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Case Study: Challenges with Algae Blooms and Their Impact on Water Treatment

Trace ASSOCIATES

EnviroTech 2019

April 25, 2019

Jeff Seaman

Presentation Overview

Introduction

Site Model

Surveys and Water Quality

Micro-Filtration

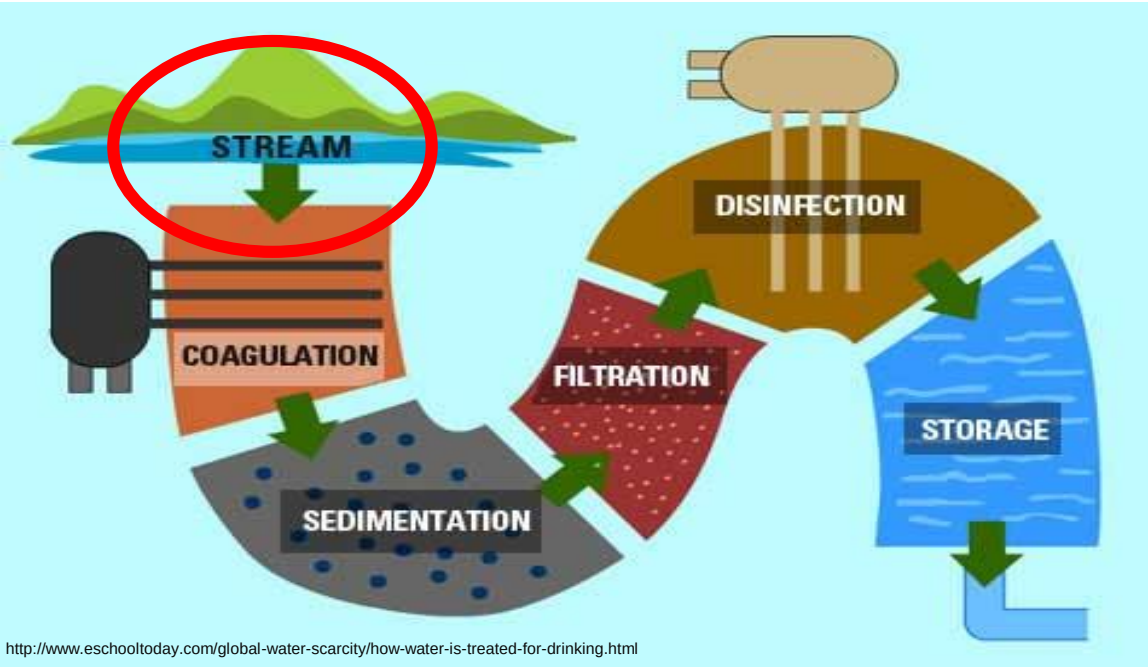
Summary

Questions

Introduction

Introduction:

Drinking Water Treatment



http://www.eschooltoday.com/global-water-scarcity/how-water-is-treated-for-drinking.html

Introduction:
Source Water – Shallow Lakes

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Blue-green algae blooms ease but toxic lake goo here to stay: U of A researcher

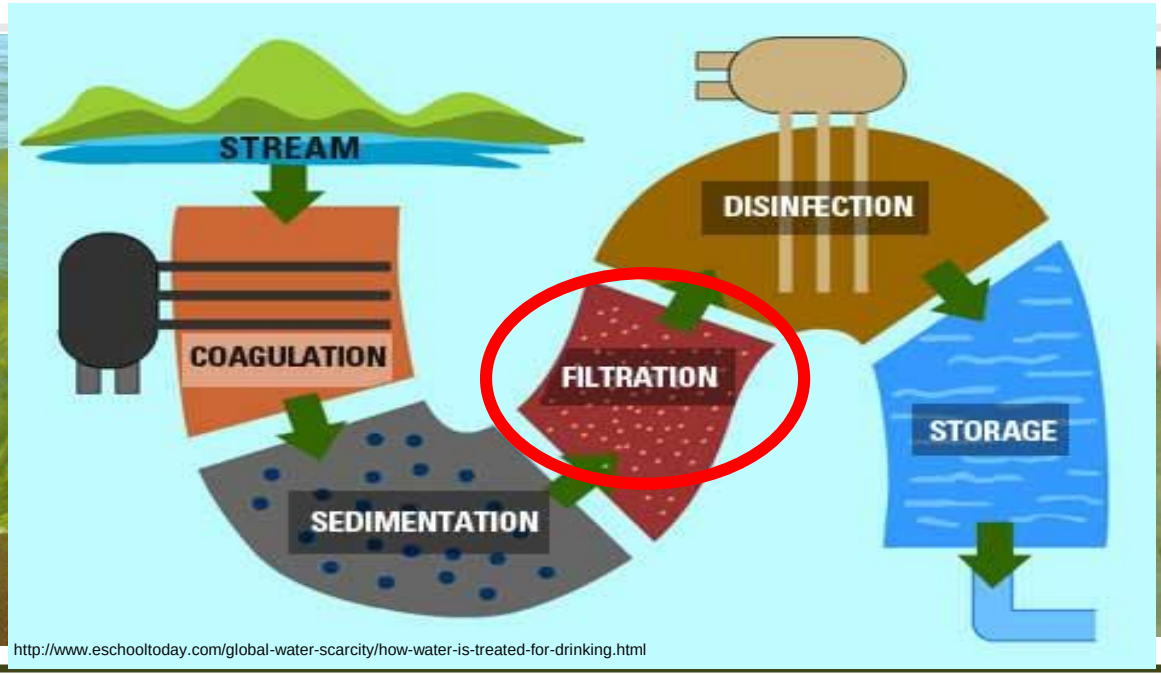
NICOLE BERGOT Updated: November 13, 2018

Source: Jackson and Moquin, 2011. https://www.researchgate.net/figure/A-typical-shallow-lake-located-near-Strathmore-Alberta-approximately-50-km-east-of_fig2_259752220

Conditions:

- Excess nutrients
- High temperature
- Sunlight
- Minimal turbulance

Introduction:
Source Water



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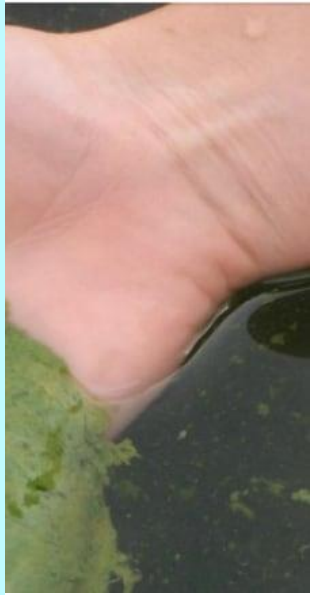


Source: https://globalnews.ca/news/3058284/blue-green-algae-advisories-lifted-for-5-alberta-lakes/

Source: https://www.cbc.ca/news/canada/edmonton/blue-green-algae-alberta-lakes-1.4255904

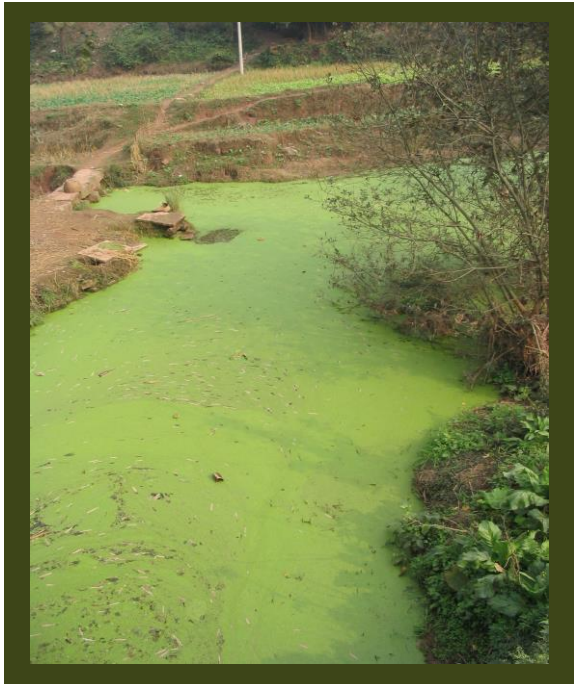
Introduction: Source Water

Main features:

- Depth 6 – 12 m
- Water intake in area of minimal turbulance
- Dam and historical flow path
- Adjacent golf course and agricultural land use
- **Algae blooms occur consistently and negatively impact water treatment**

Challenge:

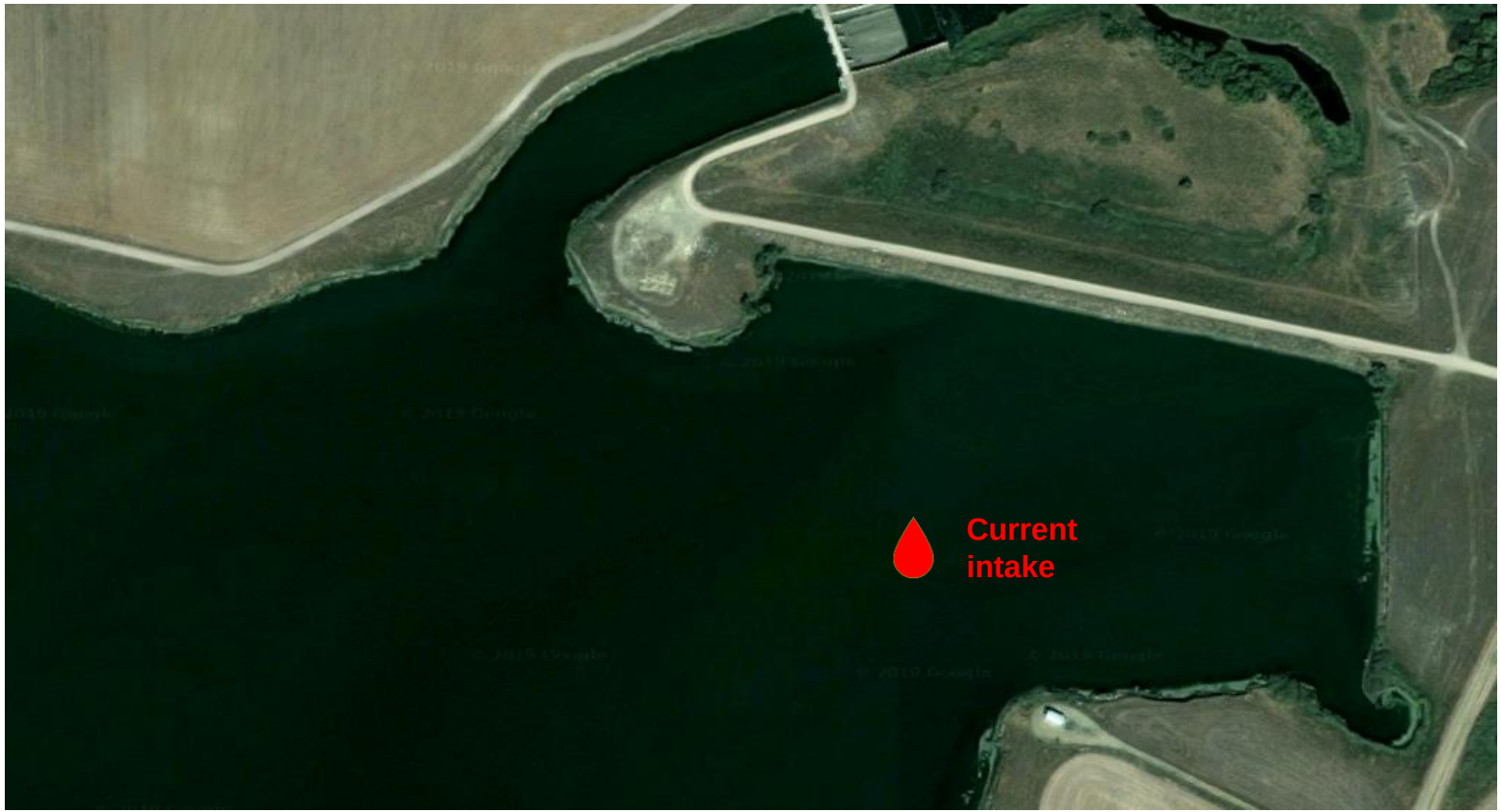
- **Eliminate or mitigate algae bloom impact on water treatment**



Source: Felix Andrews (Floybix) - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=1092921


Site Model

Site Model



Site Model

Possible solutions:

1. Move intake to area with increased flow
2. Add pretreatment step at the water treatment plant

Approach:

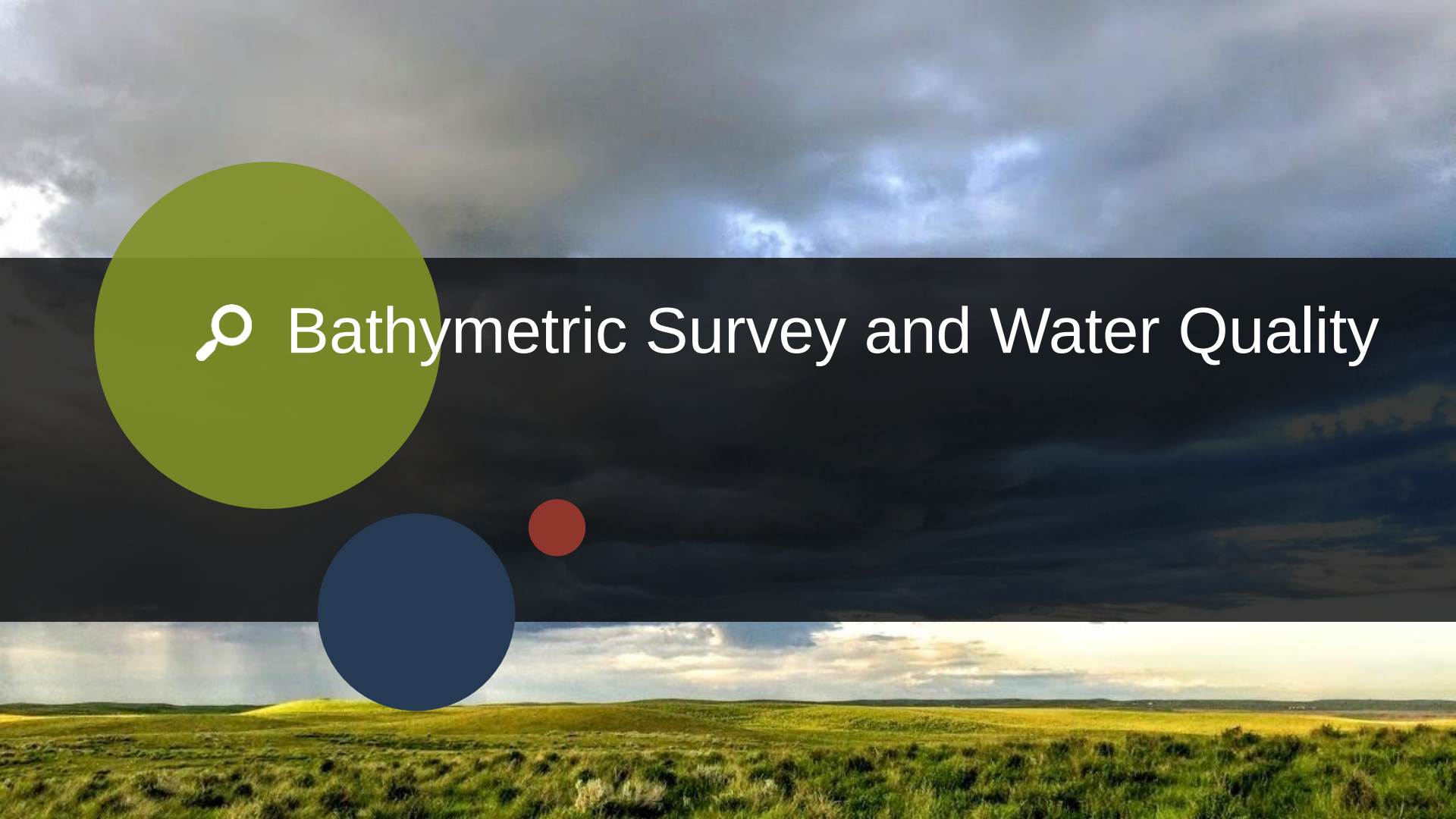
- Bathymetric survey
- Water quality

Move intake

- Microfiltration

Add pretreatment

Source:https://www.detroitnews.com/story/news/local/michigan/2018/09/16/lake-erie-free-toxicity-algae-bloom/


Bathymetric Survey and Water Quality

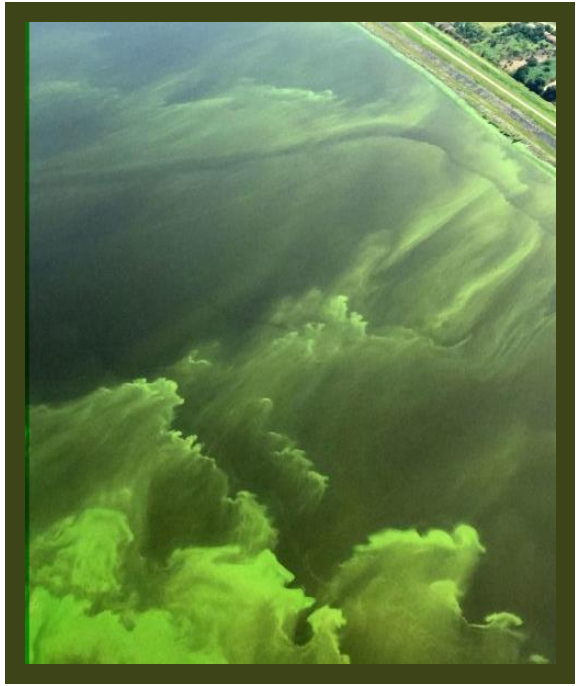
Bathymetric Survey and Water Quality

Bathymetric Survey:

- Measure depth and map underwater features
- Identify potential intake locations

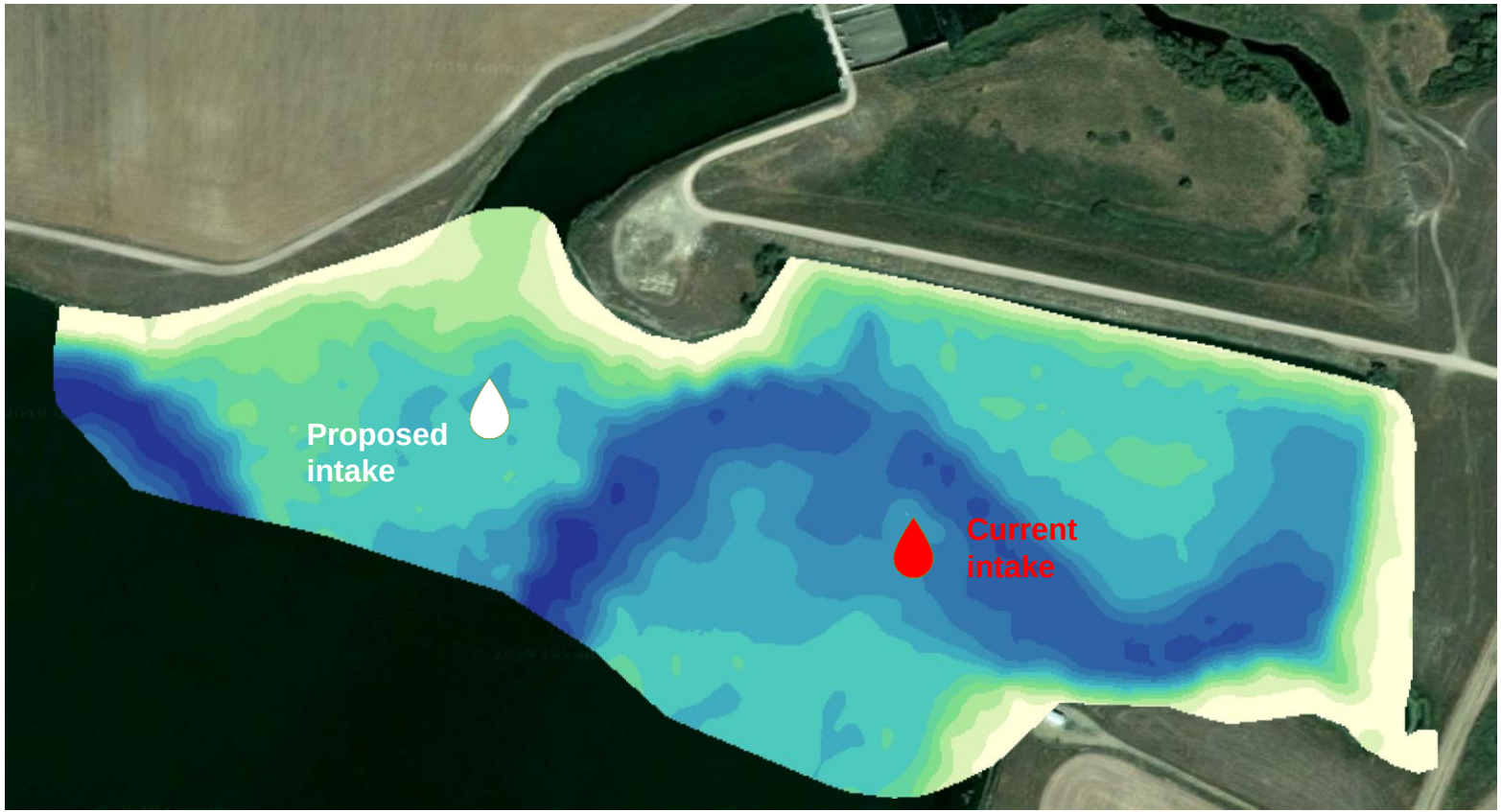
Water Quality:

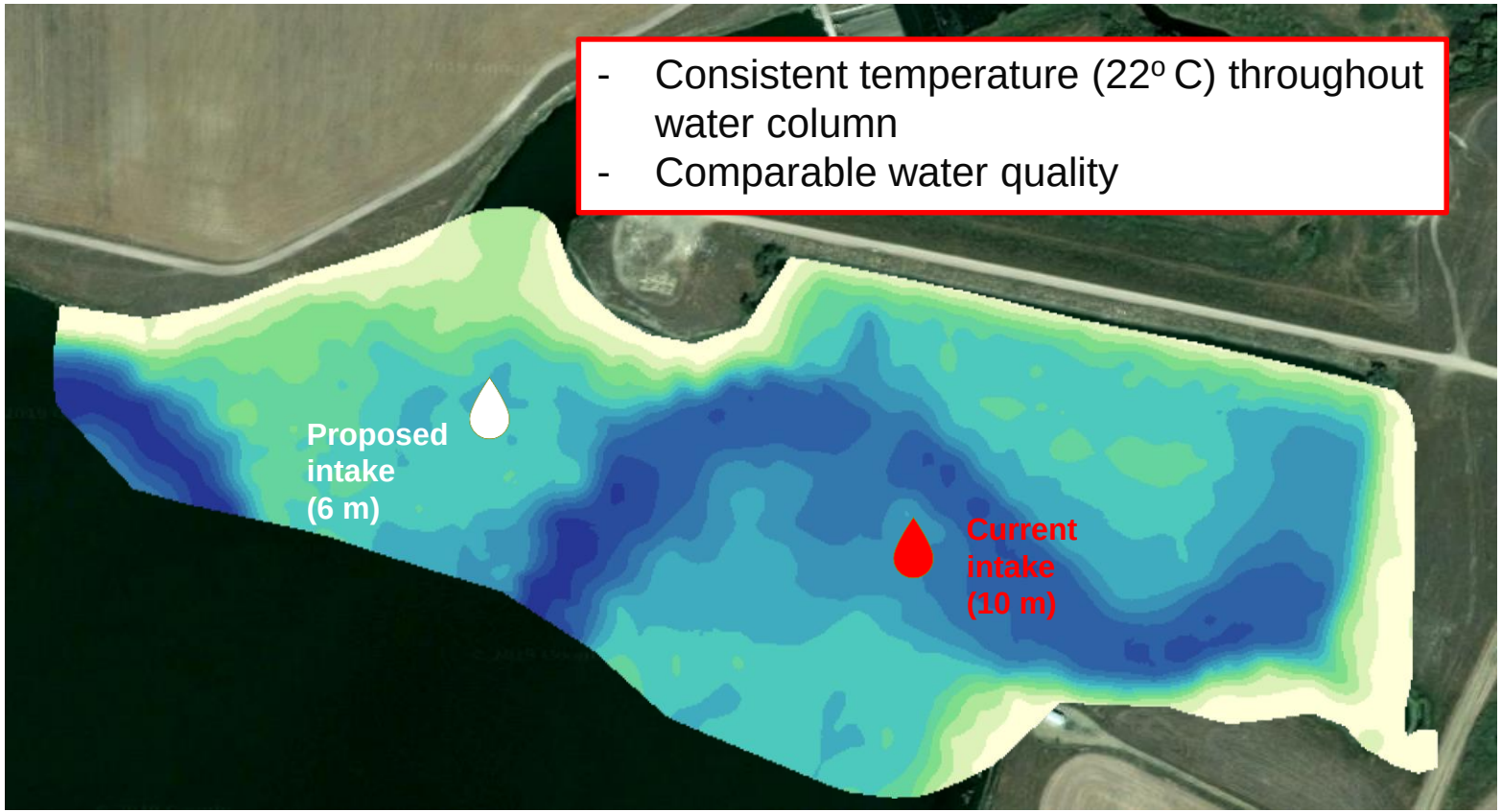
- Compare the water quality at the current intake and the proposed location
  - Temperature
  - Dissolved oxygen
  - pH
  - Total metals, conductivity, major ions, salinity, total dissolved solids, and more



Source: UW Madison Center for Limnology
http://blog.limnology.wisc.edu/floridas-red-tide-shows-algae-blooms-arent-just-a-wisconsin-problem/

Bathymetric Survey




- Consistent temperature (22º C) throughout water column
- Comparable water quality
Proposed intake (6 m)
Current intake (10 m)

Microfiltration Pilot Project

Microfiltration

Separating suspended solids based on their size

Pilot-project:

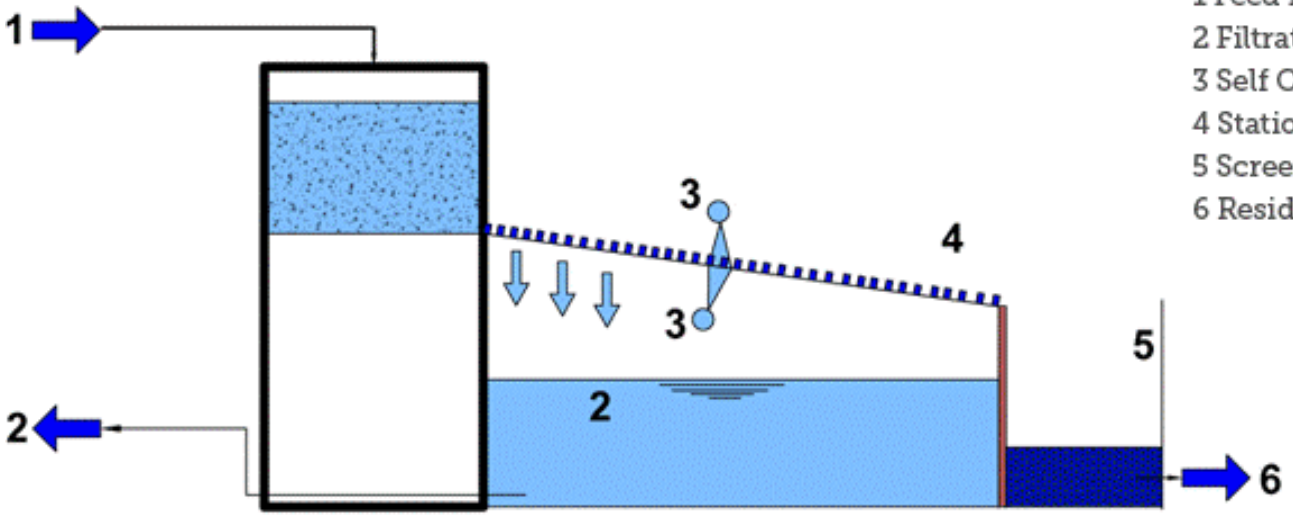
- July 2018
- Hot and sunny
- Windy

Parameters:

- Total suspended solids

Source: https://earth.esa.int/web/earth-watching/environmental-hazards/content/-/article/algal-blooms-in-lake-erie-north-america-

Microfiltration – Baleen Filter

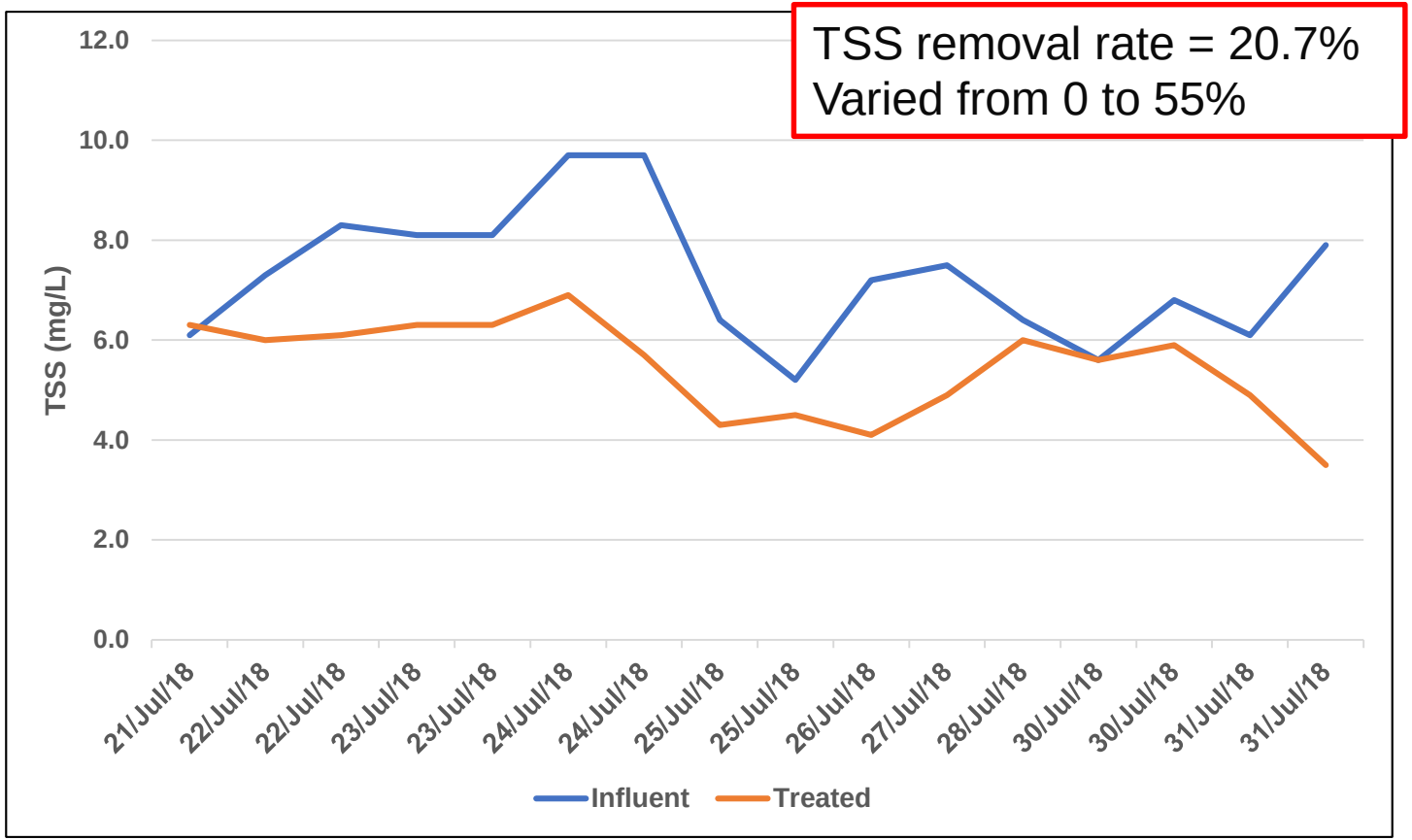


1 Feed Inflow
2 Filtrate Outflow
3 Self Cleaning Mechanism
4 Stationary Micro Screen
5 Screenings Bin
6 Residual Dewatering

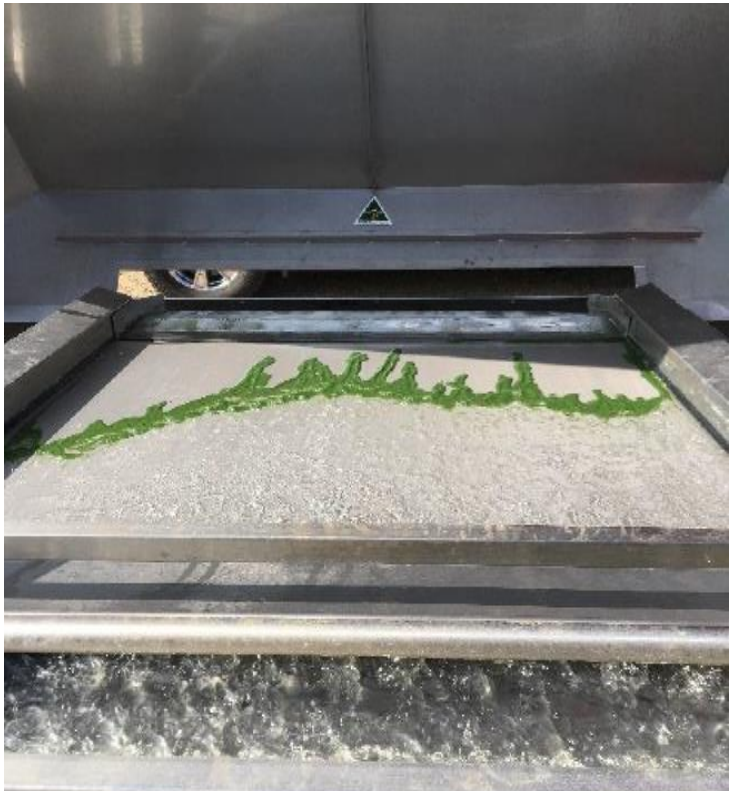
- **Screen pore size = 37 micron**
- **Flow rate = 18 L/s**

Microfiltration

Microfiltration – Total Suspended Solids



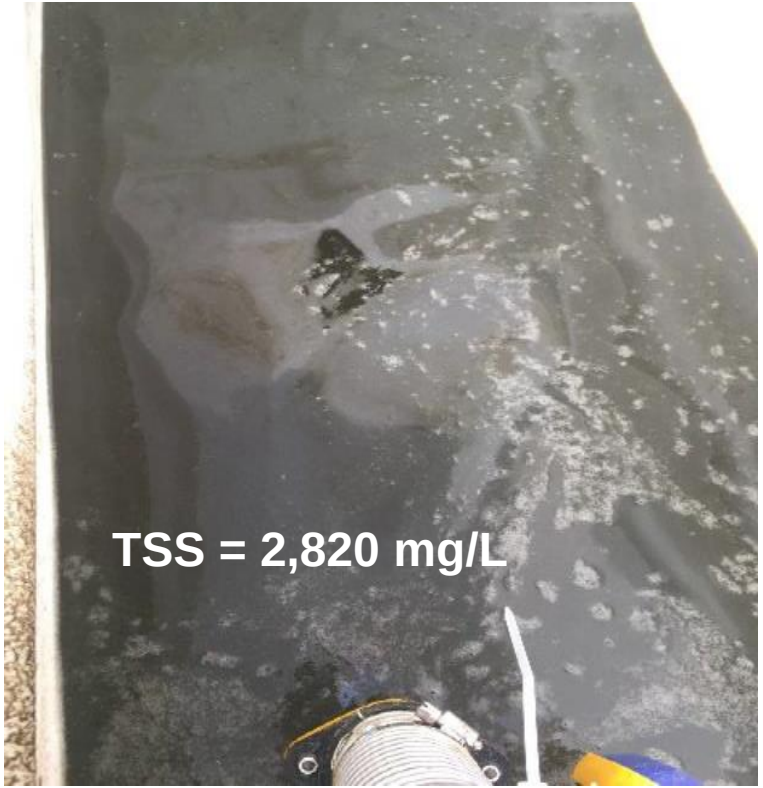
Microfiltration



Microfiltration

Microfiltration

July 25



July 27

Summary and Lessons Learned

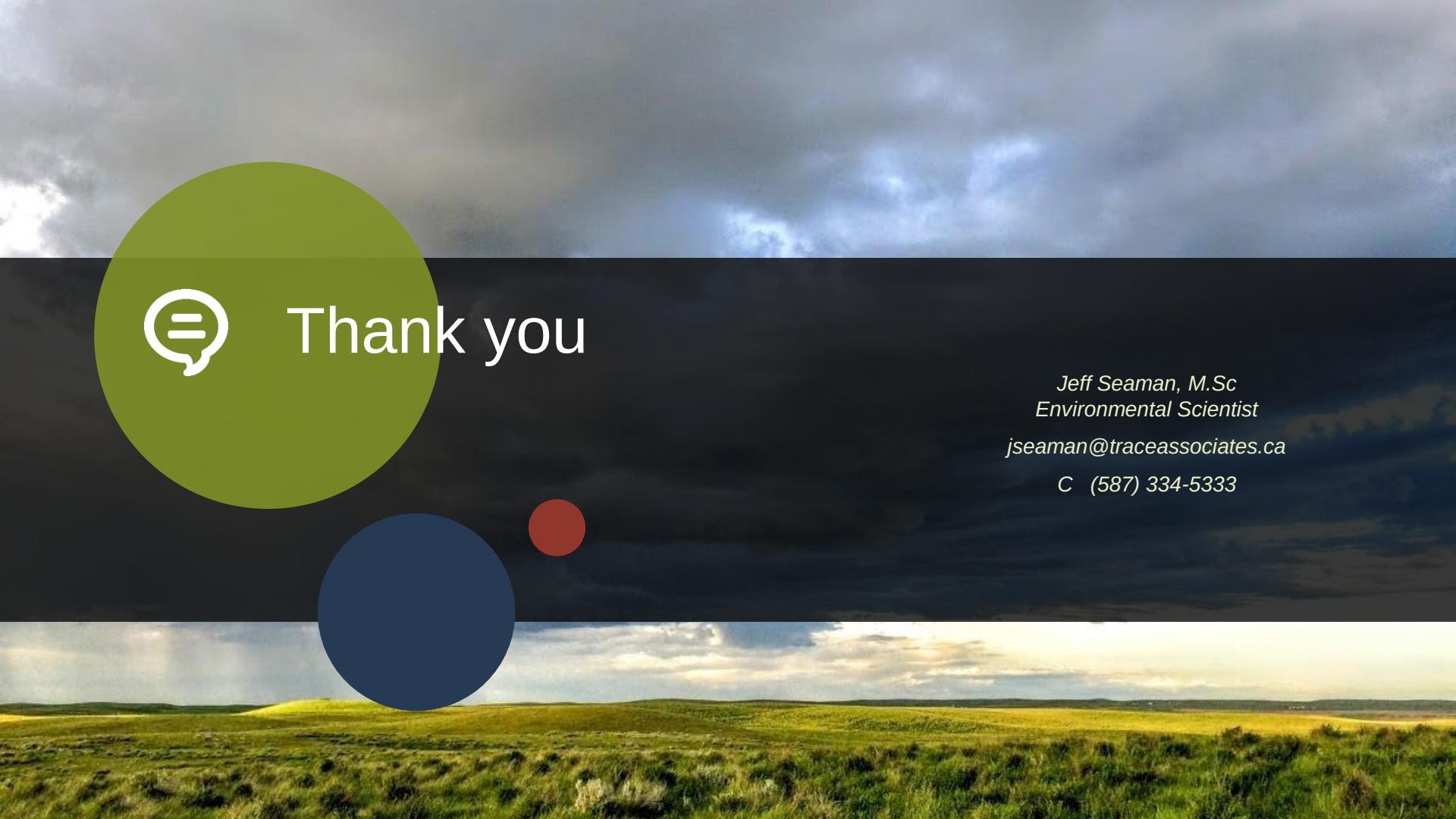
Summary

Possible solutions:

1. Move intake to flowpath - **not the best idea**
2. Add pretreatment step at the treatment plant **– a better idea**

Lessons learned:

1. Variations in algae blooms remain challenging to explain, let alone predict
2. No silver bullets – complex problems rarely have simple solutions
3. Re-evaluate how success is defined



Thank you

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