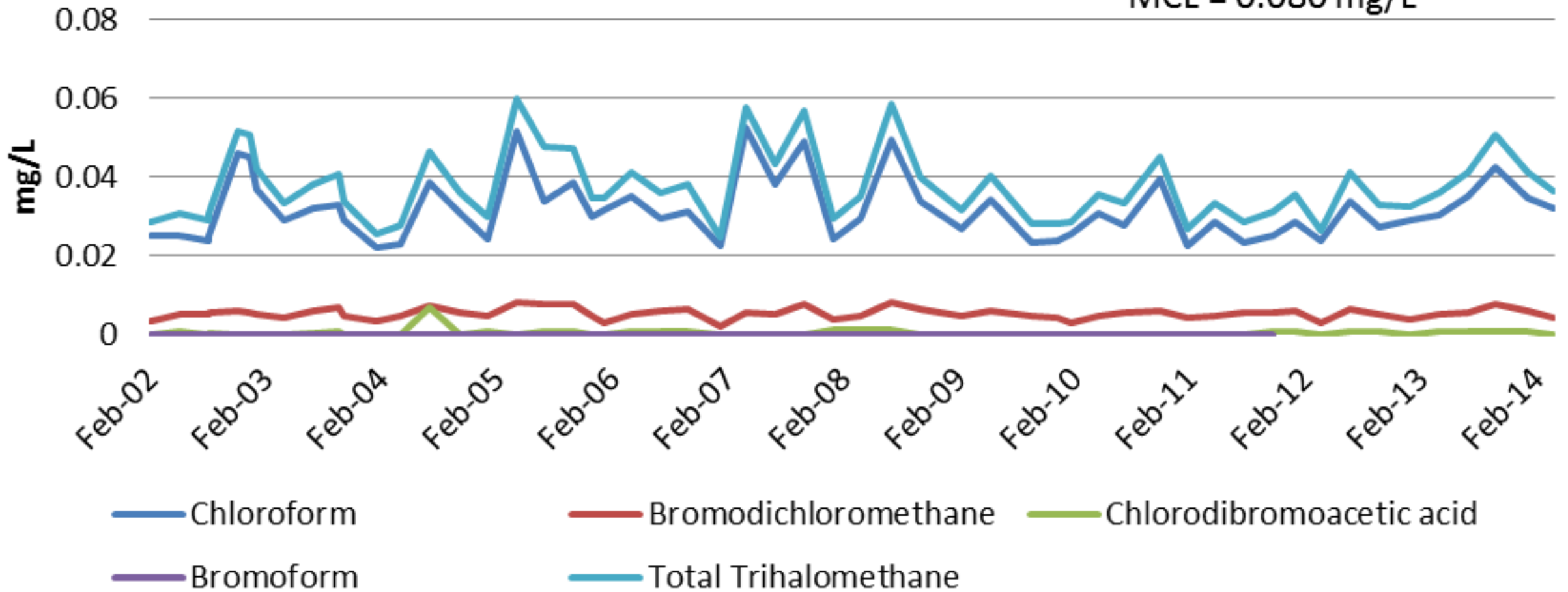


# HAA Levels at 24th St. Reservoir

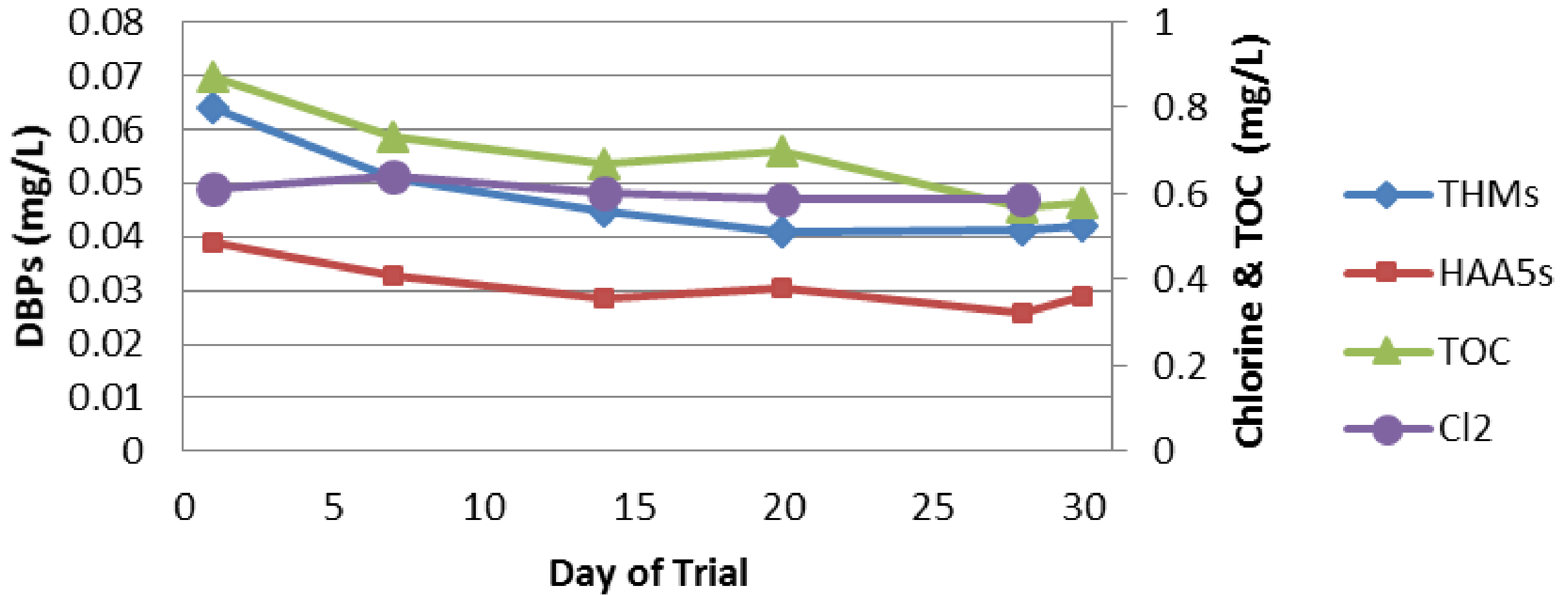


# TTHM Levels at 24th St. Reservoir

MCL = 0.080 mg/L



## 24th Street, Trial 4: 11/19/2013-12/19/2013



# 24th Street, Trial 5: 1/15/2014-2/13/2014

