CITY OF MINNEAPOLIS

Leveraging the Muscle of Mussels: River Bio-monitoring at Minneapolis Water.

Minneapolis
City of Lakes

4/28/2025

Outline

- Minneapolis Water info
- How did we get mussels?
- How they work
- What was the setup
- The new setup
- Questions

Minneapolis Water

Source water
Mississippi River

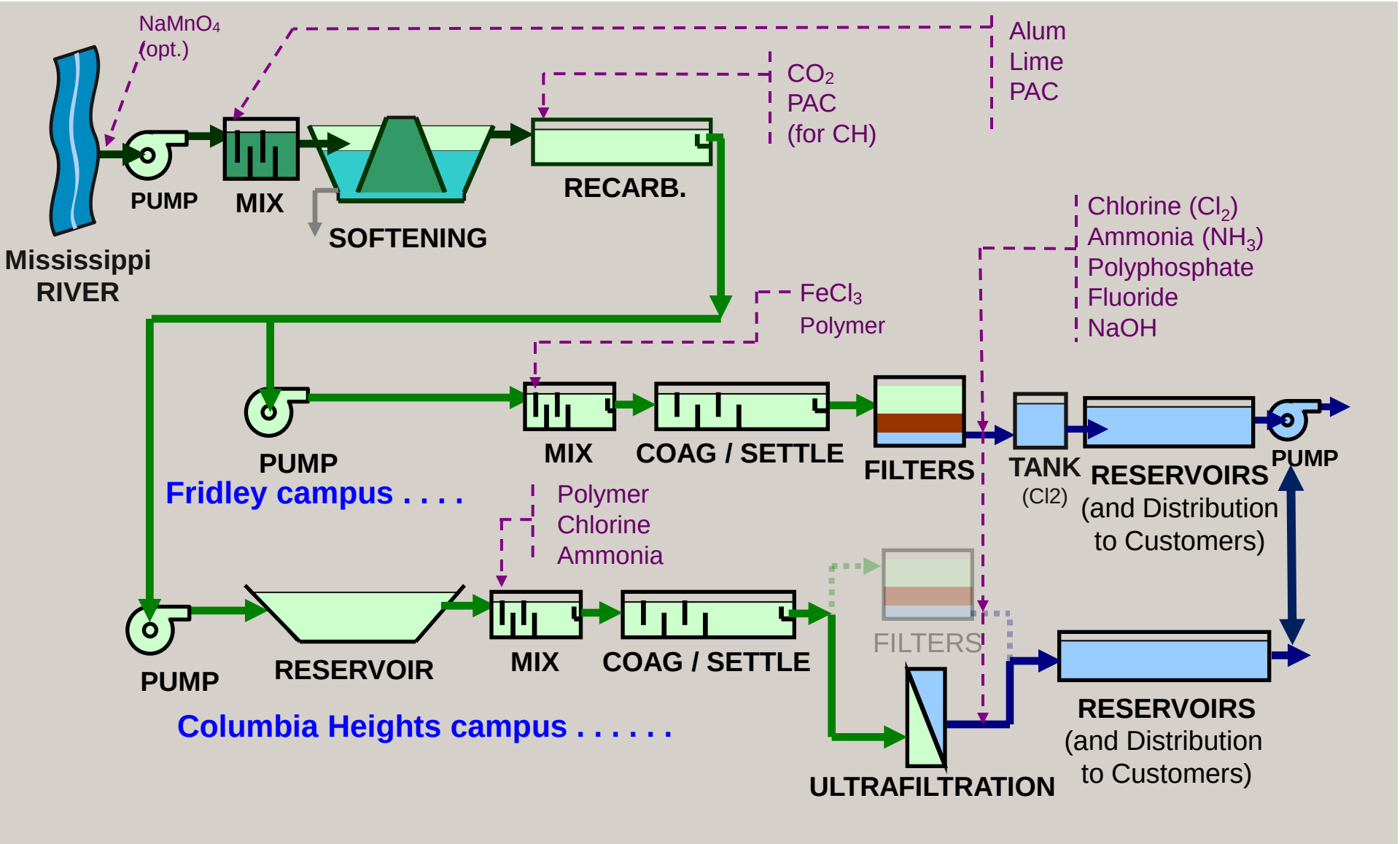
Max capacity
140 MGD

Average production
55 MGD

2024 total production
19.8 billion gallons

Minneapolis
City of Lakes

MWW Treatment System - 2025

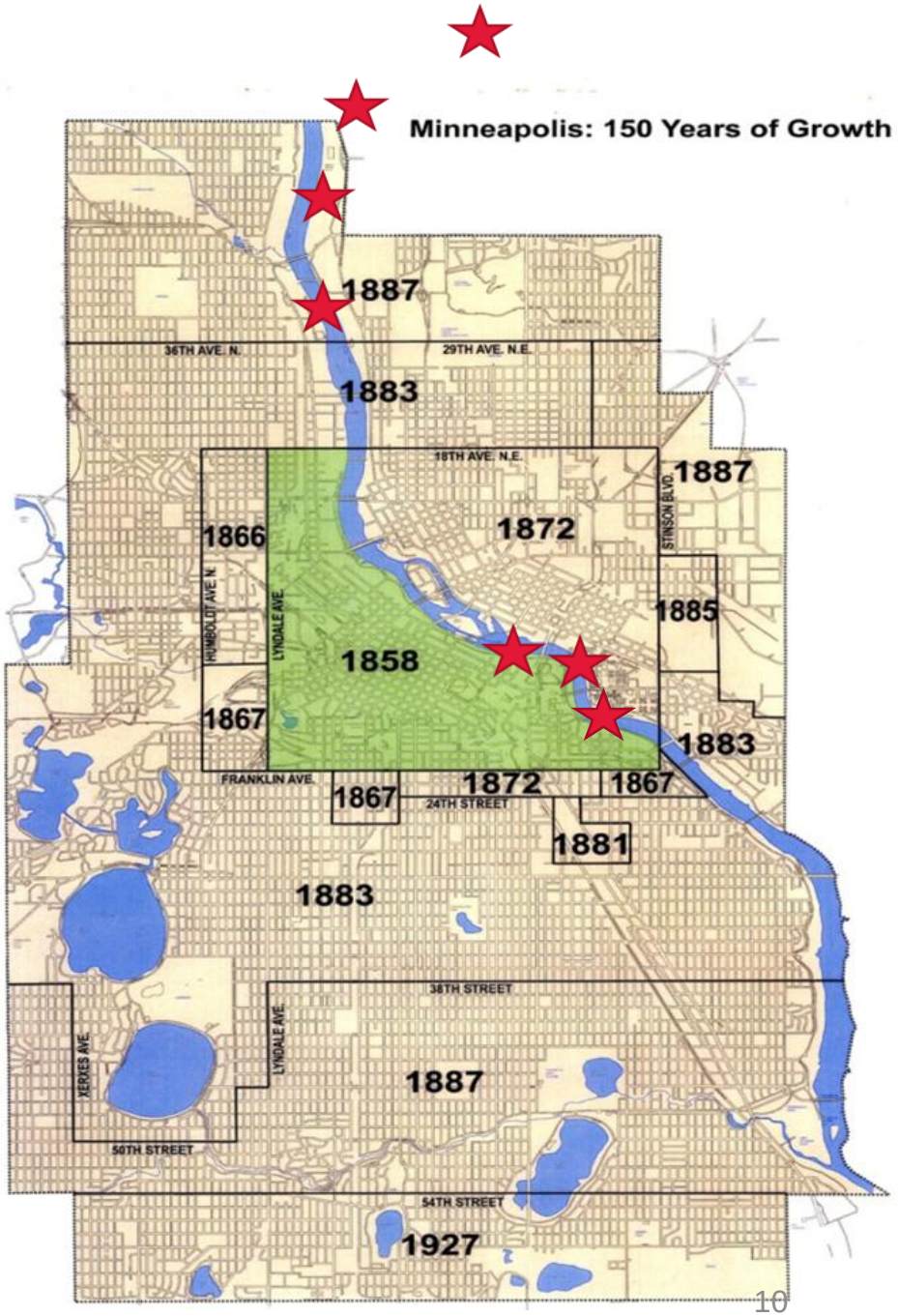


Distribution Area

1,000 miles of water mains bring water to 400,000+ customers in the Minneapolis Metro area, including:

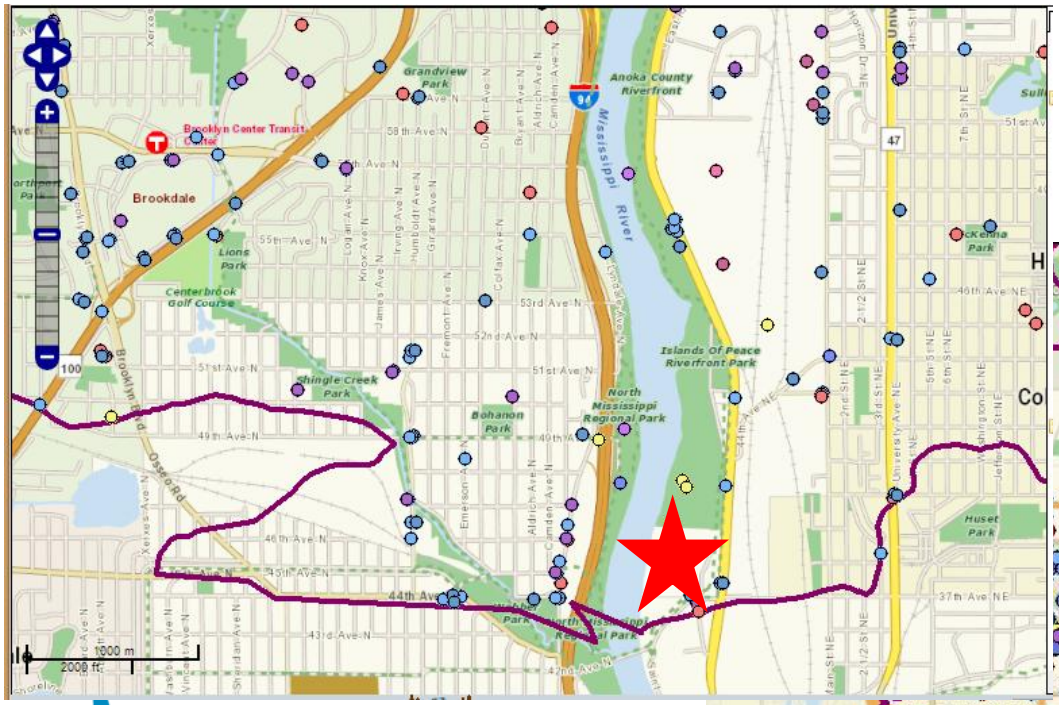
- New Hope
- Crystal
- Golden Valley
- Columbia Heights
- Hilltop
- Morningside Edina
- MSP airport
- Bloomington (partial)

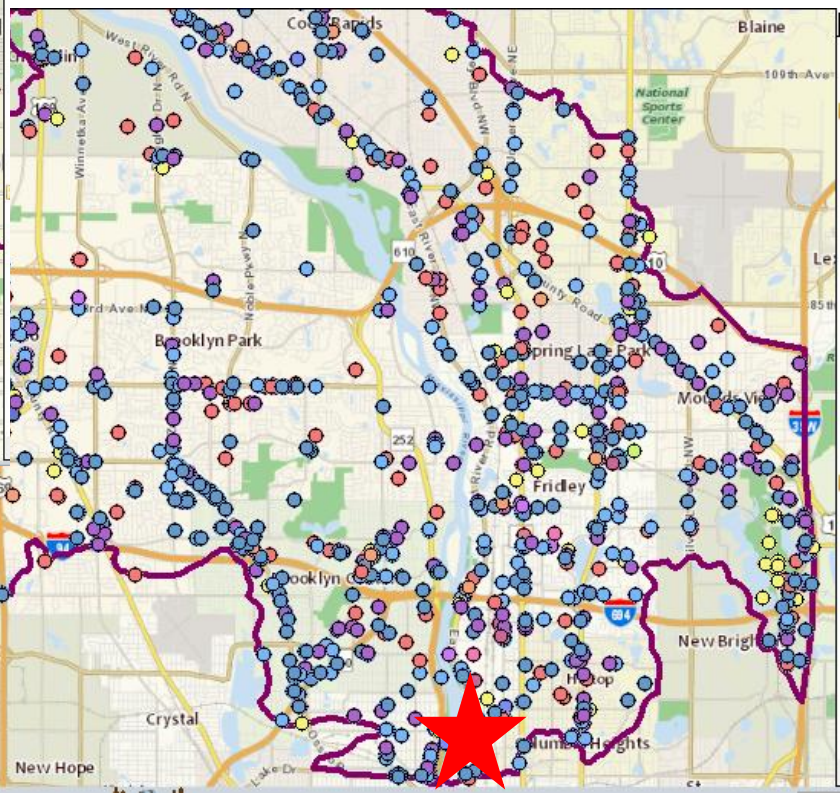
Early awareness of pollution - relocation of pump stations out of the city



Source Water Contamination

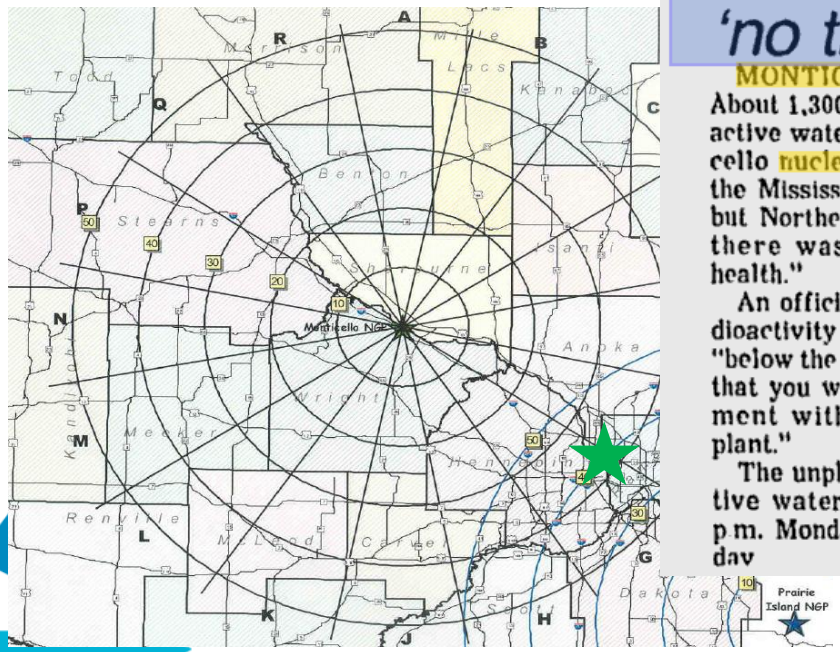
Potential Contamination Sources – Minneapolis Protection Priority Area A





Monticello NGP

- Located ~40 miles upriver
- Began operating in 1971
- Strong operational record but…



Reactor leak 'no threat'

MONTICELLO, Minn. (UPI) -
About 1,300 gallons of slightly radi
active water leaked from the Mont
cello nuclear generating plant in
the Mississippi River Monday nigh
but Northern States Power Co. sa
there was "no threat to publ
health."

An official said the amount of r
dioactivity resulting from the leak
"below the normal background leve
that you would have in the enviro
ment with or without a nuclea
plant."

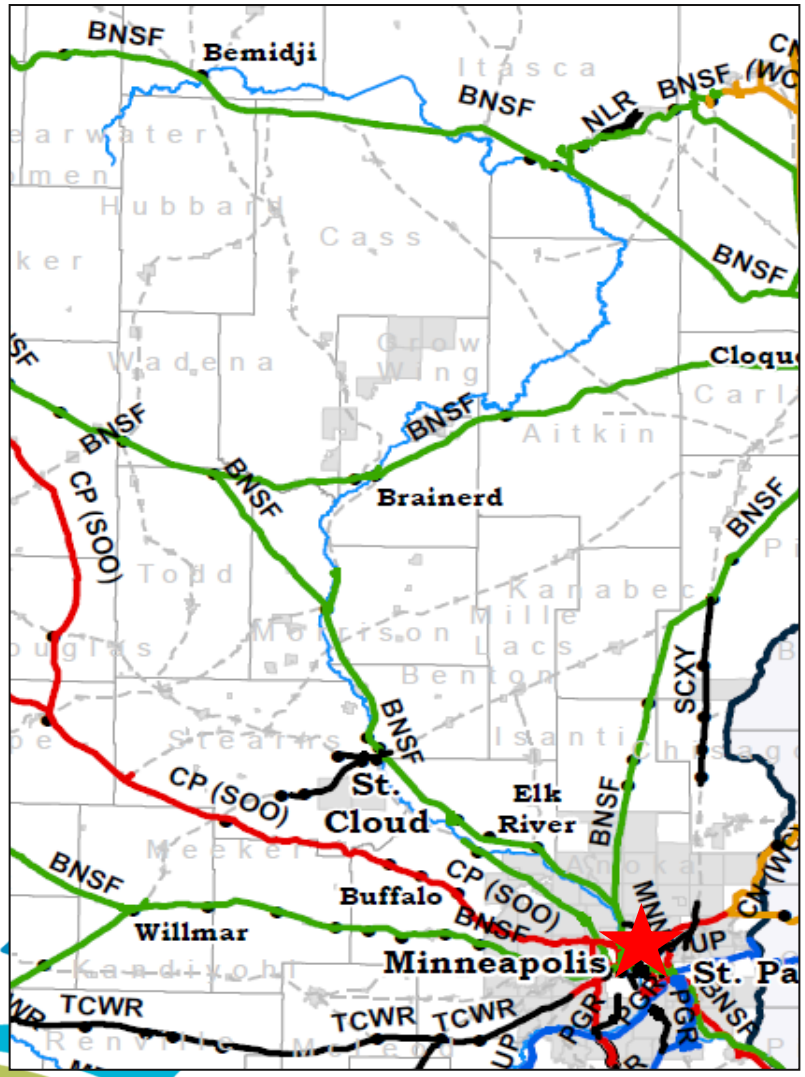
The unplanned release of radioa
tive water occurred from about
p.m. Monday until 1:30 a.m. yeste
day

What we know about the Monticello nuclear plant tritium leak

MPR News asked what questions you have about tritium, water safety and nuclear power. Here's what we found out.

The leak at Xcel Energy nuclear generating plant near Monticello, Minn. was detected nearly four months ago and reported to state and federal regulators. Ben Hovland | MPR News

Mississippi River Rail, Pipeline and Highway Crossings



So, how did we get the mussels?

Upper Mississippi River Hazardous Spills Coordination Group Meeting
October 3-4, 2007
Davenport, Iowa

Meeting Summary

Participants

Roger Lauder	Illinois EPA
Rodney Tucker	Iowa DNR/USCG
Mike Anderson*	Iowa DNR
David Morrison	Minnesota PCA
Rick Gann	Missouri DNR
Brad Harris	Missouri DNR

Biomonitoring Pilot Project

Hokanson and Joel Allen provided an overview of the project currently being supported by US EPA (Region 5 Water Division and Office of Research & Development) to install pilot early warning monitoring stations on the UMR using biologically-based online toxicity monitors, along with more conventional monitoring technology. Hokanson described the project as coming from a watershed/source water protection perspective, but at the same time capable of providing early warning/spill detection capacity using a "tiered response" model. He further described the components of the monitoring installation, which include an online toxicity monitor (mussel-based biomonitor), multiparameter water quality sonde, and UV detection device (s::can spectrometer). Hokanson further noted that the first monitoring installation has been completed and is located at the Minneapolis Water Works, and that there may be a total of three more stations installed under current funding, with at least one station likely to be located upstream from Minneapolis.

Mark Mitchell*	Illinois Rural Water Association
Kyle Waits*	YSI Incorporated
Dave Hokanson	UMRBA

*Attended on October 3rd only.
**Participated by phone on October 3rd only.

Call to Order and Introductions

Actinonaias ligamentina a.k.a Mucket

How do they work??

A BEHAVIORAL MODEL FOR DETECTION OF ACUTE STRESS IN BIVALVES

THESIS

Presented to the Graduate Council of the University of North Texas in Partial Fulfillment of the Requirements For the Degree of

MASTER OF SCIENCE

By

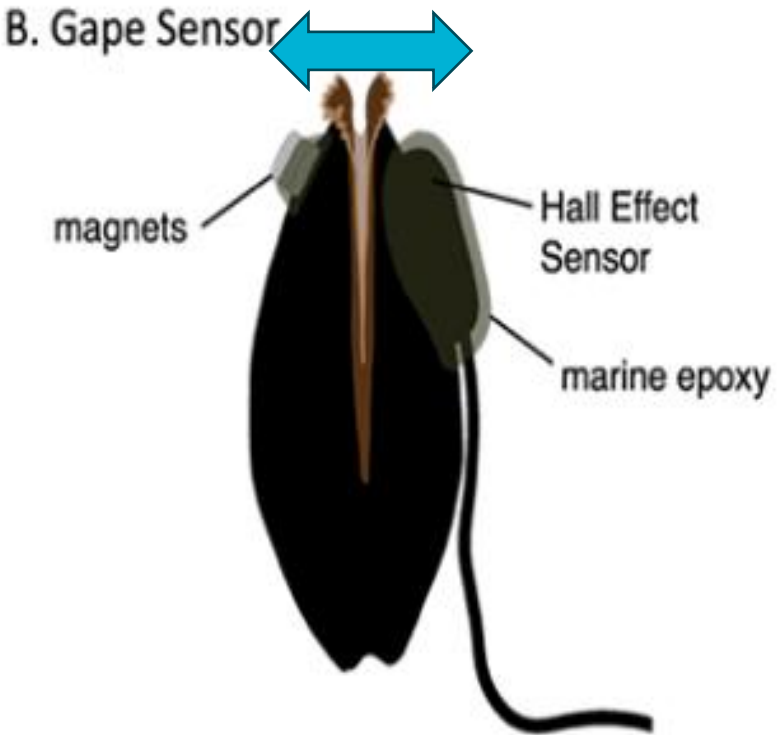
H. Joel Allen, B.A.

Denton, Texas

May, 1998

- Canary in the coal mine principle
- Sensitive to a wide range of contaminants
- Able to close for long periods
- Can measure the mussel gape with magnetic sensors

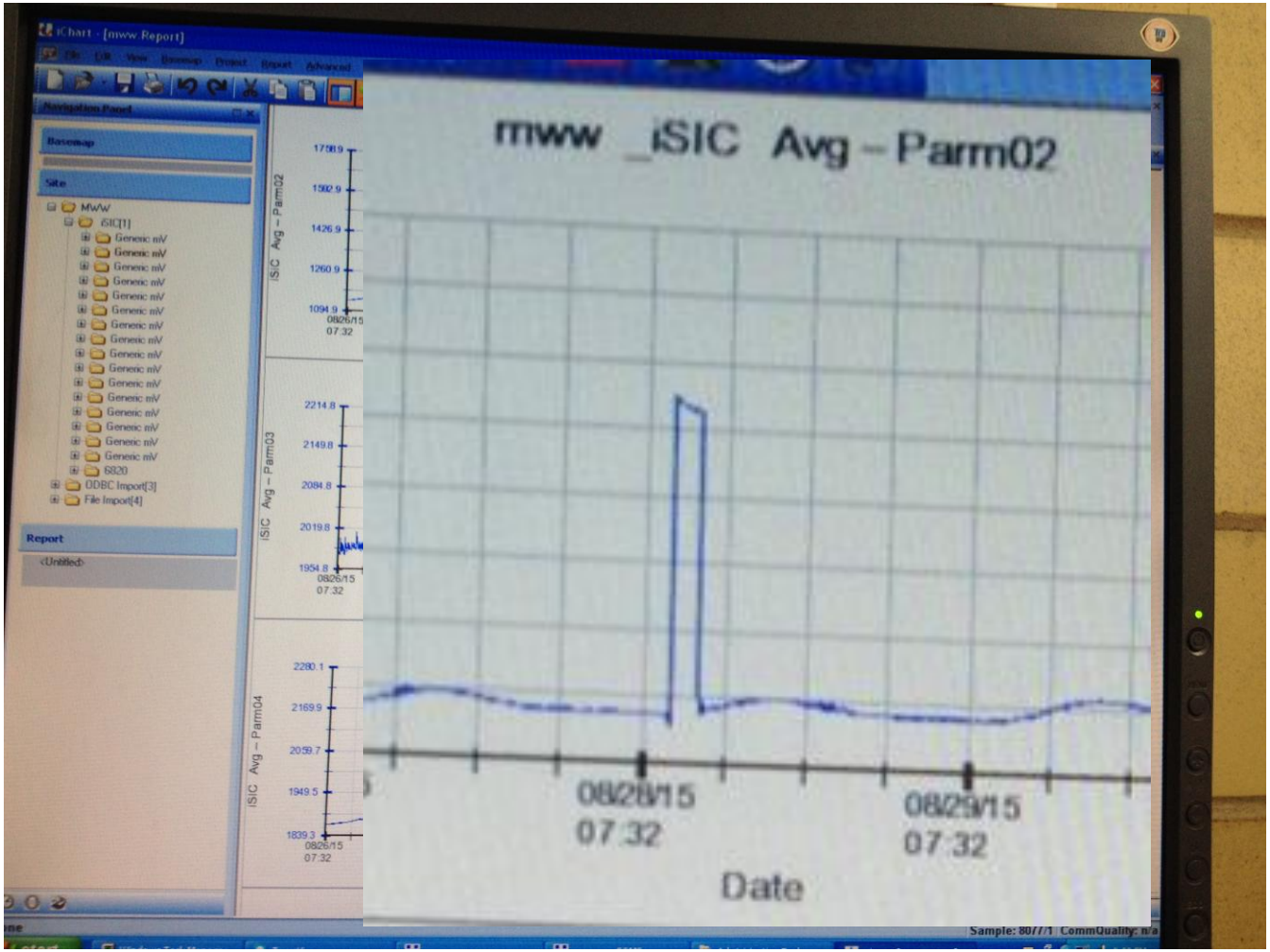
How do they work??



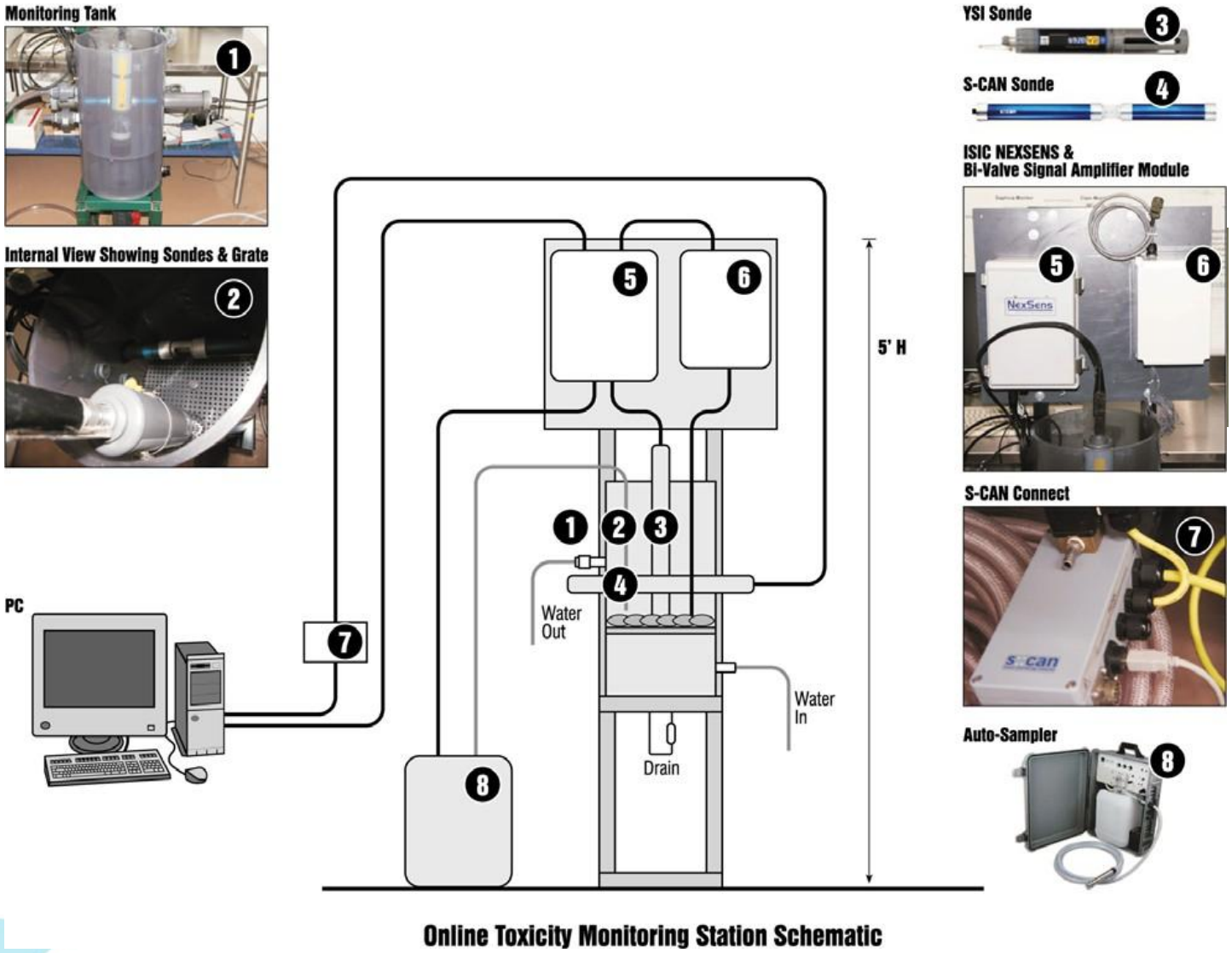
Friday Harbor Laboratories - University of Washington

- Hall sensor measures whether the mussel is open (feeding) or closed
- Typically, they feed constantly and will randomly close
- 12 mussels are monitored

What it looks like…



Not just mussels….



Online Toxicity Monitoring Station Schematic

Multiple system approach

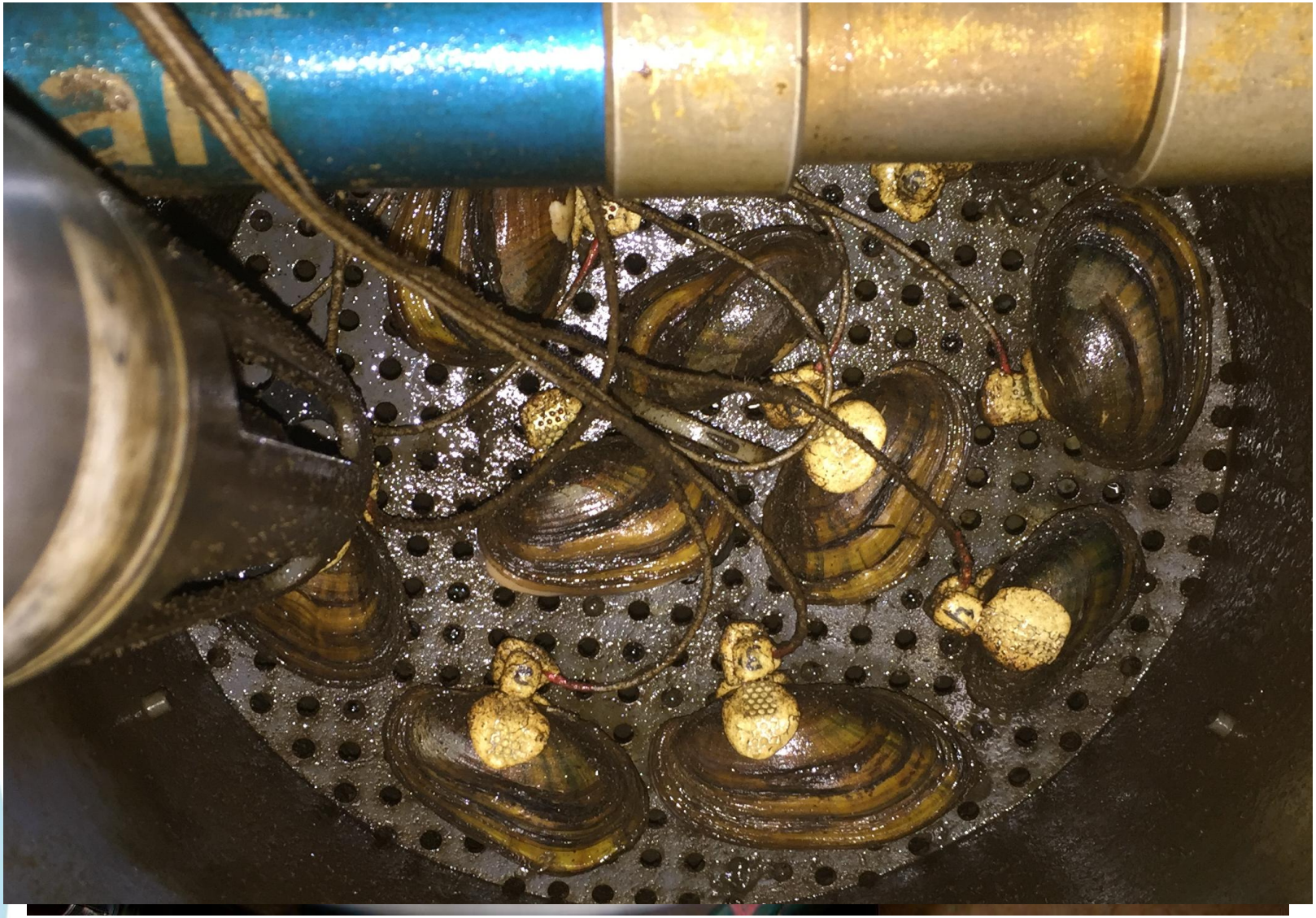
- YSI sonde probe
  - Temp, pH turbidity, conductivity
- s::can full spectrum sensor
  - UV254, TOC, DOC
- Mussels
- Algorithm ties everything together to prevent false alarms


Freshwater
Mussels
NEXSENS

24/7 monitoring begins in 2007

- Clean the tank weekly
- Constant flow of 1-2 gpm of river water
- YSI sonde calibration every few years
- s::can does not need calibrated

- Some mussels stopped reading. Why?



Time for a swap out

- The original mussels outgrew the sensors
- Dr. Allen came out in 2014 and replaced them with new mussels

Fast forward to late 2020

- Down to 3 mussels reading
- Tried to reach Dr. Allen but COVID research was his priority and he could not get approval to help revamp the system
- Still using the original hardware and software now 12 years old
- Was able to track down the original algorithm writer John Carson and fortunately he was willing to collaborate with MWW to update the system

2022 Mlps and Neptune

- Carson was still working in the industry for Neptune Company
- He was able to get the original documentation from Dr. Allen
- Mlps and Neptune signed a contract
- The revamp of the system begins

The new setup

- Same basic principle as existing system
- New hardware needed
  - PC, server, data logger, YSI sonde, s::can, sensors
- New software and algorithm
- New mussels
- Better alert system
  - Text messages and email

New species of mussels

Mucket

Actinonaias ligamentina

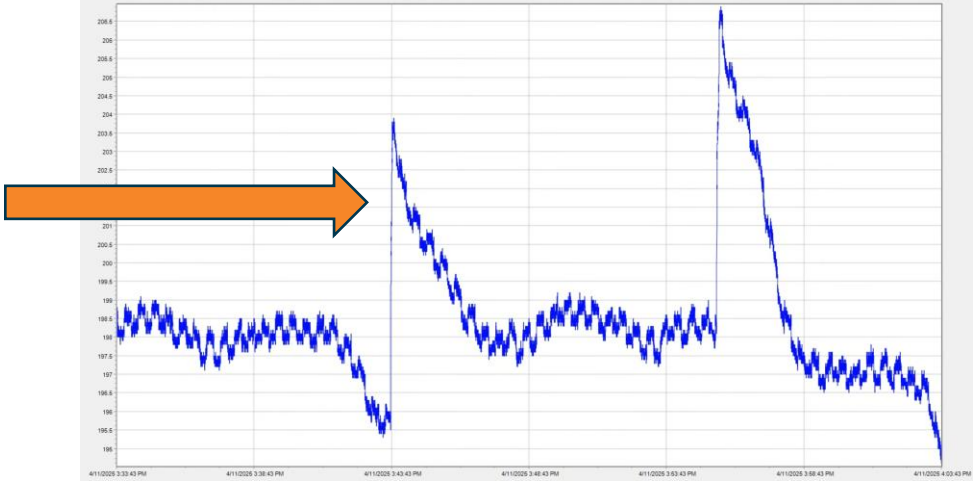
Black sandshell

Ligumia recta

Today

- Moved mussels to a better location
  - PS5 raw water pump station
- Added an observation tank
  - Working tank is hard to show off
- More user-friendly setup for tours
- People love the mussels!!!

Shell closure



This week, finish new locale setup

Next week 4/28

- Neptune to come and install instrumentation and sensors to mussels
- Break in period to calibrate system to minimize false alarms
- Fully operational in a few weeks?

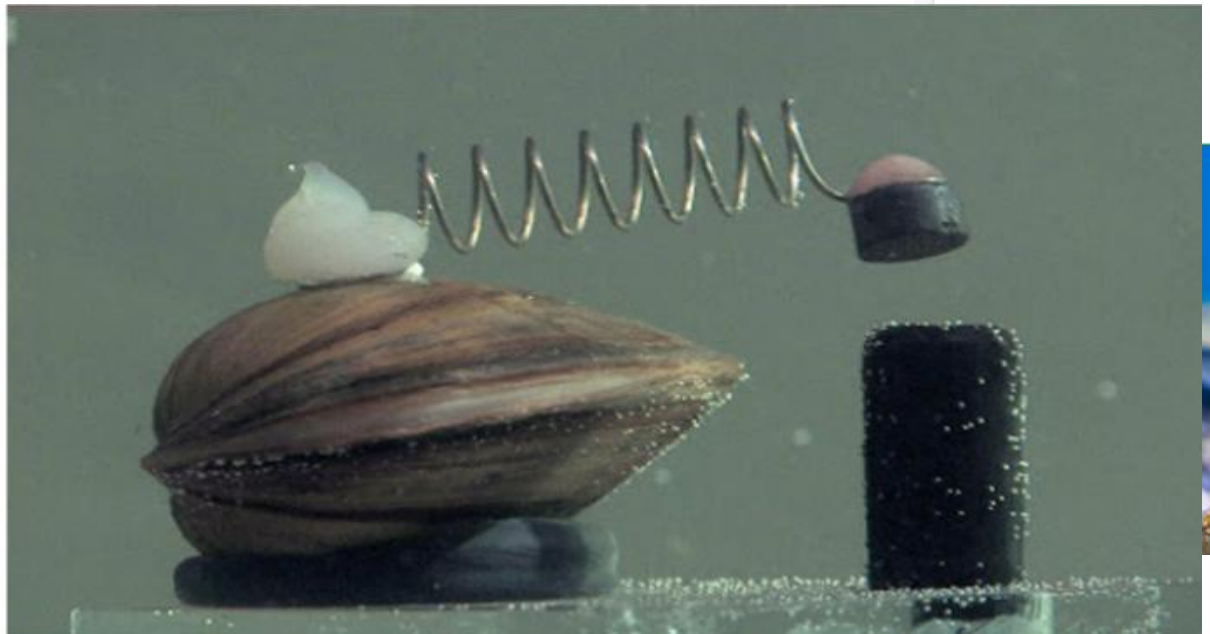
Future

- Mussel or Clam Cam for social media and visual verification that the mussels have closed during the initial start up
- Making the system available to other utilities through Neptune
- Total cost was around $200,000
  - Cheap for the monitoring capabilities the system provides

Who else uses mussels??

- Moline, Illinois did
- Warsaw and

Poznan, Poland



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NATURE ANIMALS

PUBLISHED OCTOBER 24, 2024

Teams Of Mollusks With Little Sensors Are Used To Test The Water Quality In Warsaw

After three months of work protecting residents, the mollusks retire to the lakes of Wielkopolska.

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Lastly, what happened to the old mussels?


Questions?