

BEACH MONITORING PROGRAM UPDATES & NITRATE TESTING FOR DRINKING WATER

PRESENTED TO THE DANE COUNTY LAKES
AND WATERSHED COMMISSION

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BEACH MONITORING PROGRAM



PILOTING REAL TIME TESTING & PREDICTIVE MODELING AT BEACHES



LONG TERM GOALS & NEW TECHNOLOGY



NITRATE TESTING OPTIONS IN THE LAB

CURRENT PROGRAM STATUS

PROGRAM STAFFING

1 FTE Microbiologist: Jennifer Braun, M.S

Day-to-Day Operations, Lab Analysis (QPCR Primary), and Backup

Beach Sampling

1 FTE: Environmental Technician:
Jesse Ramirez

Beach Sampling & Lab Analysis

1 LTE Lab Assistant: Allen Kaplan, B.S
Pending Hire: 1 LTE Field Staff

Beach Analysis QPCR

1 LTE Environmental Specialist:
Martha Kuka

Current Monitoring Locations

Dane County

22 Beaches*

7 Municipalities

City of Madison

UW-Madison

Maple Bluff

Monona

Middleton

Mt. Horeb

Stoughton

Verona

*Tenney Beach: Closed for Season Due to Construction



1 visit/week = 140 Miles

CURRENT TESTING PROCESS

E. coli

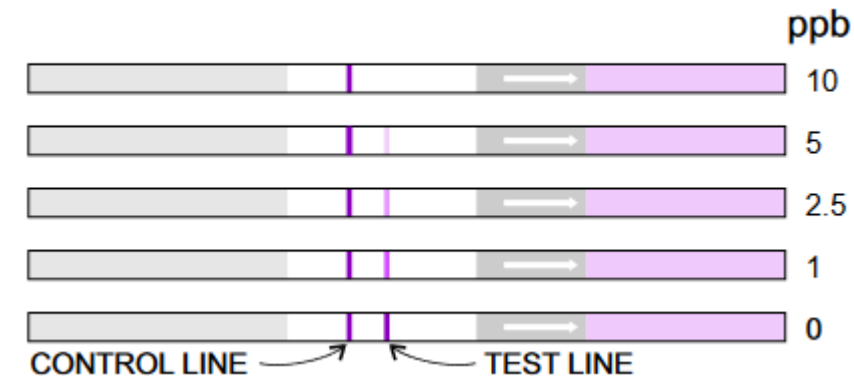
Defined Substrate Technology (DST)

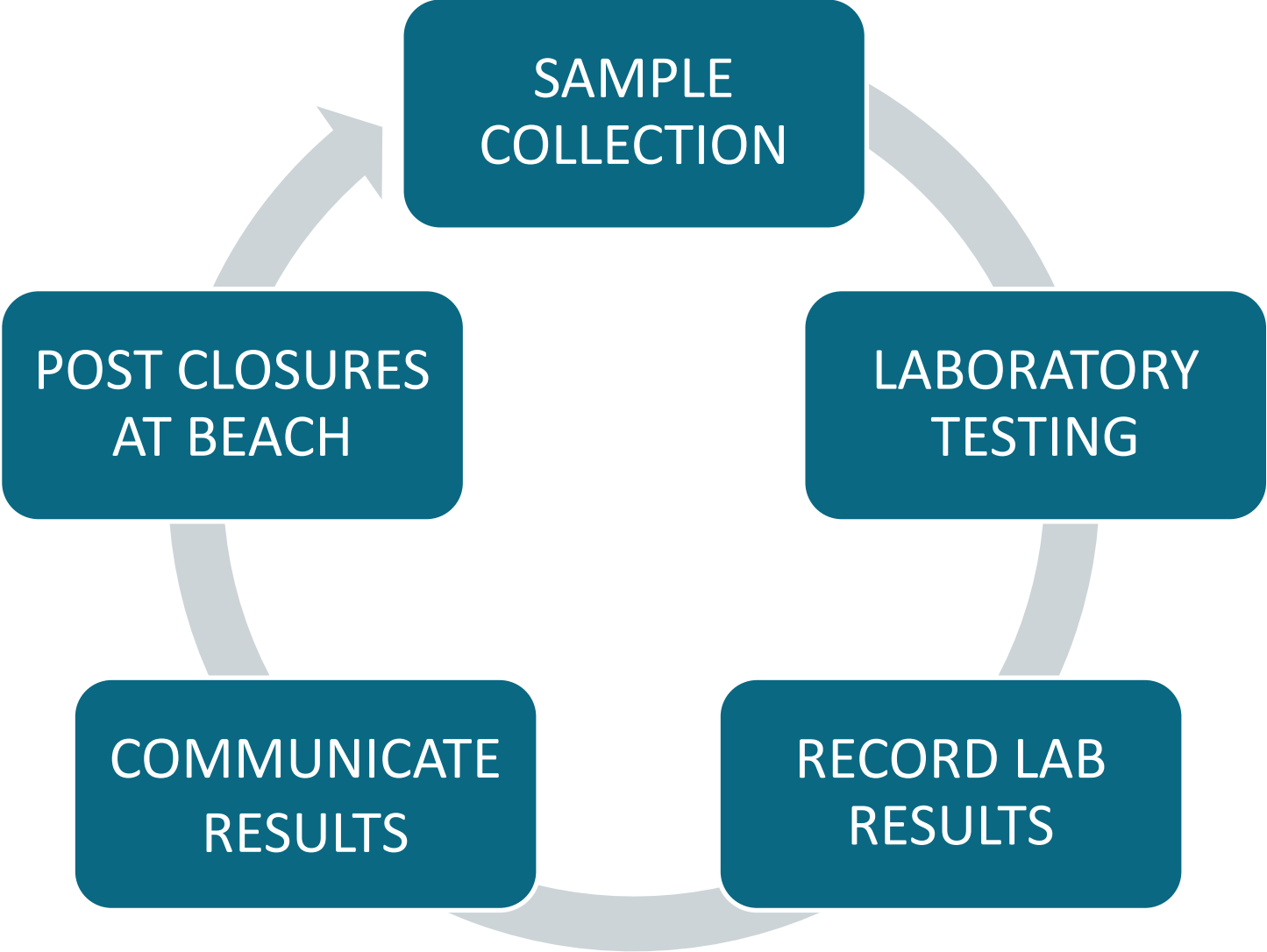
Results take 18-24 Hours

Blue-Green Algae (Cyanobacteria)

Rapid Strip Test: Microcystins

Toxin results take about 1 hour





2024 SEASON SO FAR...

BEACH CLOSURES

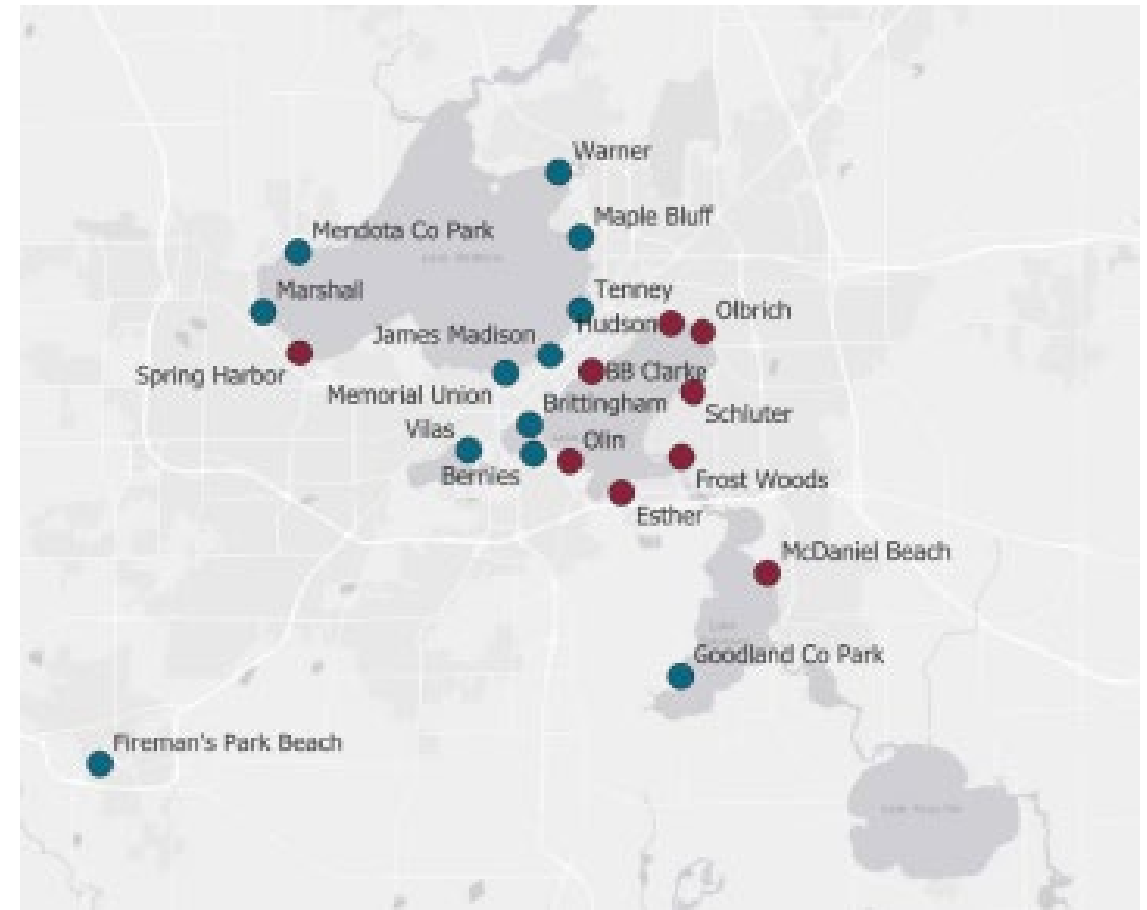
- 18 Closure Days
 - 83% Rainfall Model/Elevated Bacteria
 - 17% Cyanobacteria

Beach	Municipality	Date Sampled/ Observed	Reason for Closure	Closed due to Rainfall Model?	Date Closed/Posted	Date Re-Opened	Beach Days Lost	<i>E. coli</i> MPN/100 mL	Strip μ g/L microcystin
Olin	City of Madison	5/28/2024	<i>E. coli</i>	Yes	5/28/2024	5/29/2024	1.0	140	
Marshall	City of Madison	6/3/2024	Cyanobacteria	No	6/3/2024	6/5/2024	2.0	120	0
Spring Harbor	City of Madison	6/3/2024	Cyanobacteria	No	6/3/2024	6/5/2024	1.0	100	0
BB Clarke	City of Madison	6/4/2024	<i>E. coli</i>	Yes	6/4/2024	6/5/2024	1.0	590	
Esther	City of Madison	6/4/2024	<i>E. coli</i>	Yes	6/4/2024		2.0	1,900	
Frost Woods	Monona	6/4/2024	<i>E. coli</i>	Yes	6/4/2024	6/5/2024	1.0	410	
Hudson	City of Madison	6/4/2024	<i>E. coli</i>	Yes	6/4/2024		2.0	610	
McDaniel	McFarland	6/4/2024	<i>E. coli</i>	Yes	6/4/2024		2.0	1,300	
Olbrich	City of Madison	6/4/2024	<i>E. coli</i>	Yes	6/4/2024		2.0	730	
Olin	City of Madison	6/4/2024	<i>E. coli</i>	Yes	6/4/2024		2.0	1,400	
Schluter	Monona	6/4/2024	<i>E. coli</i>	Yes	6/4/2024	6/5/2024	1.0	340	
Spring Harbor	City of Madison	6/4/2024	<i>E. coli</i>	Yes	6/4/2024	6/5/2024	1.0	63	

IMPLEMENTATION OF REAL-TIME TESTING AND MODELING

PILOT: RAINFALL MODELING

- **GOAL:** Predict when beach *E. coli* levels were likely to be high, in order to improve the timeliness of beach closures while saving the agency resources.
- 9 of the 23 beaches were significantly likely to have elevated *E. coli* levels (resulting in a closure) after it rained.



PILOT: RAINFALL MODELING

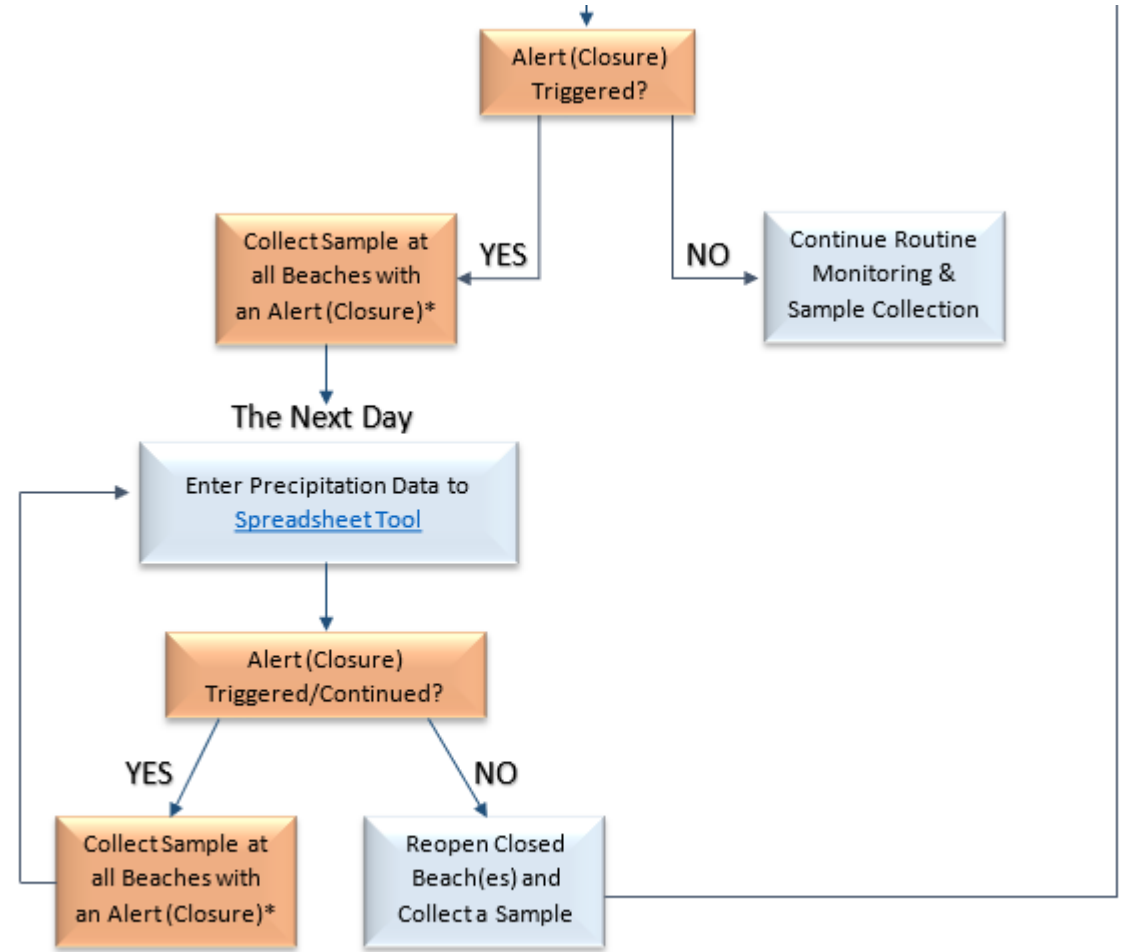
Instructions: At the beginning of each day, a user should enter the information in the cells highlighted green. The calculator will automatically predict which beaches are at high risk of high levels of E. Coli.

Data Source: Precipitation data should be downloaded from the Dane County Airport weather gage (KMSN). The data can be found at <https://w1.weather.gov/data/obhistory/KMSN.html>

Today's Date: **6/4/2024**

Previous 24-hr precipitation: **1** in.
 Previous 48-hr precipitation: **0** in.

Beach Name	24-hr Threshold (in.)	48-hr Threshold (in.)	Median Days Closed	Date		
				6/4/2024	6/5/2024	6/6/2024
BB Clarke	0.9	1.1	1	Alert	No Alert	No Alert
Esther	0.5		1	Alert	No Alert	No Alert
Frost Woods	0.9	1.6	1	Alert	No Alert	No Alert
Hudson	0.5	1.1	2	Alert	Alert	No Alert
McDaniel Beach	0.3	0.9	1	Alert	Alert	No Alert
Olbrich	0.9	0.9	2	Alert	Alert	Alert
Olin	0.4	0.6	1	Alert	Alert	No Alert
Schluter	0.9	0.9	1	Alert	Alert	No Alert
Spring Harbor	0.8	1.2	1	Alert	No Alert	No Alert



TARGETED APPROACH

PRIORITIZE RAPID TESTING AT CLOSED BEACHES

- If a beach is closed due to elevated *E. coli* levels (lab testing or rainfall model), resamples will be prioritized for QPCR analysis.
- Beaches can open more quickly following a closure.
- Allows for testing to take place on a Monday or Friday

IMPROVED SIGNAGE

PILOT IMPROVED SIGNAGE

- Aluminum Signs
- Informative
 - Rainfall Impacts
 - Harmful Algal Bloom Risks
- QR Code link to website
- Multilingual
 - English, Spanish, Hmong

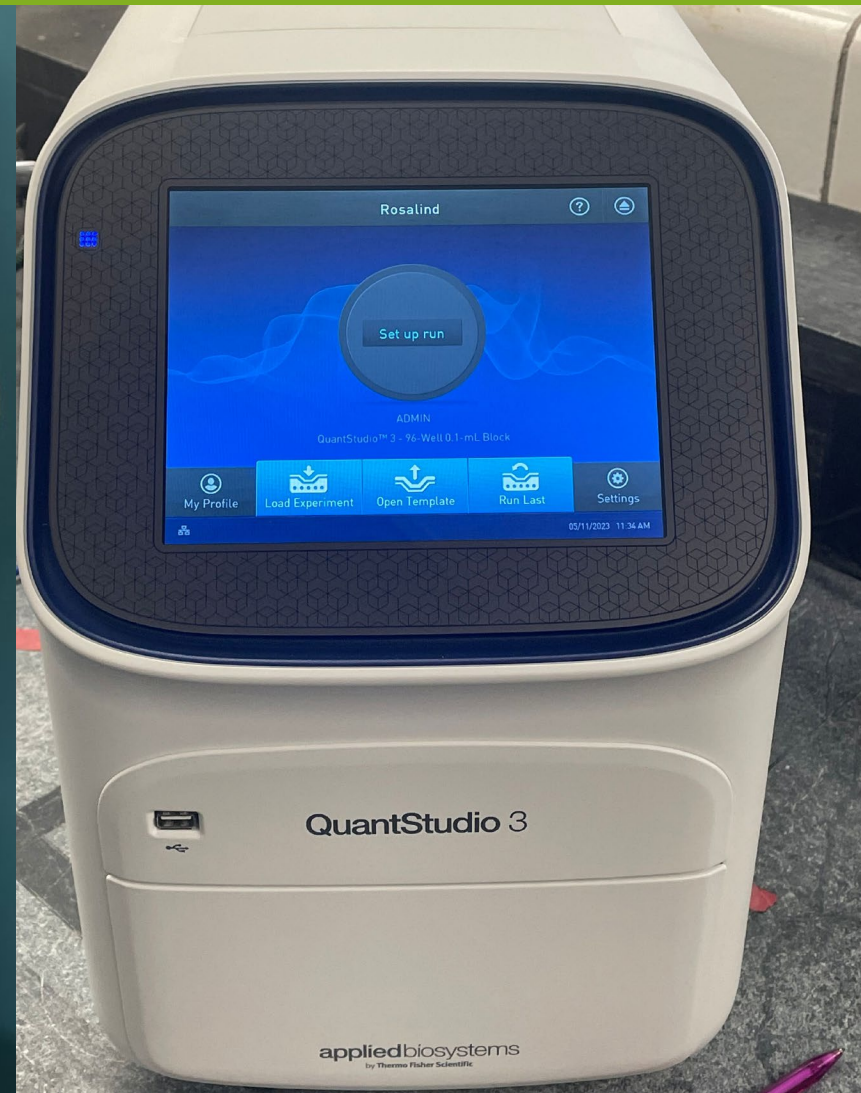


Example Sign courtesy of Surfrider Foundation
www.surfrider.org

REAL-TIME TESTING: QPCR

Targets bacterial DNA to allow for rapid detection of *E. coli* levels.

BioGx
Recreational
Water Reagents



REAL-TIME PCR (QPCR)

PROs

- Rapid Testing: Same Day Results (3-4 Hours)
 - Measures DNA instead of culturing cells overnight

CONs

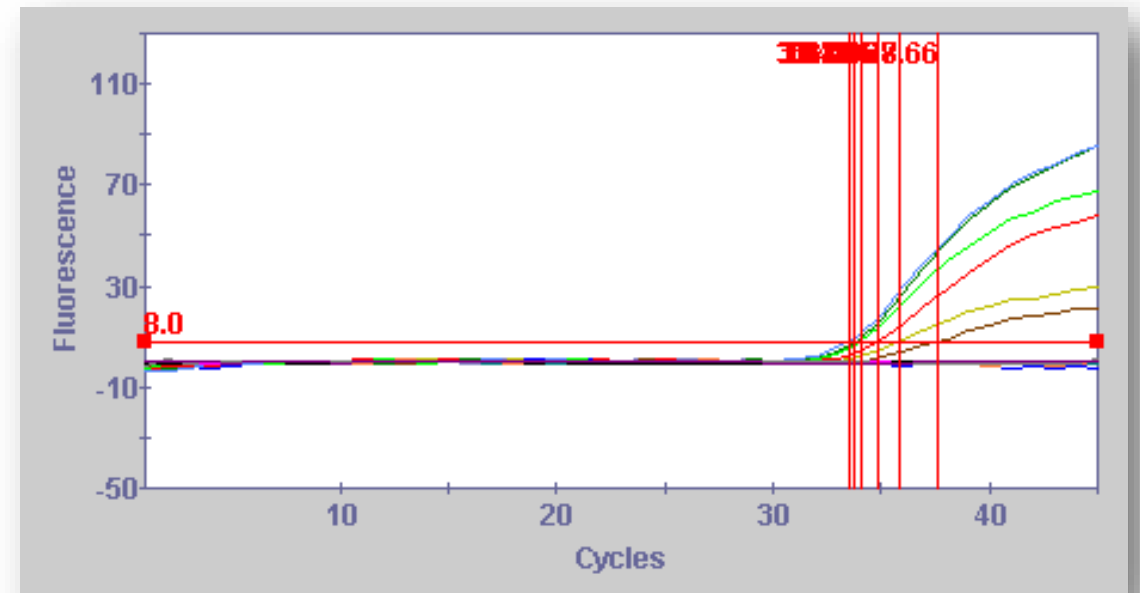
- Higher Cost: \$30/Sample vs \$10/Sample (Supplies ONLY)
- Requires specially trained staff to run the testing.
 - 1 FTE: Jennifer Braun, M.S
 - 1 LTE: Martha Kuka, B.S

REAL-TIME PCR (QPCR)

CHALLENGES

Results can be impacted by presence of blue-green algae, and other naturally occurring compounds.

- False positives
- Invalid results
- Reaction Inhibition

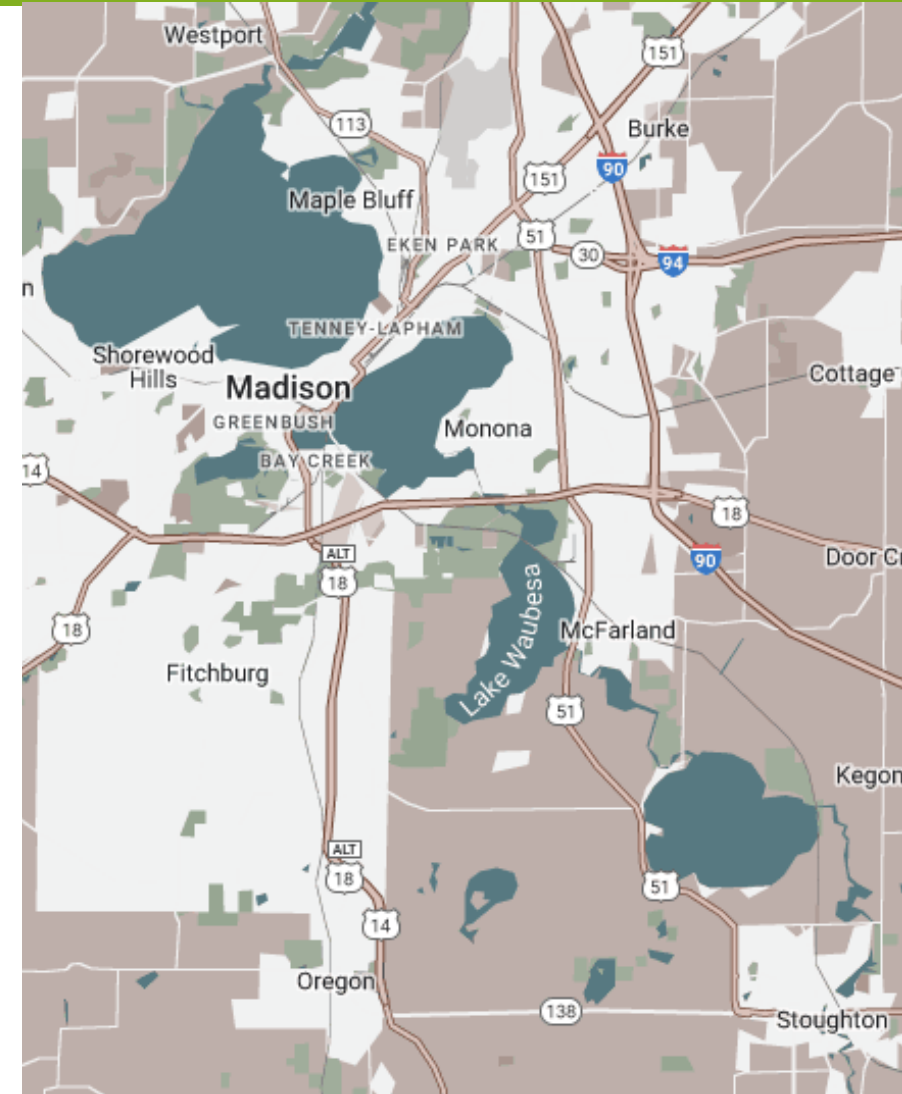


REAL-TIME PCR (QPCR)

CHALLENGES

Takes time to implement each season.

- Each beach is unique
- 23 Beaches
- A lot of ground to cover
- Works best at beaches with point source pollution (wastewater)



NEXT STEPS

VALIDATE RAINFALL MODEL

- Gather more data this season to validate rainfall model.

IMPROVE RAPID METHODS

- More sampling staff
- Samples to the lab faster
- Results sooner.
- Real-Time Data



LONG TERM GOALS & NEW TECHNOLOGY

LONG TERM GOALS

- **Targeted Analysis**
 - Modeling, Rapid Methods, Harmful Algal Blooms
 - Improved Workflow
- **Improved Beach Signage & Communication**
 - Inclusive and Accessible
 - Multilingual, Plain Language, Visuals Cues



Photo Courtesy of SwimSmart swimsmarttech.com

NEW TECHNOLOGY “GOALS”

- **FlowCam Cyano**

- Flow imaging microscopy
- Allows for identification of cyanobacteria species
- Target toxin testing to those samples that show prevalent toxin producers.
- Identify blooms that may not produce toxin to help inform public health risk.



DRINKING WATER NITRATE TESTING OPTIONS

NITRATE IN DRINKING WATER

- **IMPORTANCE**

- Blue Baby Syndrome in infants under six months of age and that are bottle fed.
 - Competes for oxygen in the bloodstream.
- National Cancer Institute suggests a link between elevated levels of nitrate in drinking water and an increased risk of non-Hodgkin's lymphoma.

- **MAJOR SOURCES**

Fertilizers (agriculture), animal waste, and human sewage.

NITRATE IN DRINKING WATER

- **MAXIMUM CONTAMINATE LEVEL (MCL)**
 - Set by the US EPA at 10 ppm
- **MCL Exceedances (Nitrate >10 ppm)**
 - **Treatment Methods:**
 - Reverse Osmosis
 - Anion Exchange
 - Nitrate “Selective” Anion Exchange
 - Distillation
 - Electrodialysis

NITRATE IN DRINKING WATER

- **TESTING OPTIONS AT PUBLIC HEALTH MADISON & DANE COUNTY (ENVIRONMENTAL LABORATORY UNIT)**
 - **US EPA METHOD 300.00**
 - Anion Chromatography
 - Increased Accuracy
 - Compared to at home tests
 - Low Level Detection (0.029 PPM)
 - Samples must be analyzed within 48 hours of collection.
 - Cost \$30 per sample

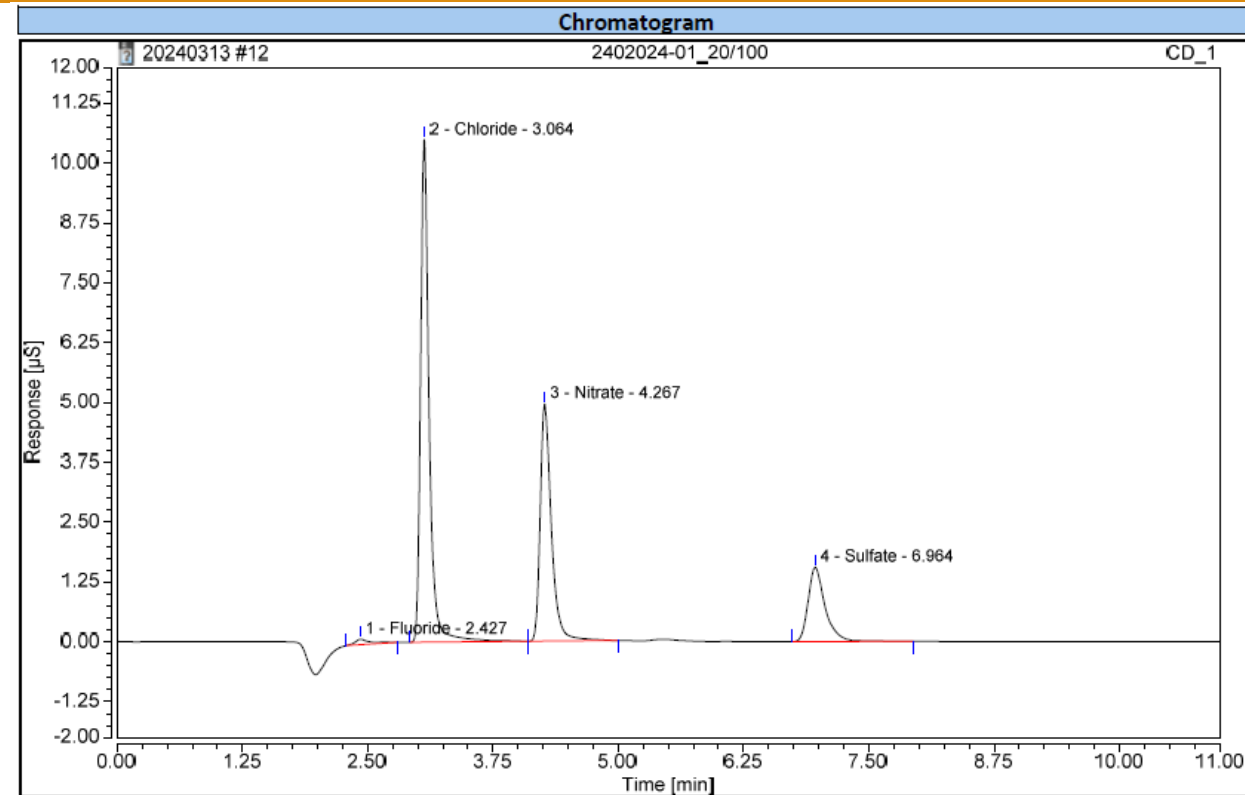
NITRATE IN DRINKING WATER

LABORATORY TEST DATA

10 YEARS: 2014-2024

- Samples Tested: 2,263¹
- MCL Exceedances: 292 (13%)
 - Range: 10 ppm – 42 ppm²
 - Average Exceedance: 13.8 ppm

¹: No samples were accepted March 2020-August 2020 due to the COVID-19 pandemic. ²: Sample with 42 ppm nitrate was collected from a private residence in Green County, WI. Nitrate levels >20 ppm detected in Dane County were collected in Town of Dane (34 ppm), Cottage Grove, Cross Plains, Sun Prairie, and Waunakee (20-29 ppm).



Integration Results						
No.	Peak Name	Retention Time min	Area µS*min	Height µS	Amount PPM	Comment
1	Fluoride	2.427	0.021	0.115	1.1615	
2	Chloride	3.064	1.038	10.499	55.2948	
n.a.	Nitrite	n.a.	n.a.	n.a.	n.a.	
3	Nitrate	4.267	0.640	4.952	13.5899	
n.a.	Phosphate	n.a.	n.a.	n.a.	n.a.	
4	Sulfate	6.964	0.306	1.559	27.7235	

NITRATE IN DRINKING WATER

ANNUAL TESTING

- Recommended for all private well owners.
- Bacteria (Coliform) and Nitrate
- Annual Private Well Testing Package \$75
- E-mail: Lab@publichealthmdc.com



Test your well water every year!

We recommend testing your water every year for bacteria and nitrate to keep your water safe to drink.

Last test date: _____



Get a test kit & instructions:
publichealthmdc.com/WaterTesting



CONTACT ME

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