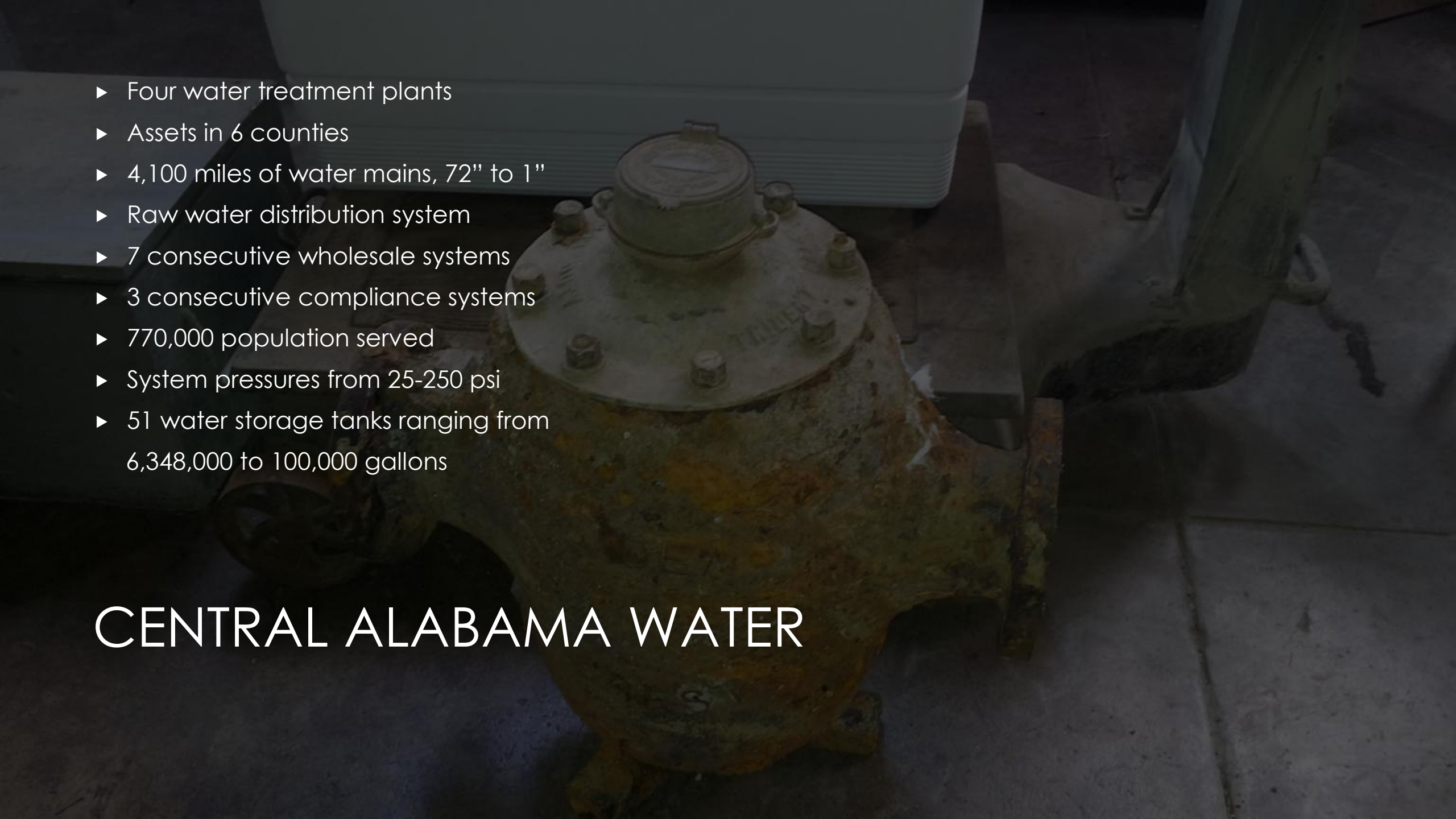
PARTNERSHIP TO CONTROL DISINFECTION BYPRODUCTS

Strategies for Wholesale and Consecutive Systems

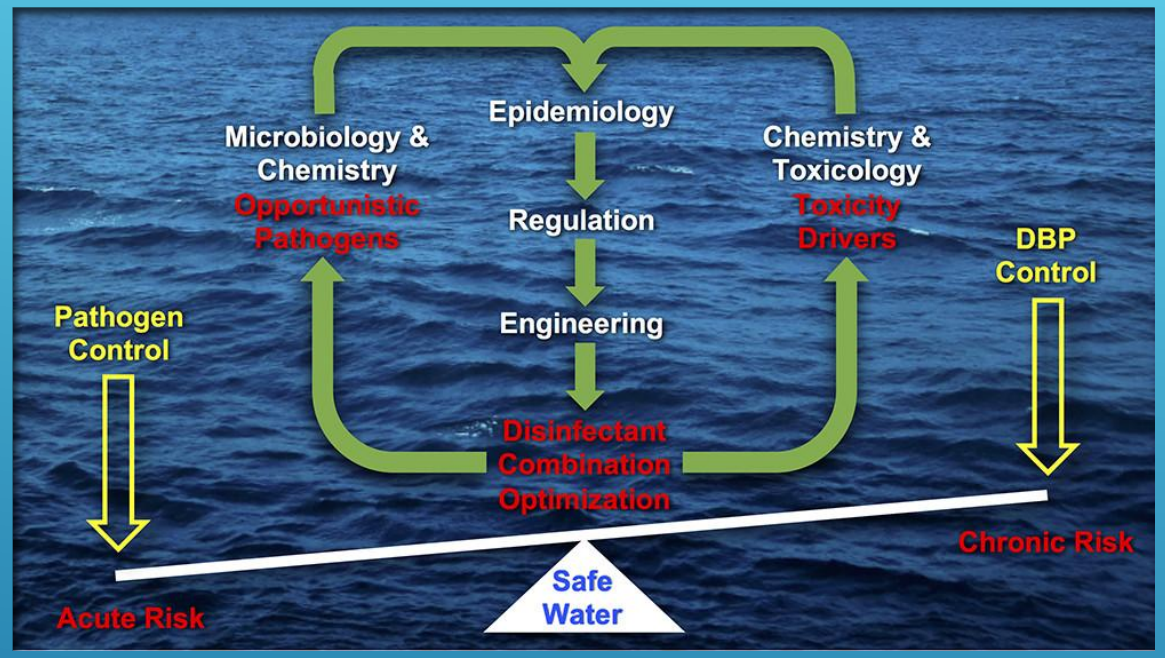
Ray Sloan

Central Alabama Water



- Four water treatment plants
- Assets in 6 counties
- 4,100 miles of water mains, 72” to 1”
- Raw water distribution system
- 7 consecutive wholesale systems
- 3 consecutive compliance systems
- 770,000 population served
- System pressures from 25-250 psi
- 51 water storage tanks ranging from 6,348,000 to 100,000 gallons

CENTRAL ALABAMA WATER



- When naturally occurring materials react with disinfectants, DBPs can be produced.
- Essentially, we trade what will probably make us sick with something that may harm a smaller percentage of the population.
- Different materials in the source water and different types of disinfectant create different DBPs, many of which are not regulated.

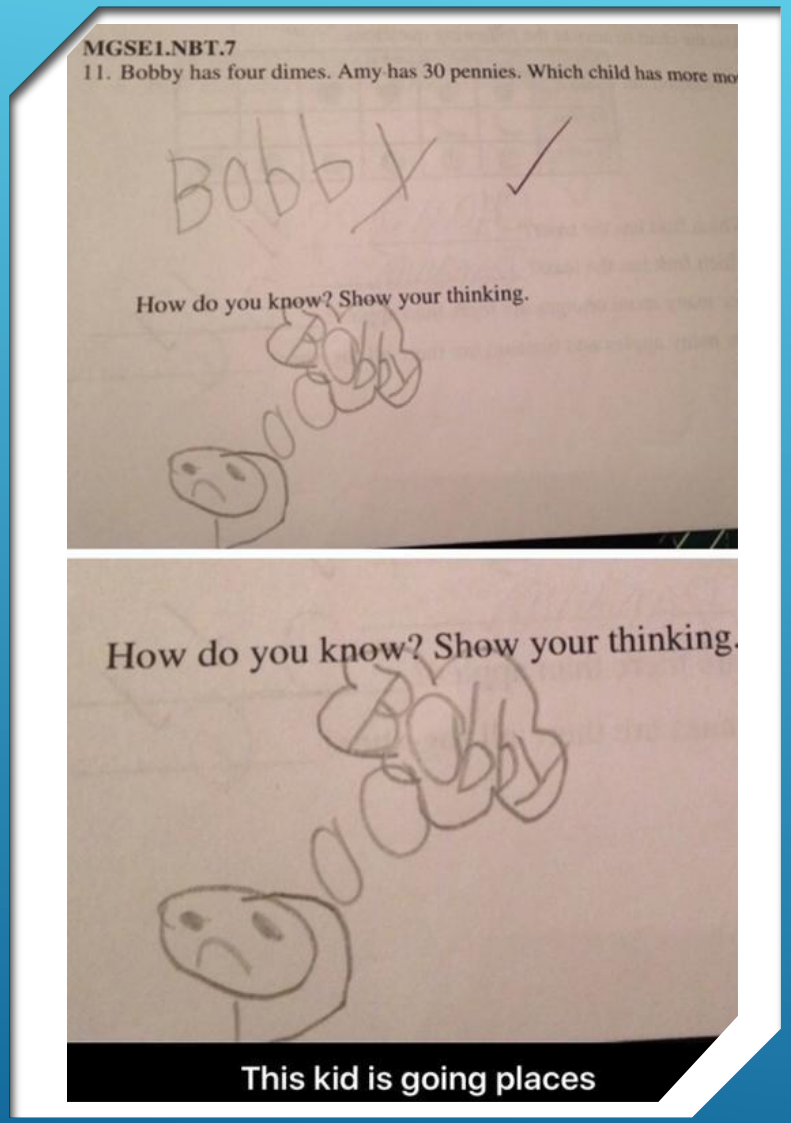
DISINFECTION BYPRODUCTS

TOCS, DISINFECTANTS, AND DBPS

- Total organic carbon (TOC) is a common metric to track to determine potential DBP creation.
- TOCs are regulated as a percentage removal of the total source water load, depending on source water alkalinity.
- Removal of TOCs is the best way to control DBPs. But it’s expensive.
- Another method is to change the disinfectant to match your water chemistry, which can reduce REGULATED DBPs, but not necessarily total DBPs.

CHALLENGES

- It's a balancing act between pathogen control and DBP reduction.
- Contact time between disinfectants and organic matter creates DBPs.
- Age of water is a affects DBP creation.
- Keeping tanks turned over quickly reduces water age.
- Reducing dead ends without sufficient usage reduces water age.
- Keep in mind that the goal in reducing water age is to get the water to the customer as soon as possible, not to just keep it moving.
- Requires planning, sometimes years in advance. (pipe size)



WHY IS IT A BALANCING ACT?

- When there is organic matter in the water with a disinfectant, DPBs will be formed.
- Additionally, those DBPs form more quickly when water temperatures are higher. Water can get very warm in storage tanks.
- Disinfectants, especially chlorine, dissipate faster in warmer water temperatures.
- In Summer, the chlorine we add creates more DBPs and "runs out" faster.
- Do we add more chlorine?

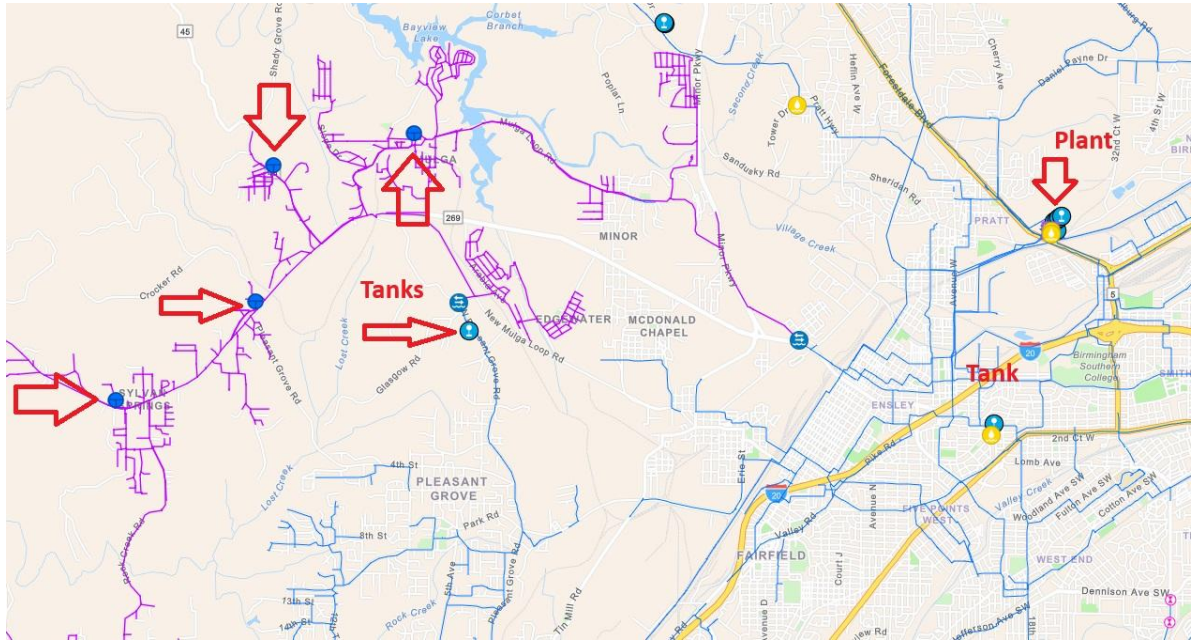
CONTACT TIME – WATER AGE

- Begins when the disinfectant is added into the water supply.
- Includes treatment contact time in clear wells as well as time in transmission piping, distribution piping, and storage tanks, including those in consecutive systems.
- If disinfectant residuals are low, adding more disinfectant can raise the DBP levels.
- Organic matter is always present, so the additional treatment reacts with that matter.

AGE OF WATER

- Age of water is the amount of time it takes from when water leaves the treatment process until it is consumed by the customer.
- Hydraulic modeling is the best way to determine water age in a system.
- However, it can be calculated using flows in pipes, tank turn-over times, and customer demand.
- Another good marker is conductivity, which rises as water ages.
- A good rule of thumb is 48 hours, but longer periods normally result in meeting water standards.

AGE OF WATER – COMMON PLACES FOR OLD WATER



- Where pipe size is inappropriate for demand. Consider a 12” service line that’s half a mile long.
- Long sections of pipe with few customers.
- Water that travels through multiple tanks before reaching a customer.

WAYS TO COMBAT DBPS

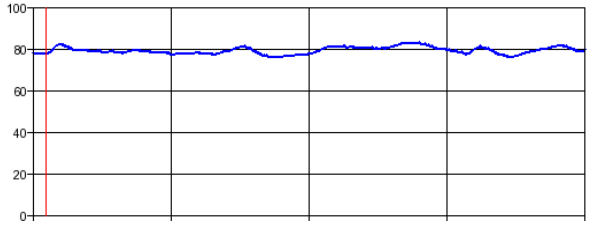
- Form a partnership with your customers
  - Communicate about higher temperatures and perform increased monitoring to know when issues are coming.
  - Try differing tank level targets.
  - Consider incentivizing usage in troublesome times to increase usage.

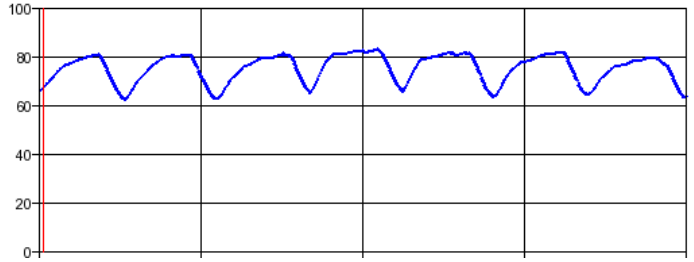
Pipe Size (inches)	Gallons per Foot	Gallons per Mile
0.50	0.01	54
0.75	0.02	121
1.00	0.04	215
2	0.16	861
4	0.65	3,445
6	1.47	7,752
8	2.61	13,781
10	4.08	21,533
12	5.87	31,007
14	7.99	42,204
16	10.44	55,124
18	13.21	69,766
20	16.31	86,131
24	23.49	124,029
30	36.70	193,795
32	41.76	220,496
36	52.85	279,065
42	71.94	379,839
48	93.96	496,116
56	127.89	675,269
60	146.81	775,181
66	177.65	937,969
72	211.41	1,116,261

WAYS TO COMBAT DBPS

- Flushing isn't always the answer
  - It can cause a high demand on the system that prevents tank turn-over/ fluctuation.
  - Must always be a calculated volume. Perform water quality testing and flushing exercises to monitor for changes in water quality parameters.
  - Find creative ways to use the water that is flushed. Point of sale for contractors?

WAYS TO COMBAT DBPS

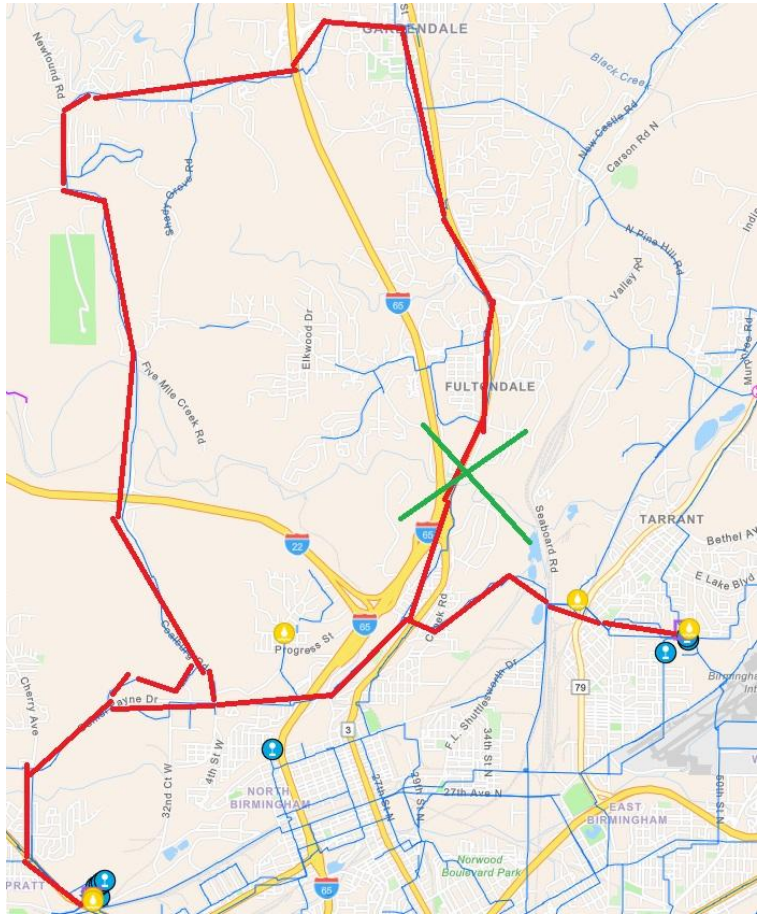




- Fluctuate tanks.
- Get a good plan and stick to it.
- Add mixers in tanks. Especially important for those tanks with large storage volumes or minimum values above 50% of the tank volume.

- Remove or reduce organics
  - Very expensive.
  - Chemicals used to reduce TOCs may have adverse effects on equipment and other water quality parameters.
- Change disinfectant
  - Costly.
  - Can be difficult to change as it usually results in taste and odor issues.
  - UV can be used to transform some organics into simpler forms and creates less harmful DBPs.

WAYS TO COMBAT DBPS



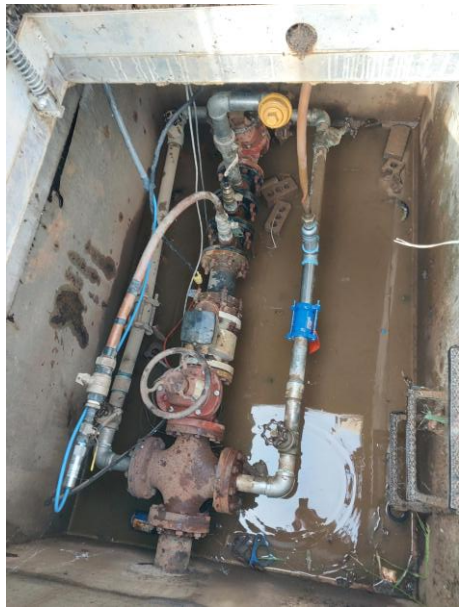
WAYS TO COMBAT DBPS

- Reduce dead-ends.
- Adding a loop to a system changes the hydraulic break-points rather than solving the problems.

size, inches	fps		gpm		mgd
12	5.00		1761.8		2.54
12	0.28		100.0		0.14
21	3.22		3472.2		5
			8104.2		11.7
			8104.2		11.7

WAYS TO COMBAT DBPS

- Size your piping correctly during installation.
- It's common to plan for future growth, but water quality is a major concern.
- Consideration water flow speed when sizing pipe.



- **Whatever you do, do it ALL THE TIME.**
- **It'll change every season and every year. Keep up your monitoring!**

REMINDERS

QUESTIONS?