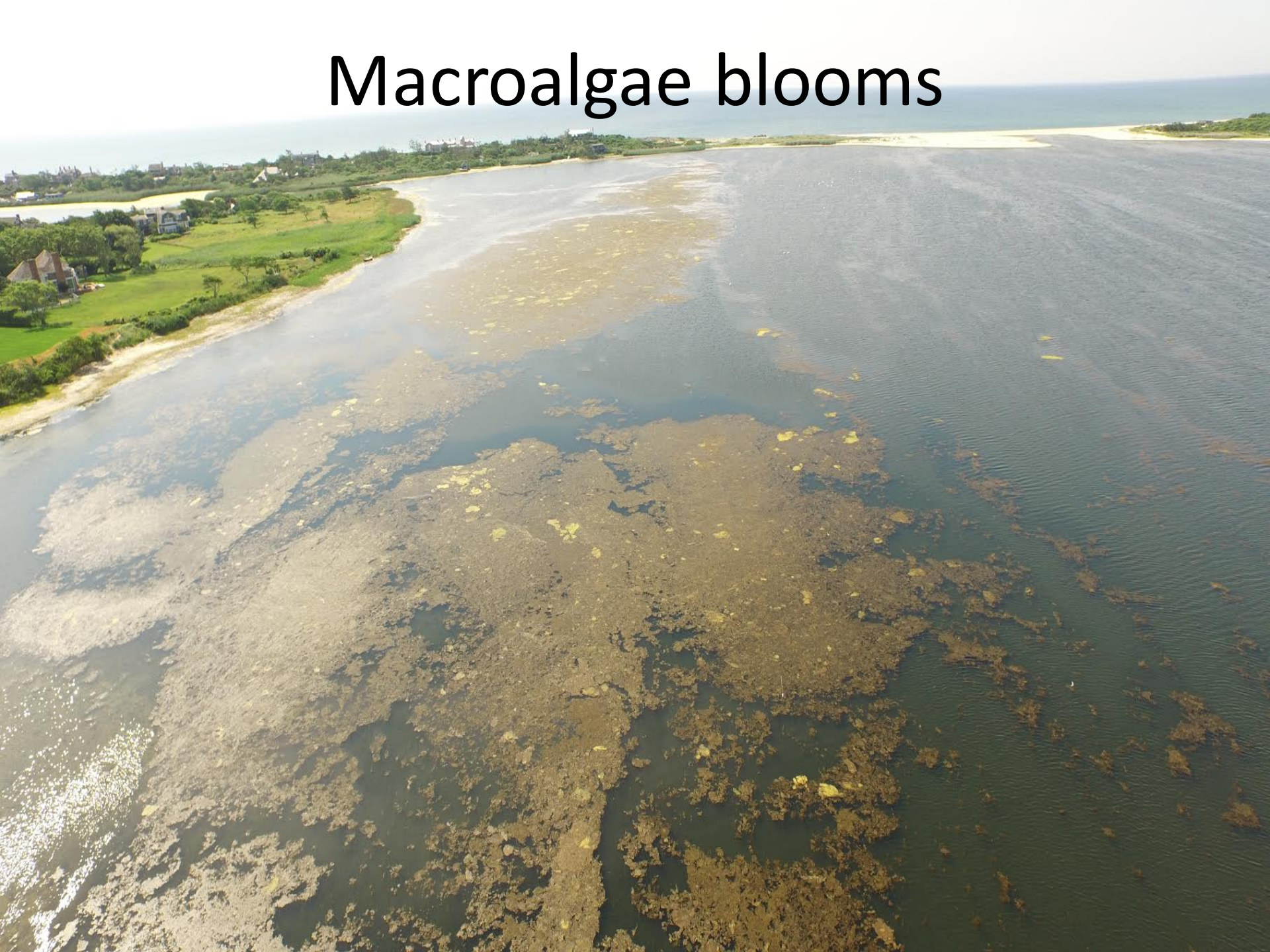
Working Towards a Sustainable Remediation of Georgica Pond

Christopher J. Gobler, PhD

Stony Brook University
School *of* Marine and
Atmospheric Sciences

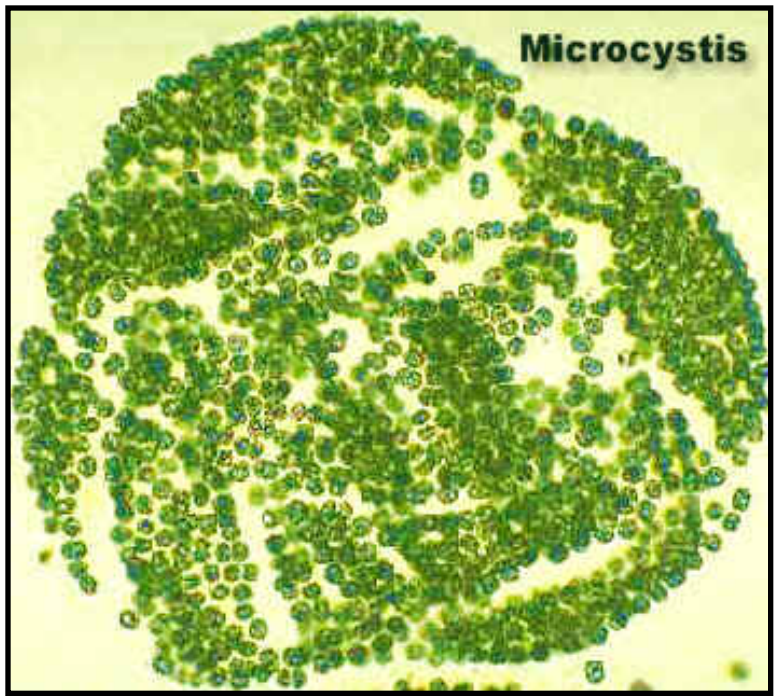
Why remediate Georgica Pond?

Macroalgae blooms

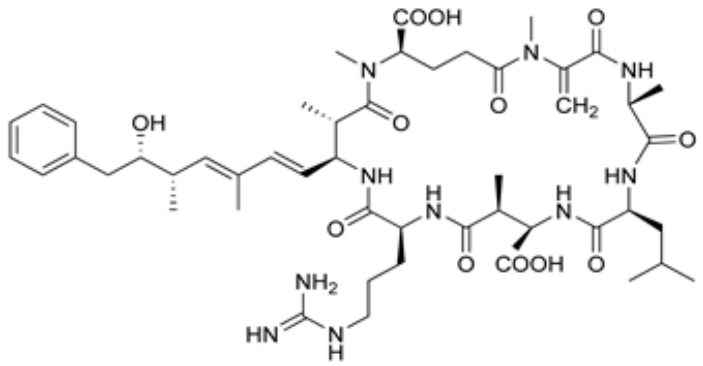


Blue-green algae blooms

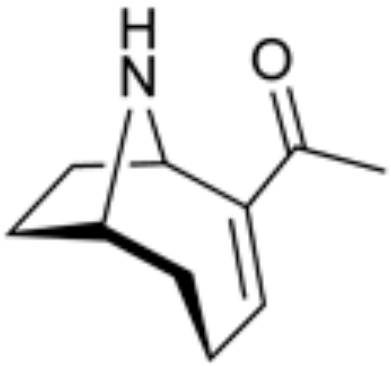
Blue-green algae and their toxins



Microcystin – gastrointestinal toxin



Anatoxin-a – neurotoxin



Low oxygen, death of wildlife






Why remediate Georgica Pond?

- Blooms of macroalgae
- Blooms of toxic blue green algae
- Hypoxia, anoxia
- Kills of fish, eels, birds, dogs
- Pathogenic bacteria

Overview

- Observations for 2020
- Long-term trends
- Action to improve conditions

Real-time monitoring buoy rebuild

An investigation led by the Gobler Lab of Stony Brook University

Georgica Pond

Chart View | Table View | Site Information

GP_south
Site Id

40.934192
Latitude

-72.22572
Longitude

Georgica Pond Buoy - The Gobler Lab of Stony Brook University
Description

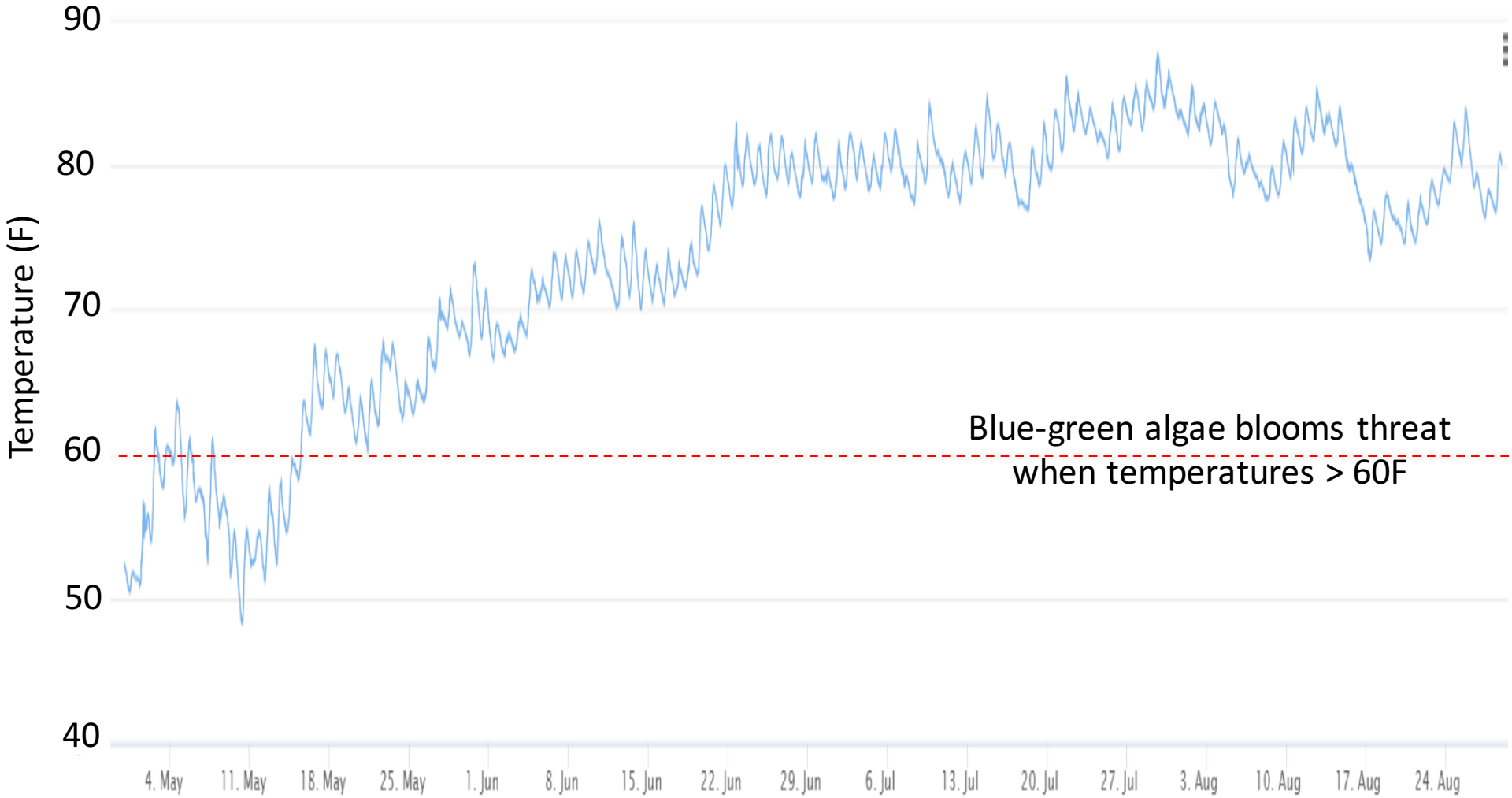
As part of The Georgica Pond Project, the Gobler laboratory has installed a water quality monitoring buoy in Georgica Pond. This device is making continuous, real-time measurements of key water quality indicators that are instantly telemetered to this web site.


An investigation led by the Gobler Lab of Stony Brook University
Georgica Pond
Chart View
Table View
Site Information
Parameters
Studies
Last Month
Last Day
Last Week
Last Month
Last Year
Custom range
Y-axis scaling
Min
Max
Clear
Blue-Green Algae (ug/L)
5
4
3
2
1
0

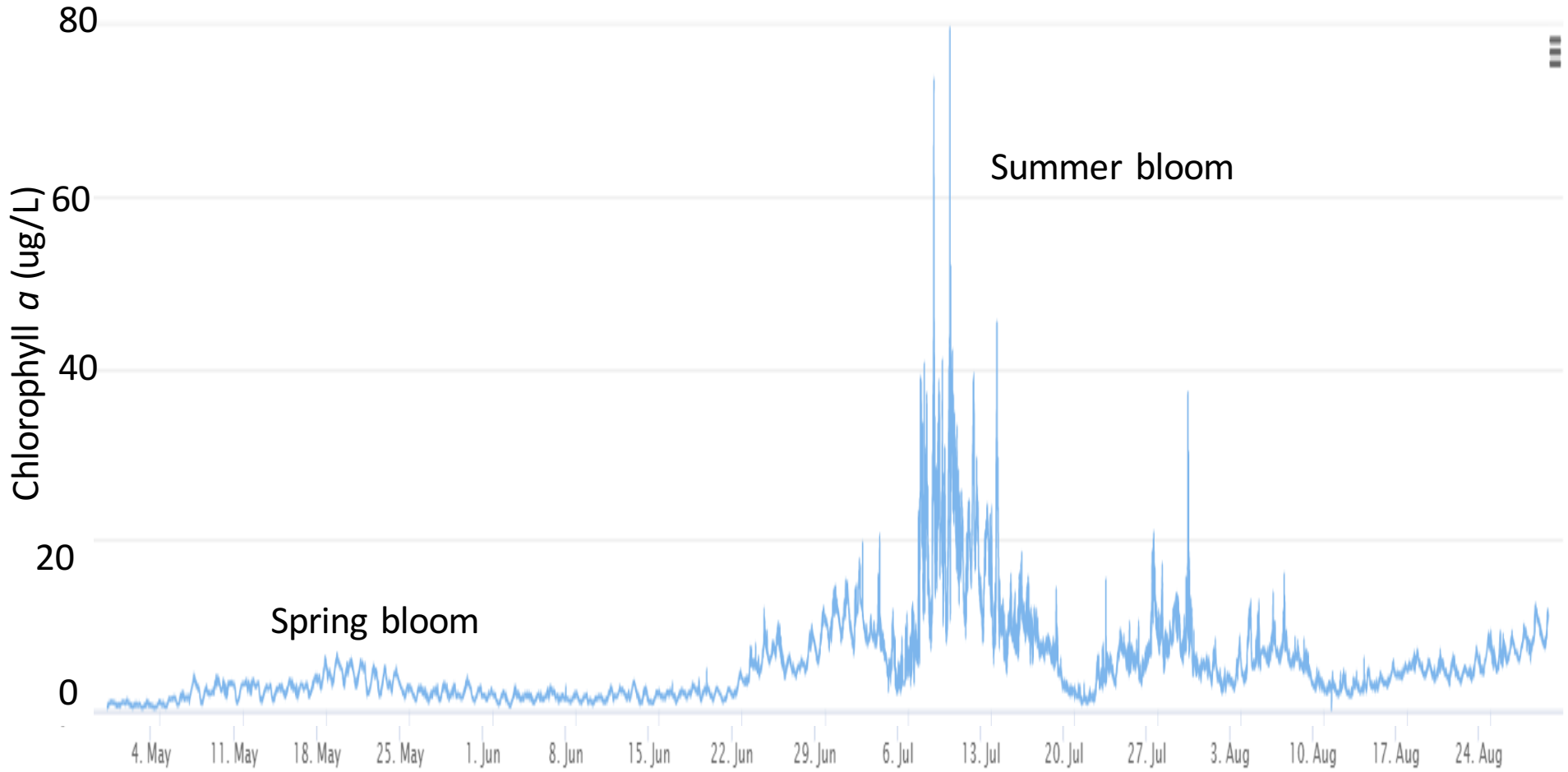
Cut opened in spring, closed since April

Salinity, buoy

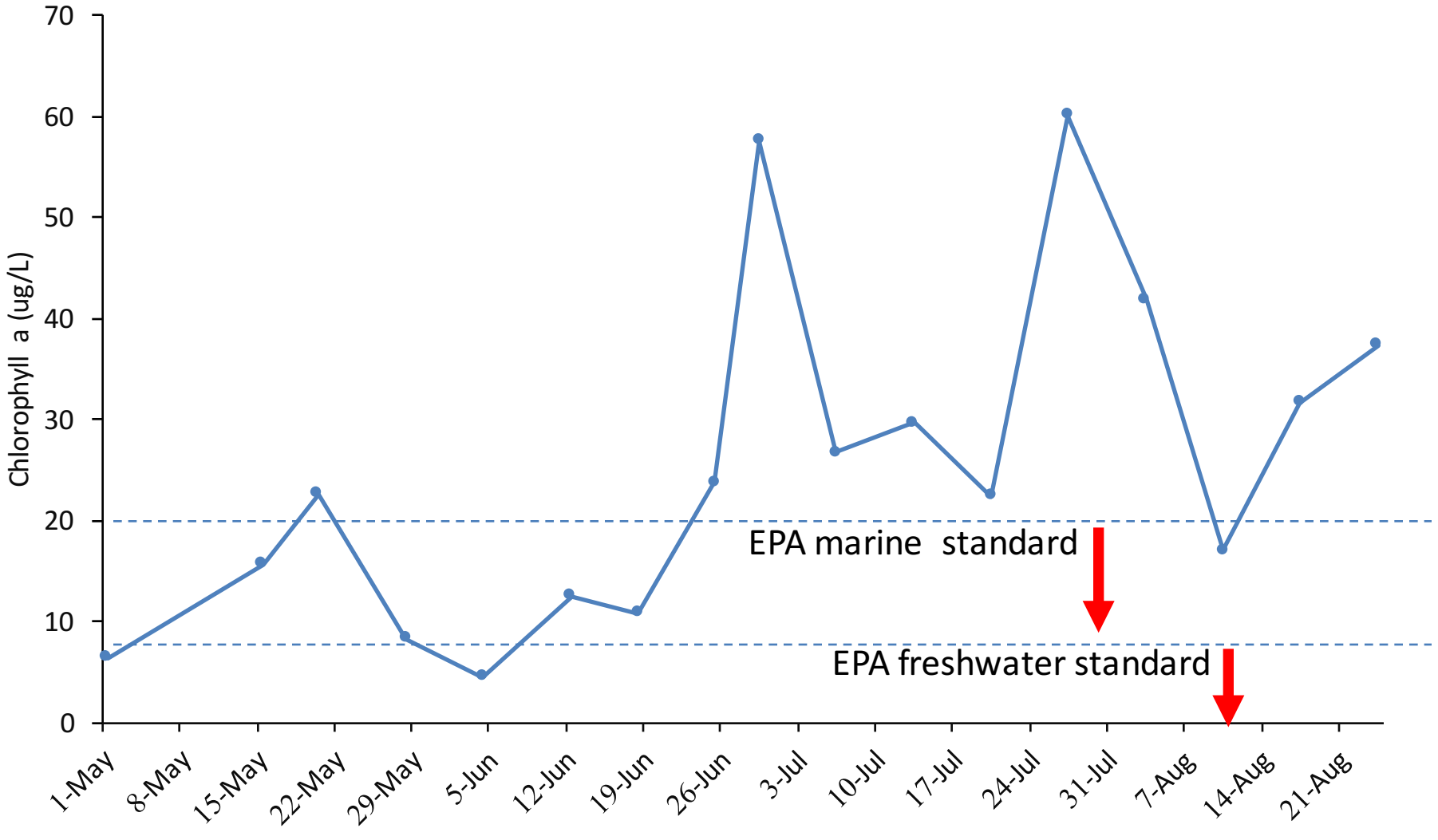
Temperature, buoy



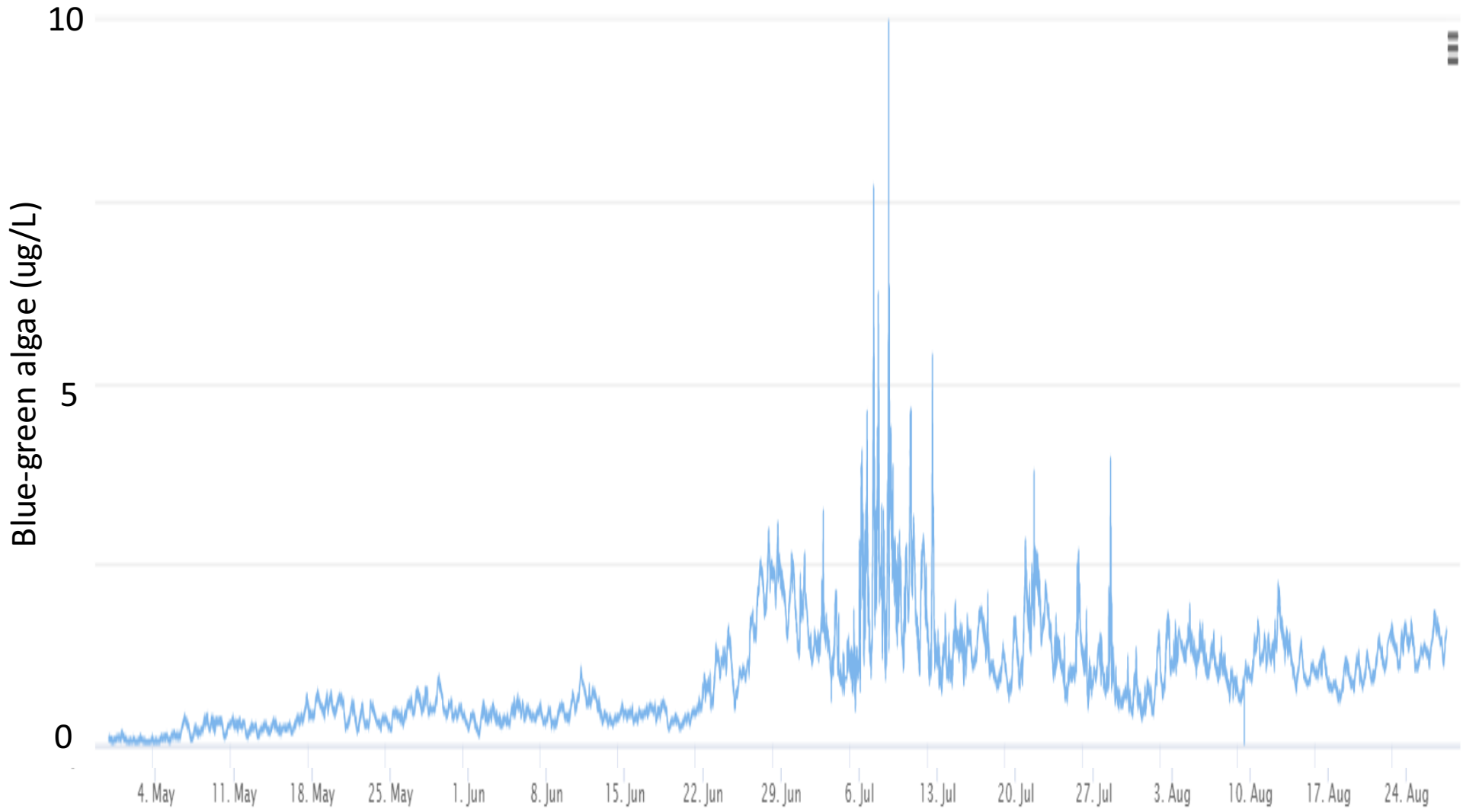
Chlorophyll *a*, buoy



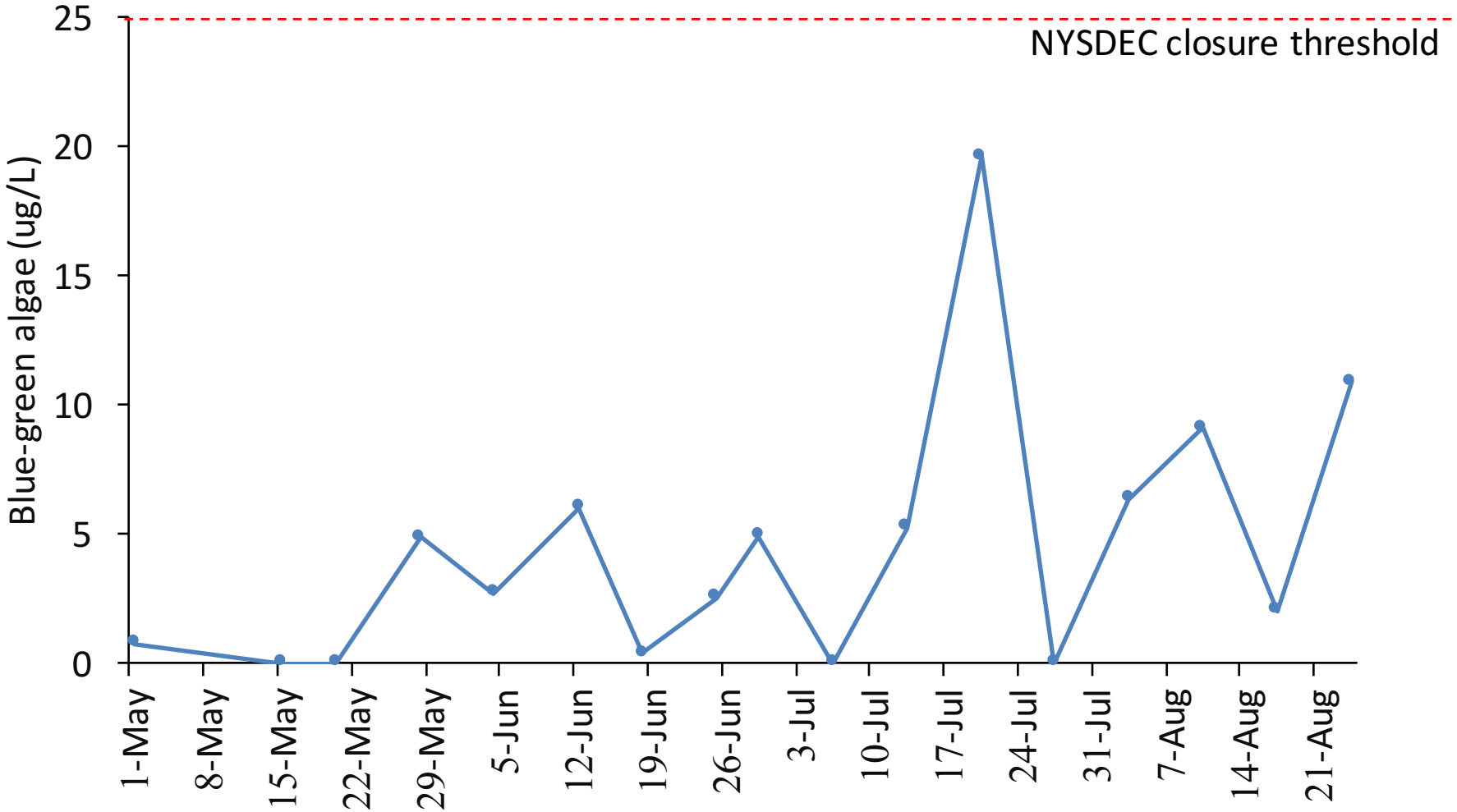
Chlorophyll *a*, extracted



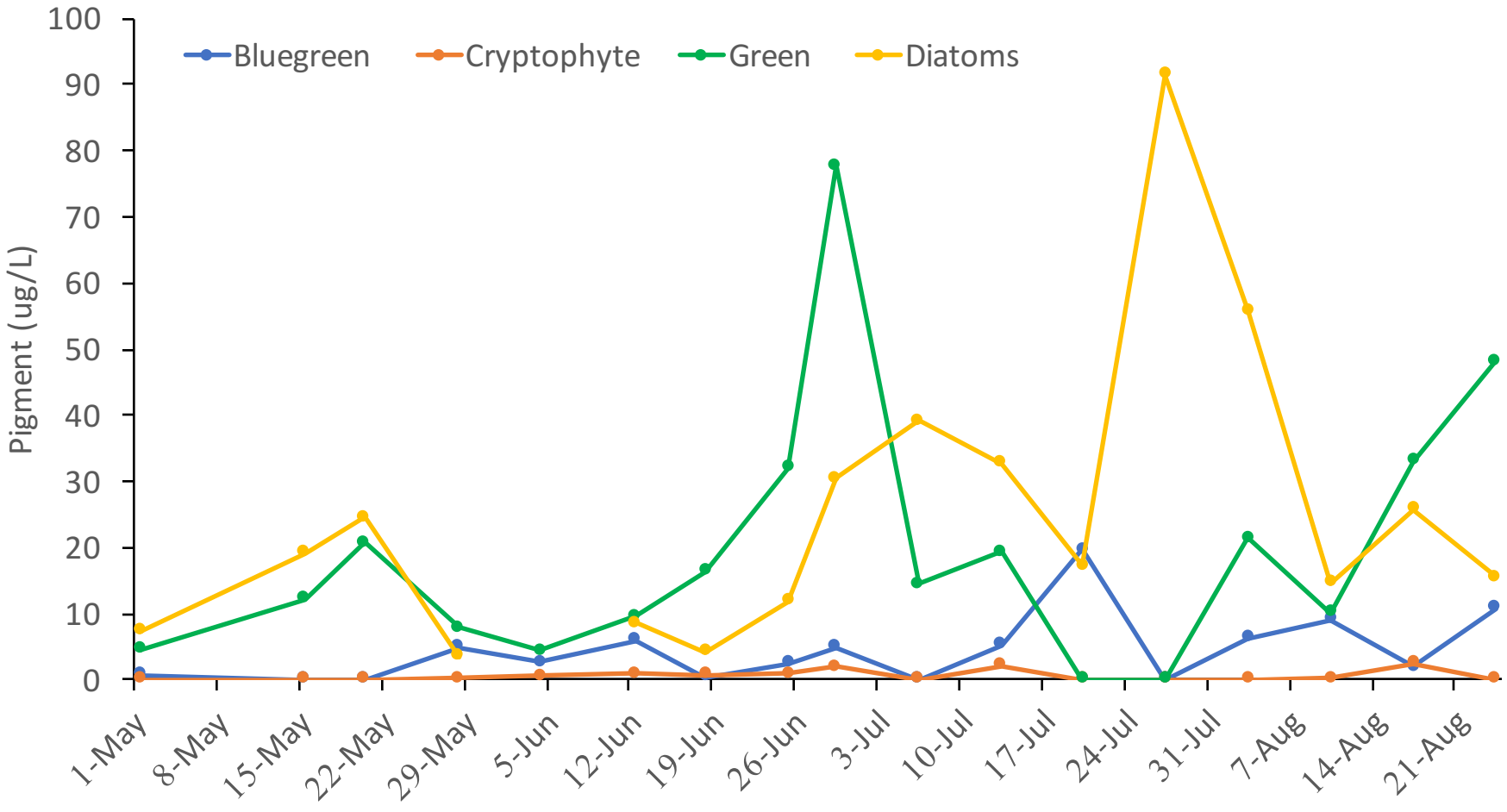
Blue green algae, buoy



Blue-green algae, extracted



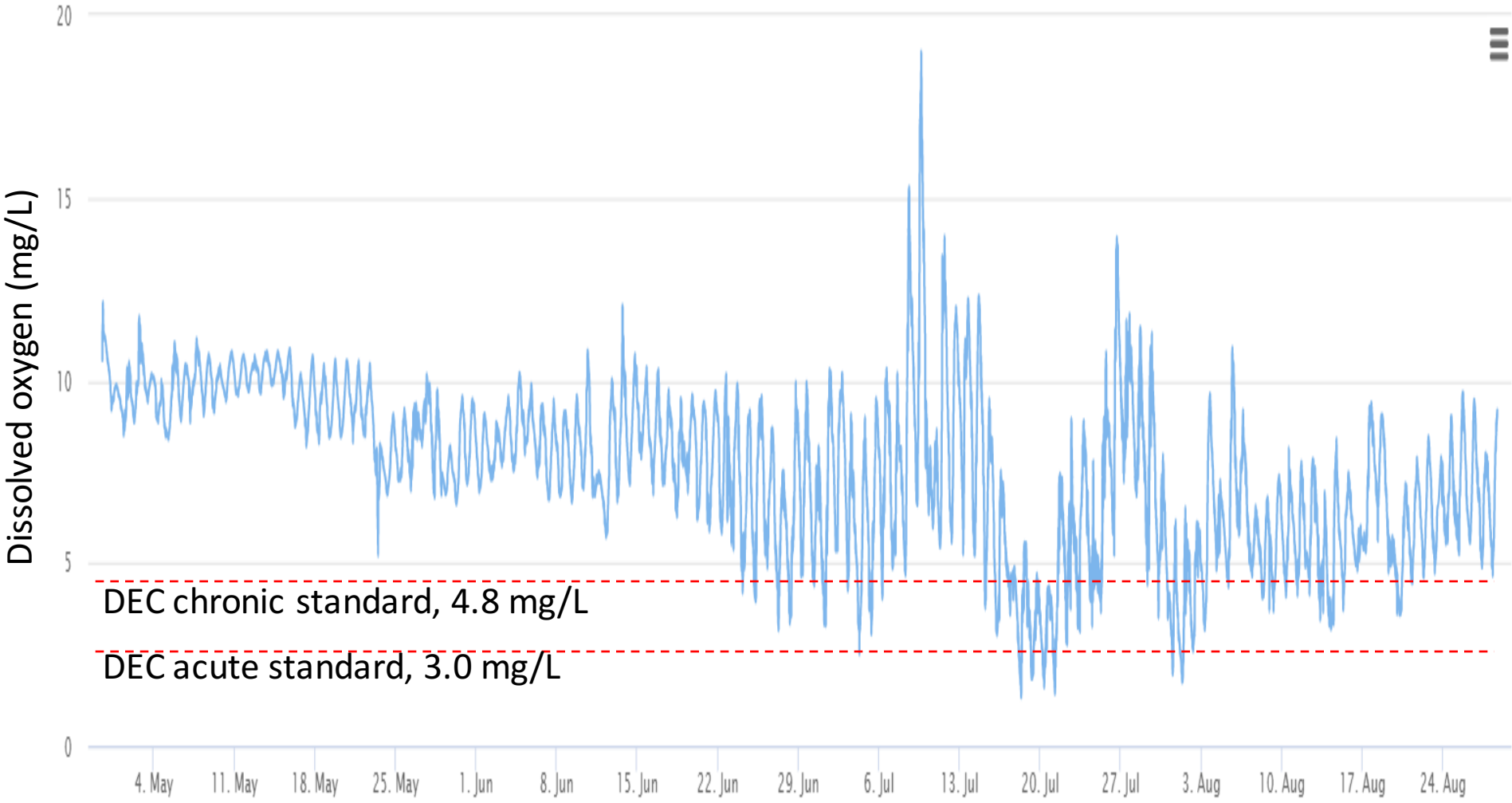
Algae communities, 2020



May

June

Dissolved oxygen, 2019



Georgica Pond macroalgae

Excessive nutrient loading in Pond

Macroalgae bloom

Collapsing macroalgal bloom regenerates nutrients

Blue-green algae use released nutrients; hypoxia

2016 - 2018: NYSDEC permitted harvesting of macroalgae funded by FoGP

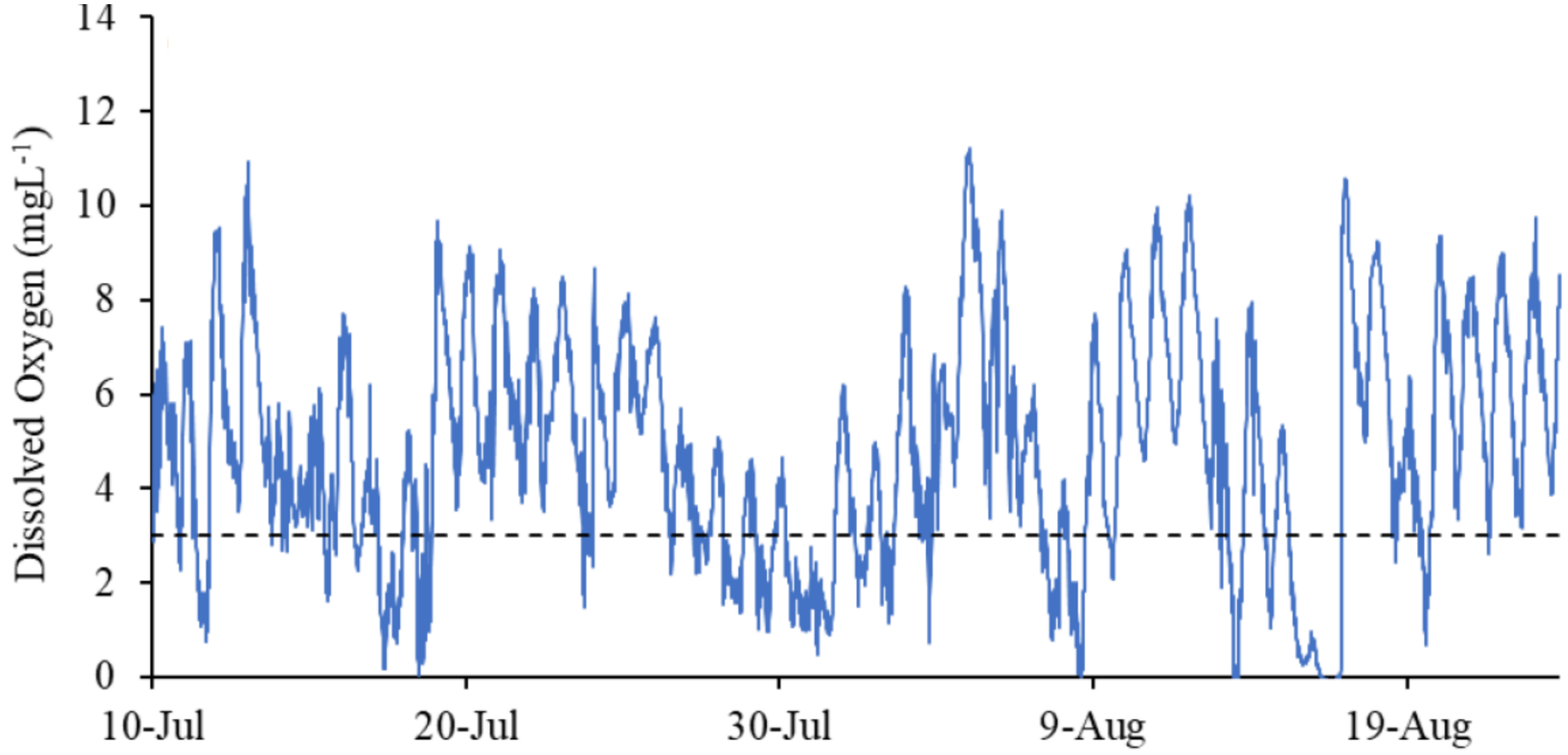
FRIENDS OF GEORGICA POND FOUNDATION

Georgica Cove, July 21, 2020

The macroalgae – blue green algae connection, **2015**

June → July → August

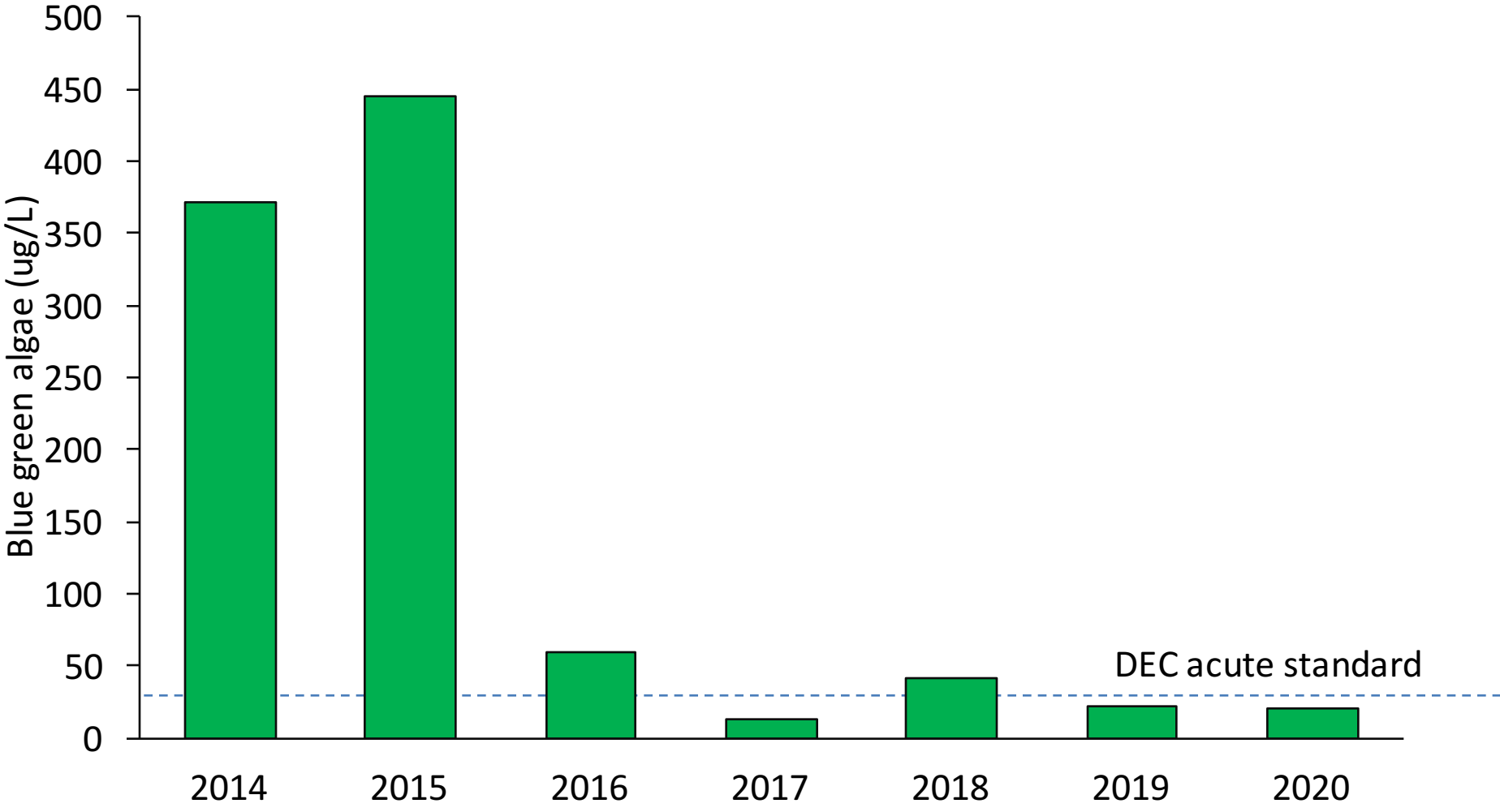
Georgica Cove dissolved oxygen, 2020



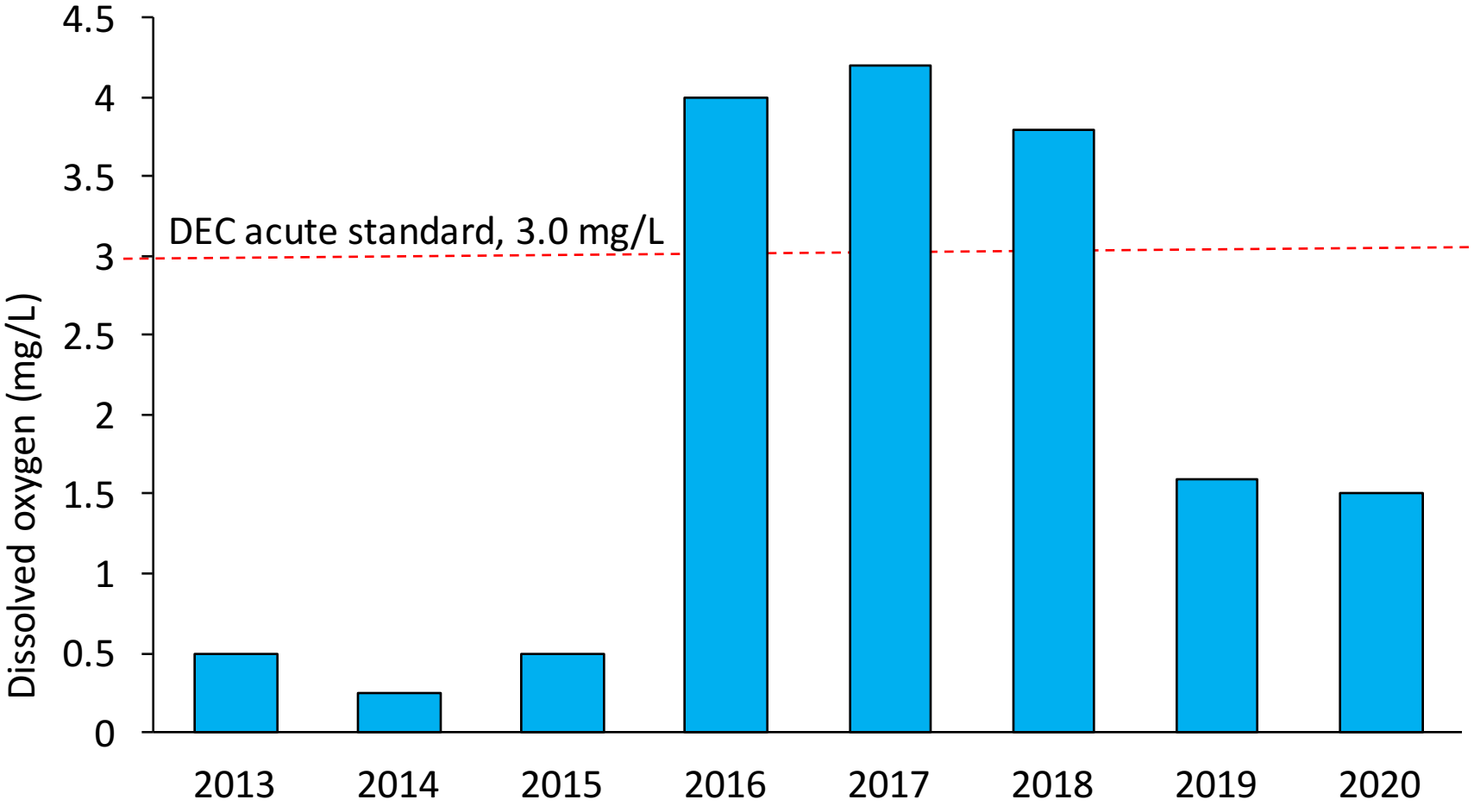
Emergency authorization for harvester granted by DEC, August 2020

Start of blue-green algae bloom in Georgica Cove?

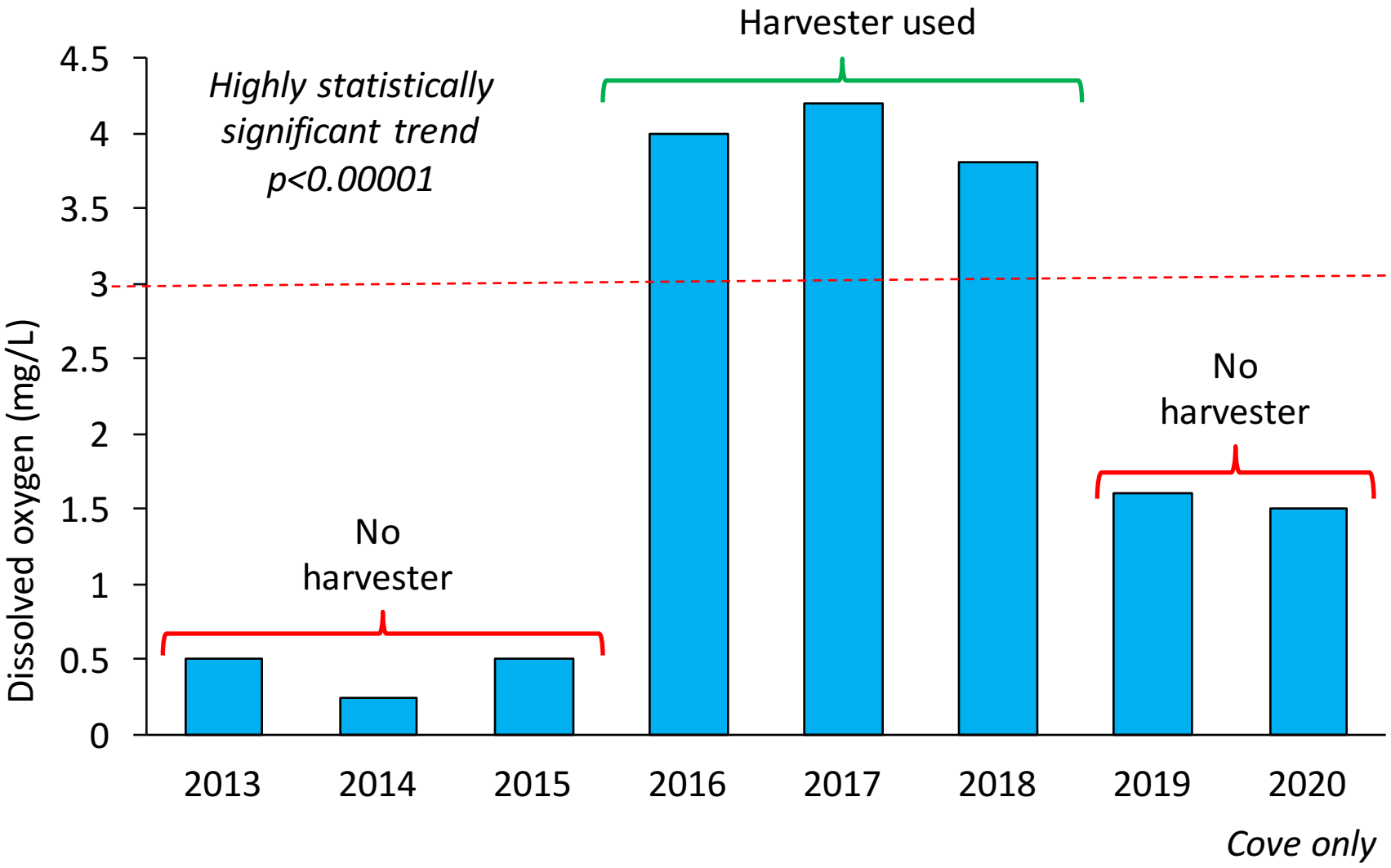
Blue-green algae blooms, 2014-2020



Summer dissolved oxygen minimum by year

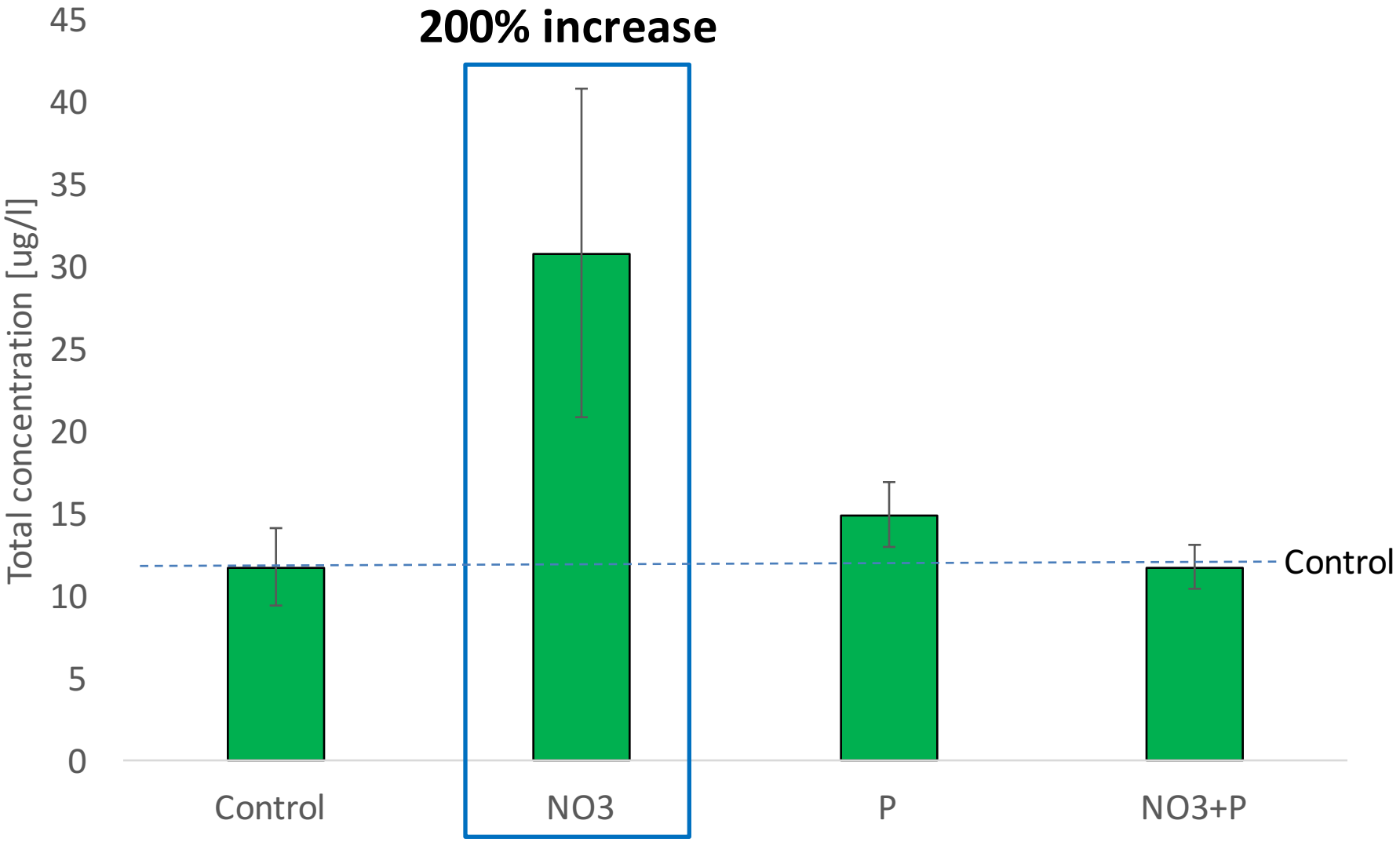


Summer dissolved oxygen minimum by year

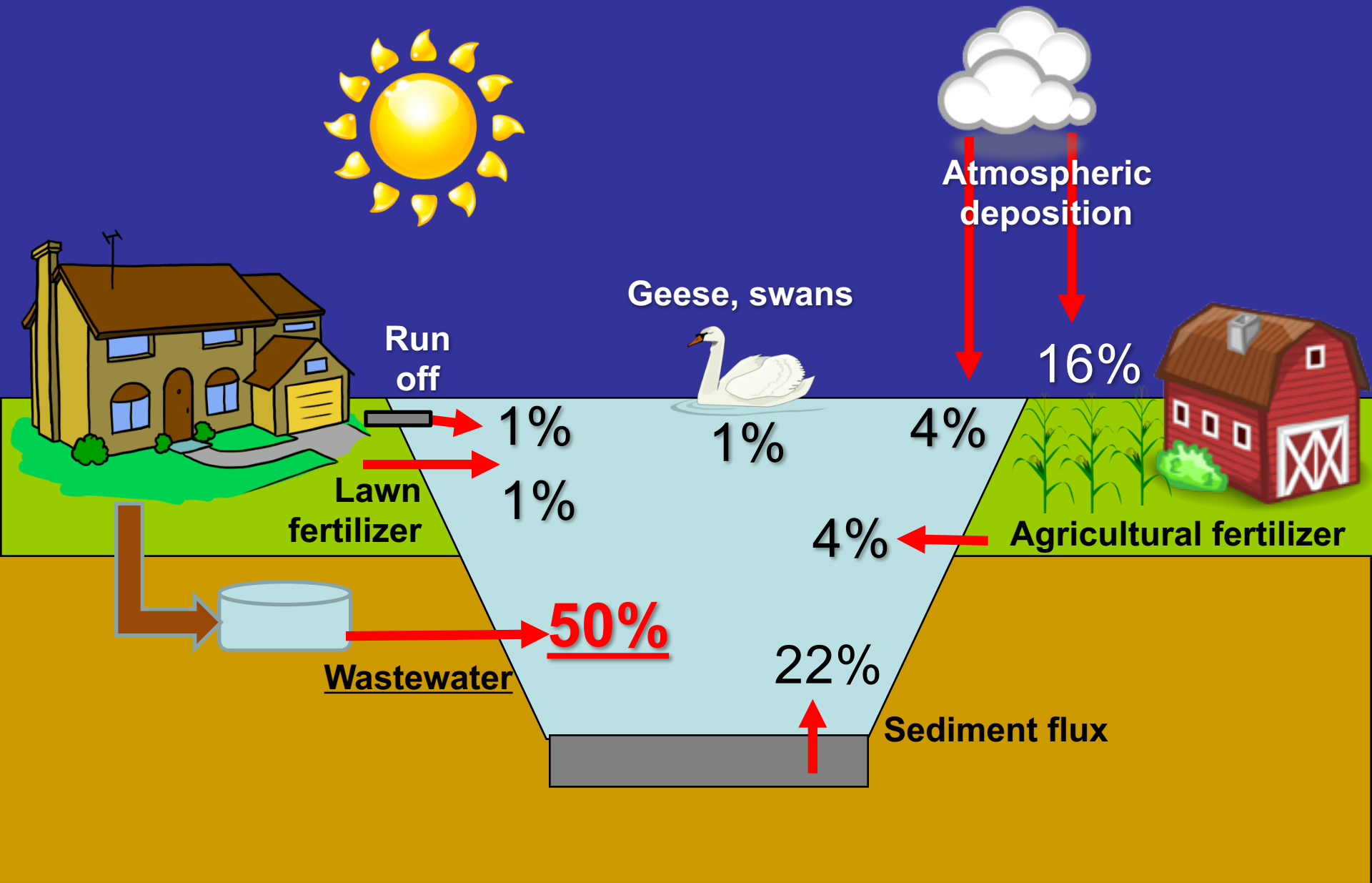


What is promoting algal blooms and low oxygen in Georgica Pond?

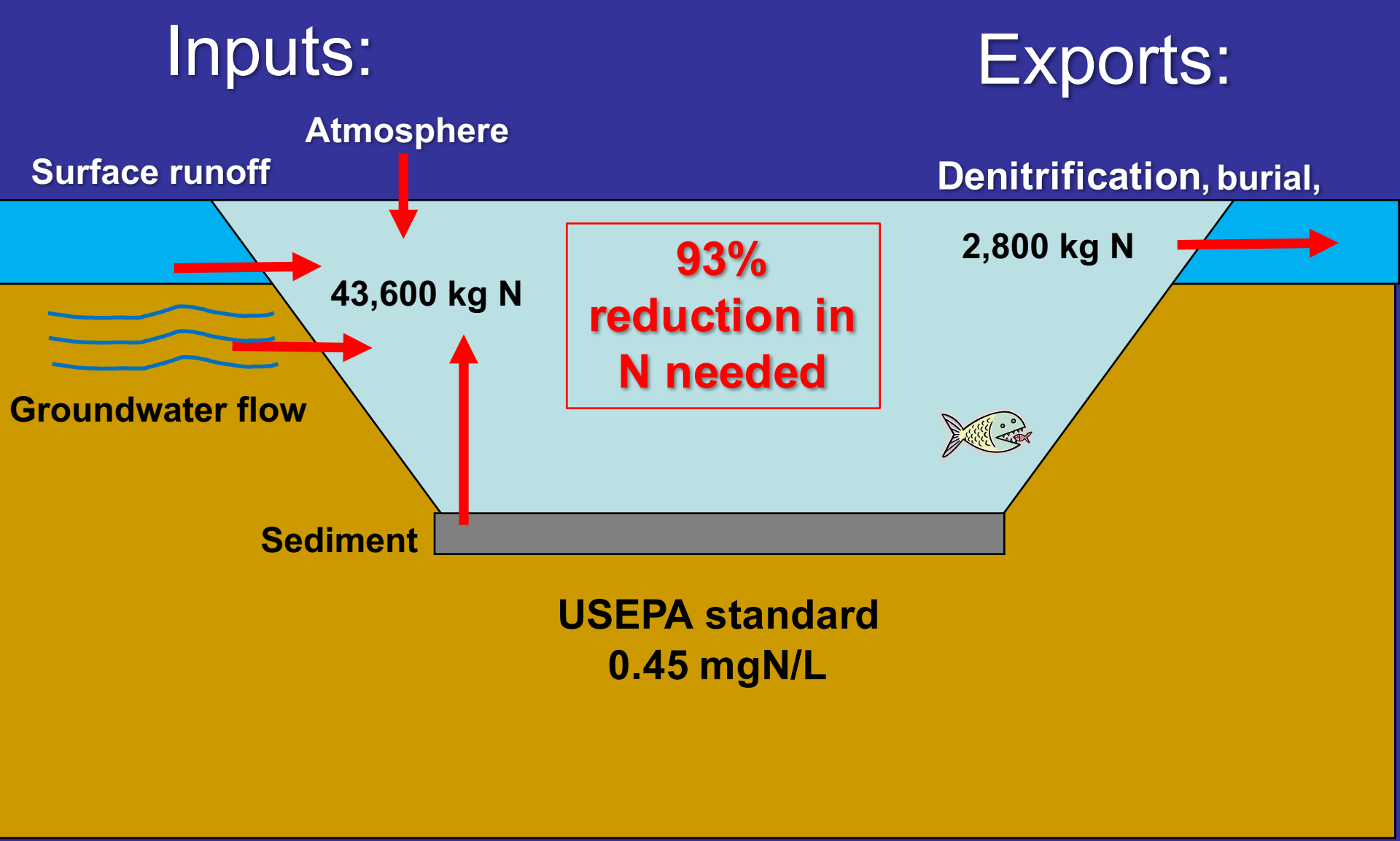
Nutrients controlling blue-green algae



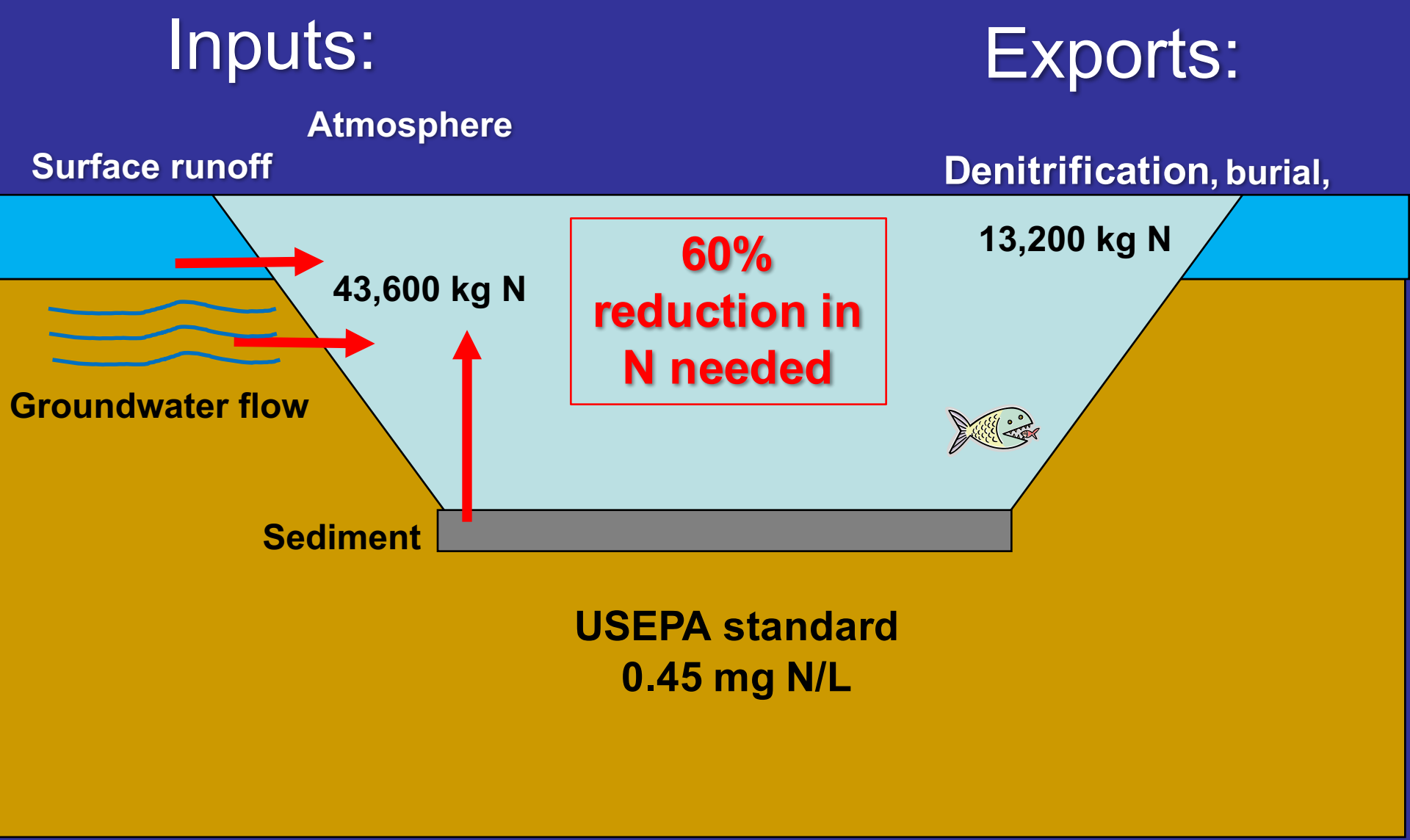
Nitrogen loading model



Total maximum daily load, nitrogen cut open two months

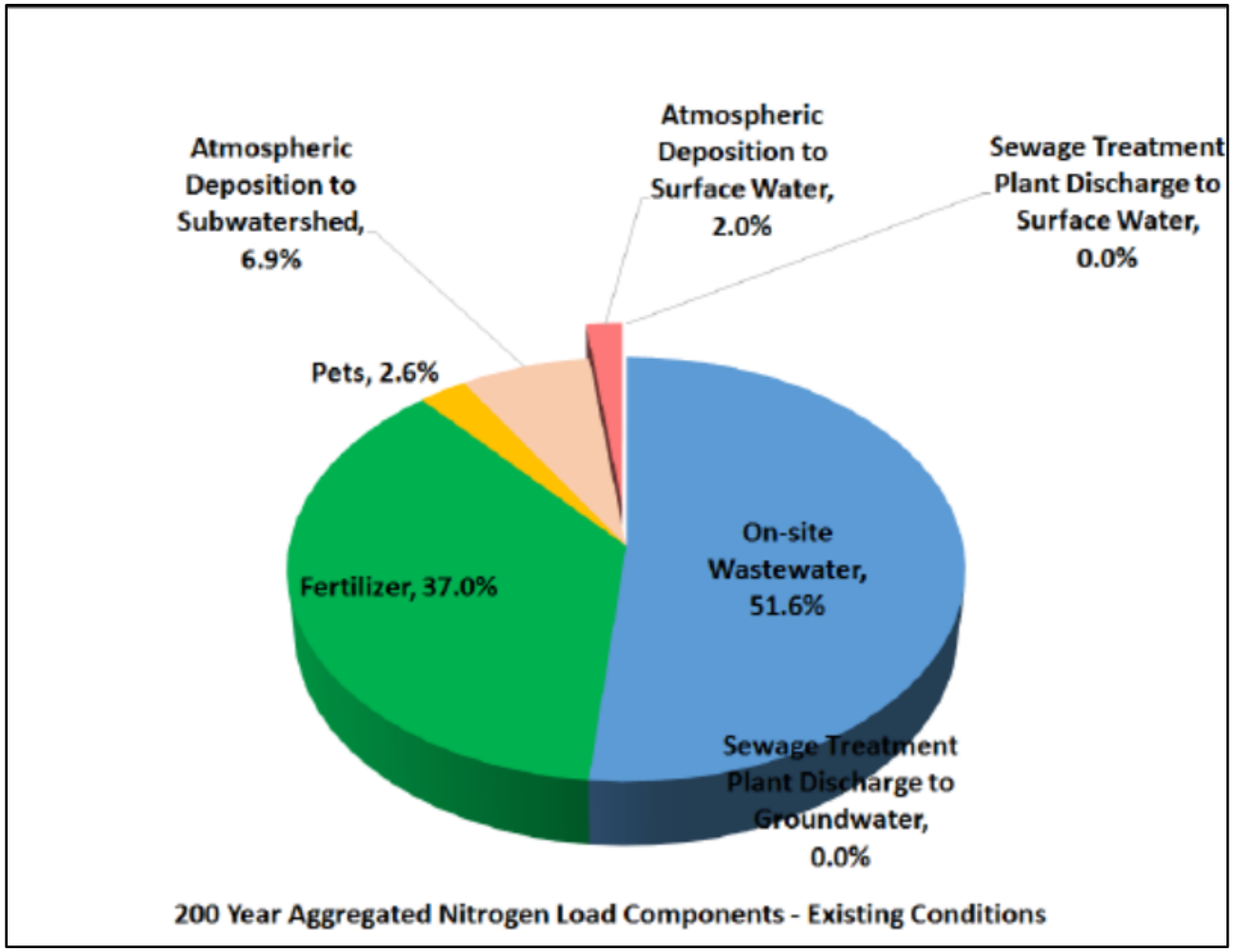


Total maximum daily load, nitrogen cut open ten months



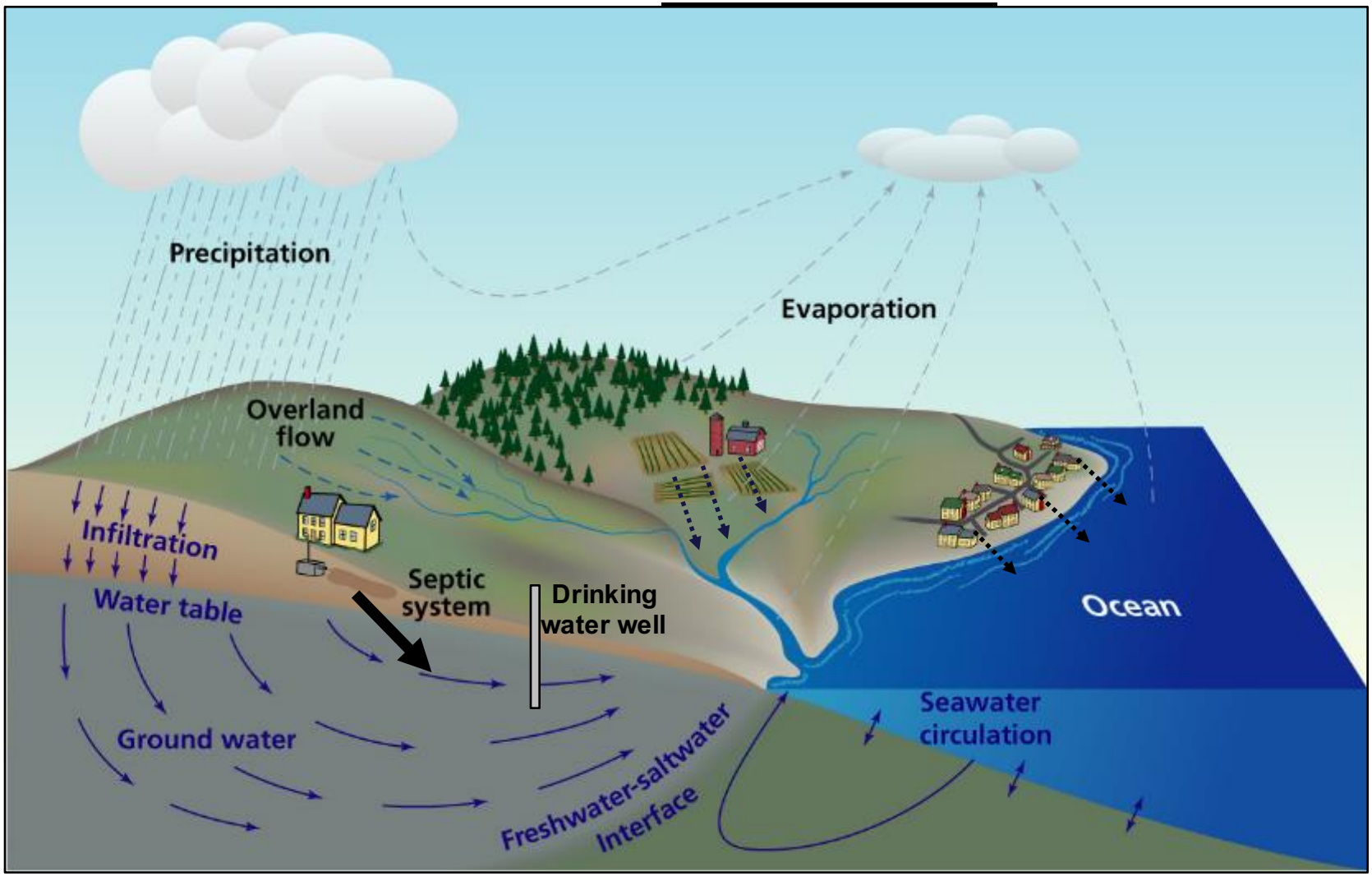
Released, September 2019; approved June 2020

Suffolk County Subwatershed N-budget for Georgica Pond

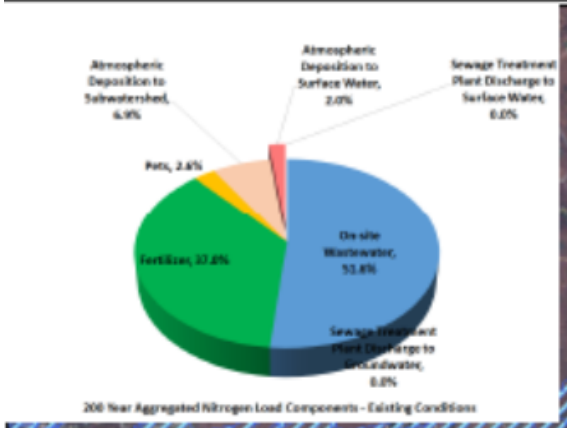


The Watershed

*Materials from land enter our **groundwater**, become our **drinking water**, and enter our **surface waters.***



Ecological Sensitivity Rank
1

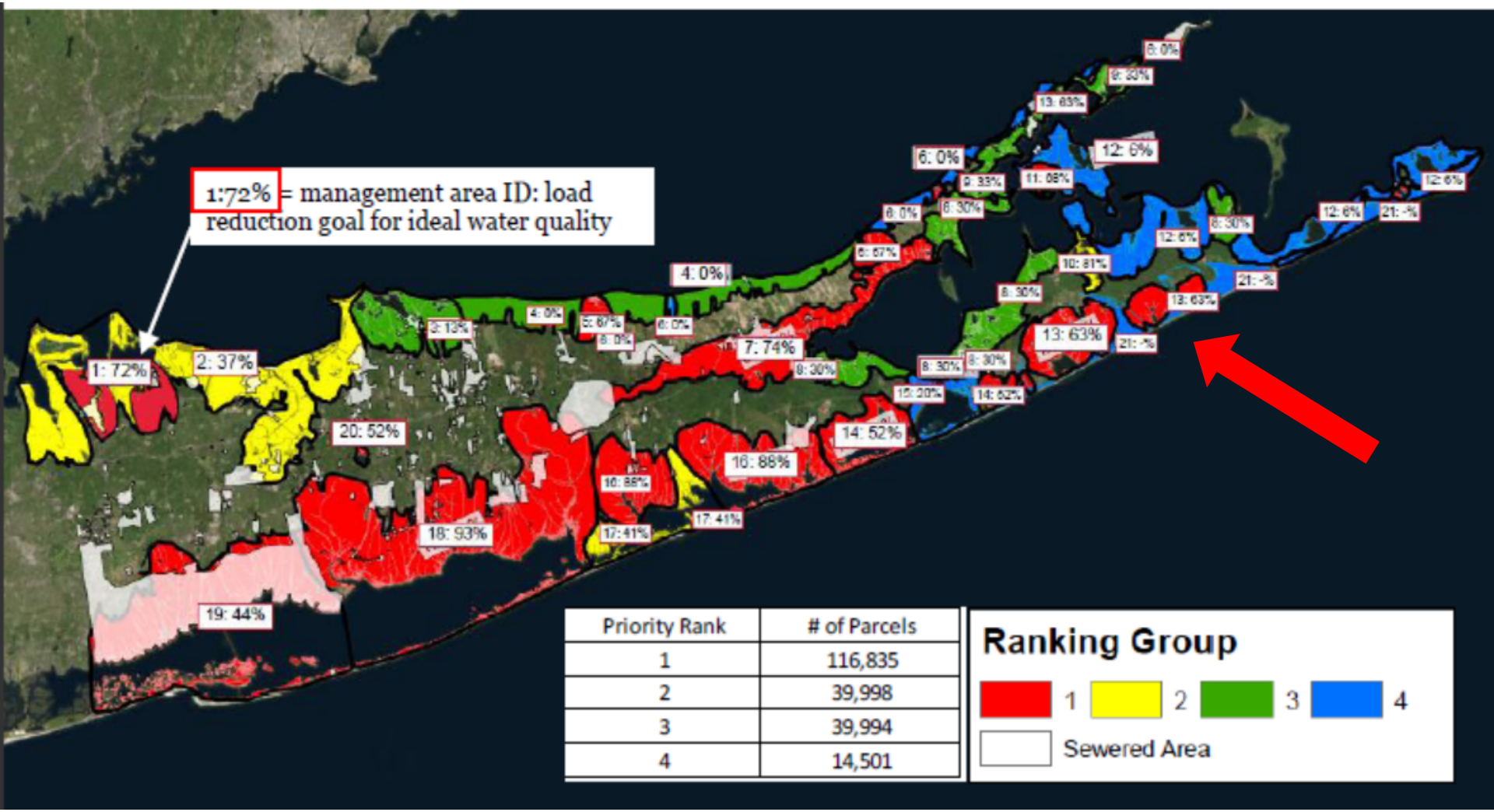


Travel Time Interval (Years)	Contributing Area (%)	Cumulative Contributing Area (%)
0 to 2	30.2%	30.2%
2 to 10	34.3%	64.5%
10 to 25	16.3%	80.8%
25 to 50	15.8%	96.6%
50 to 100	2.9%	99.5%
100 to 200	0.5%	100%

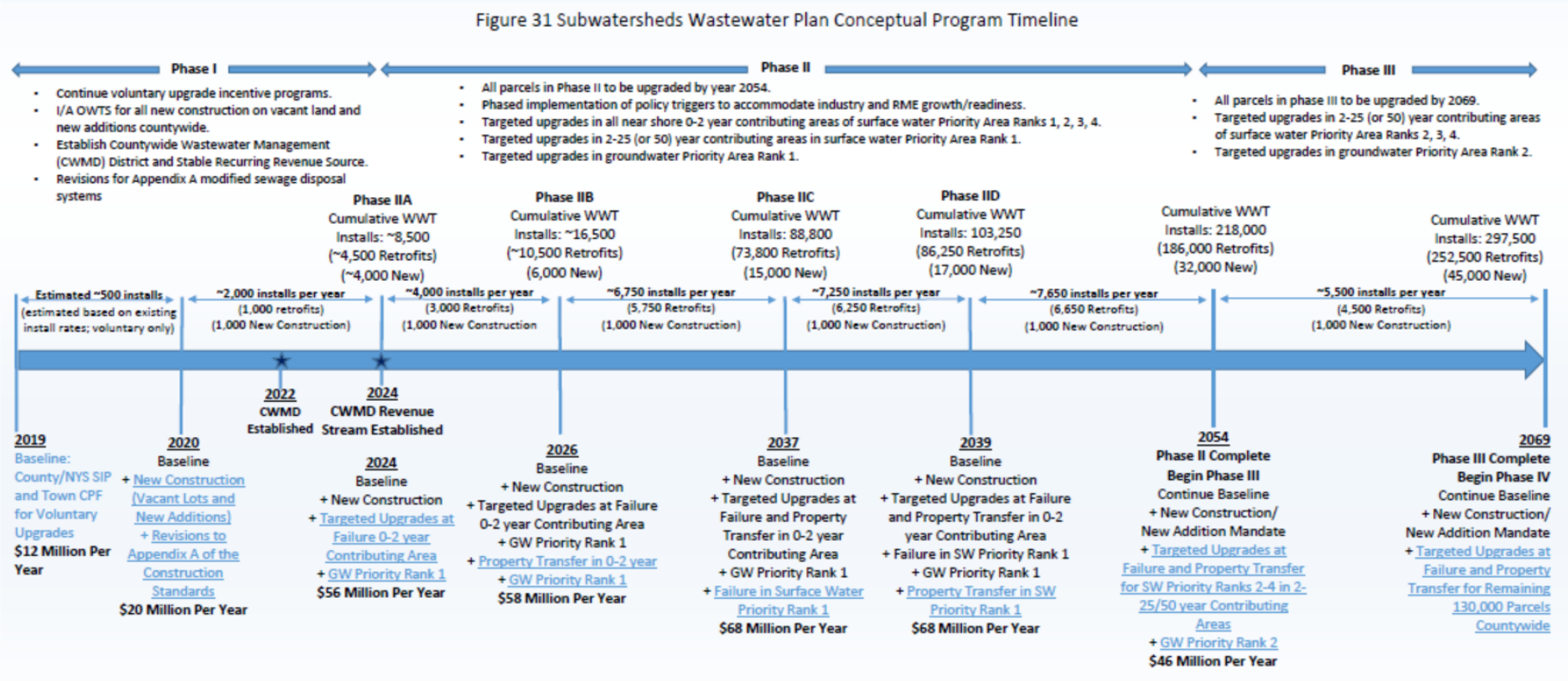
Suffolk County Subwatershed Nitrogen reductions for Georgica Pond

Approach	N reduction recommended
Gobler mass balance, cut open two months	90%
Gobler mass balance, cut open ten months	60%

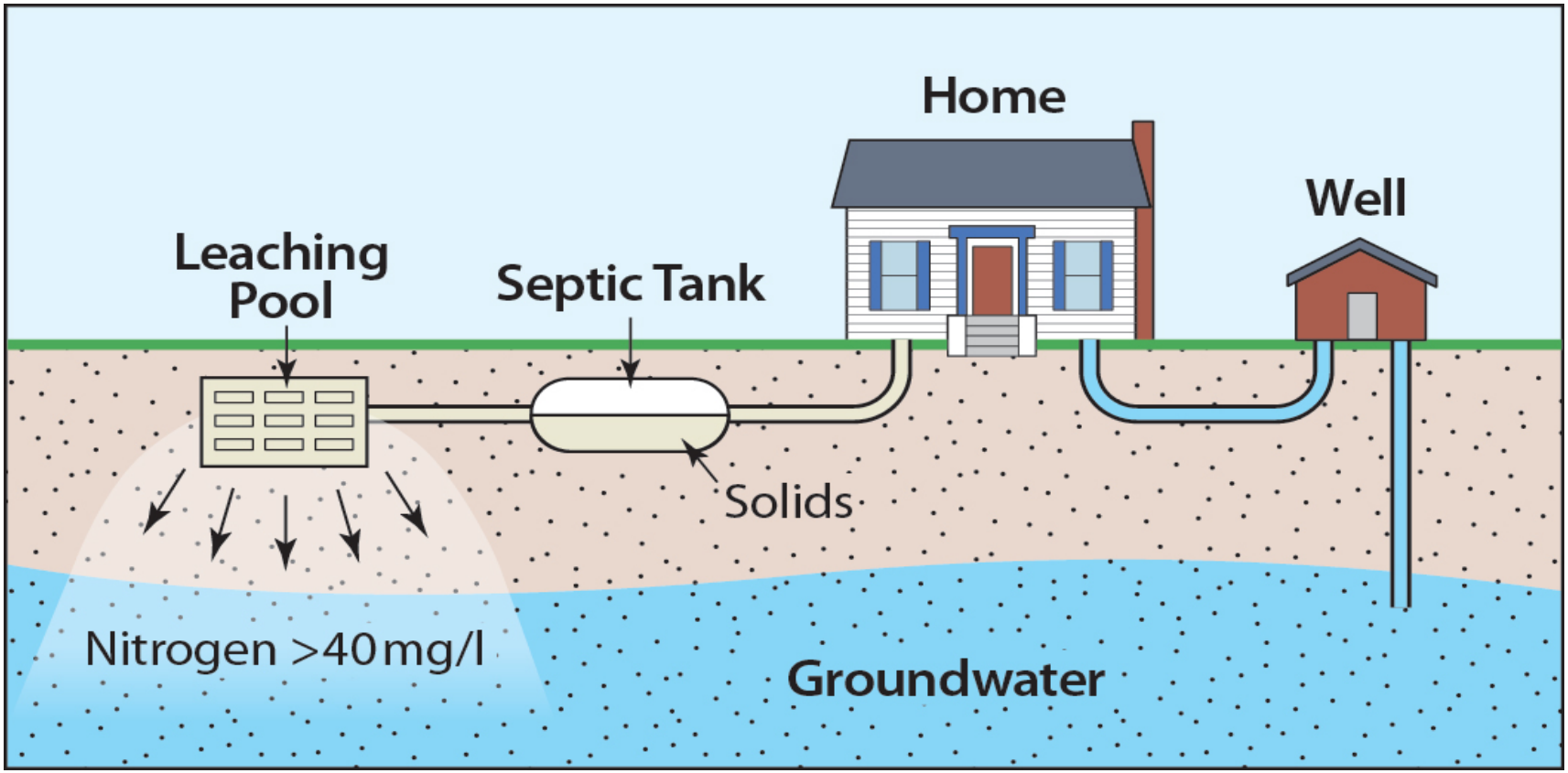
Georgica Pond is priority #1 for nitrogen load reductions



A fifty-year plan



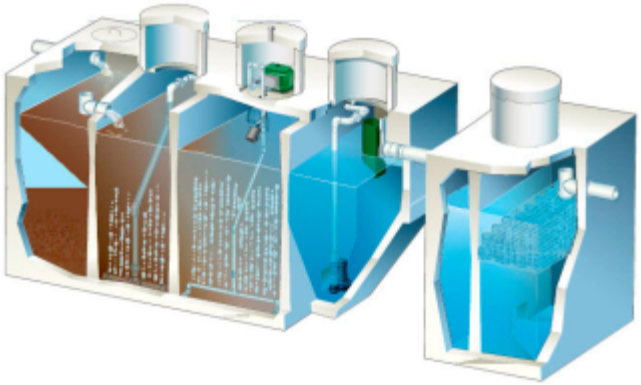
Long Island household wastewater system



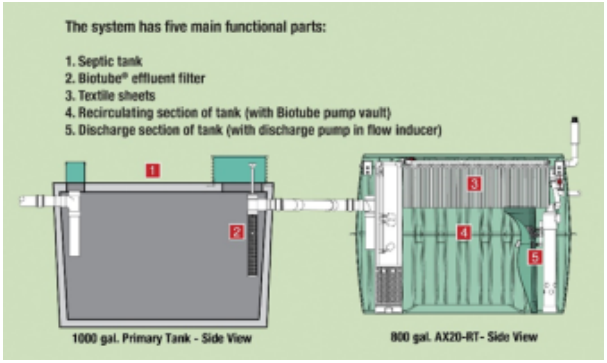
PROVISIONALLY APPROVED I/A OWTS: Reduce N below 19 mg/L

Hydro-Action

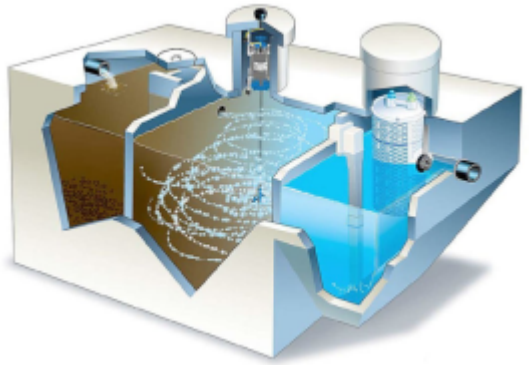
Fuji Clean System



Norweco Hydrokinetic



Orenco Advantex AX-RT



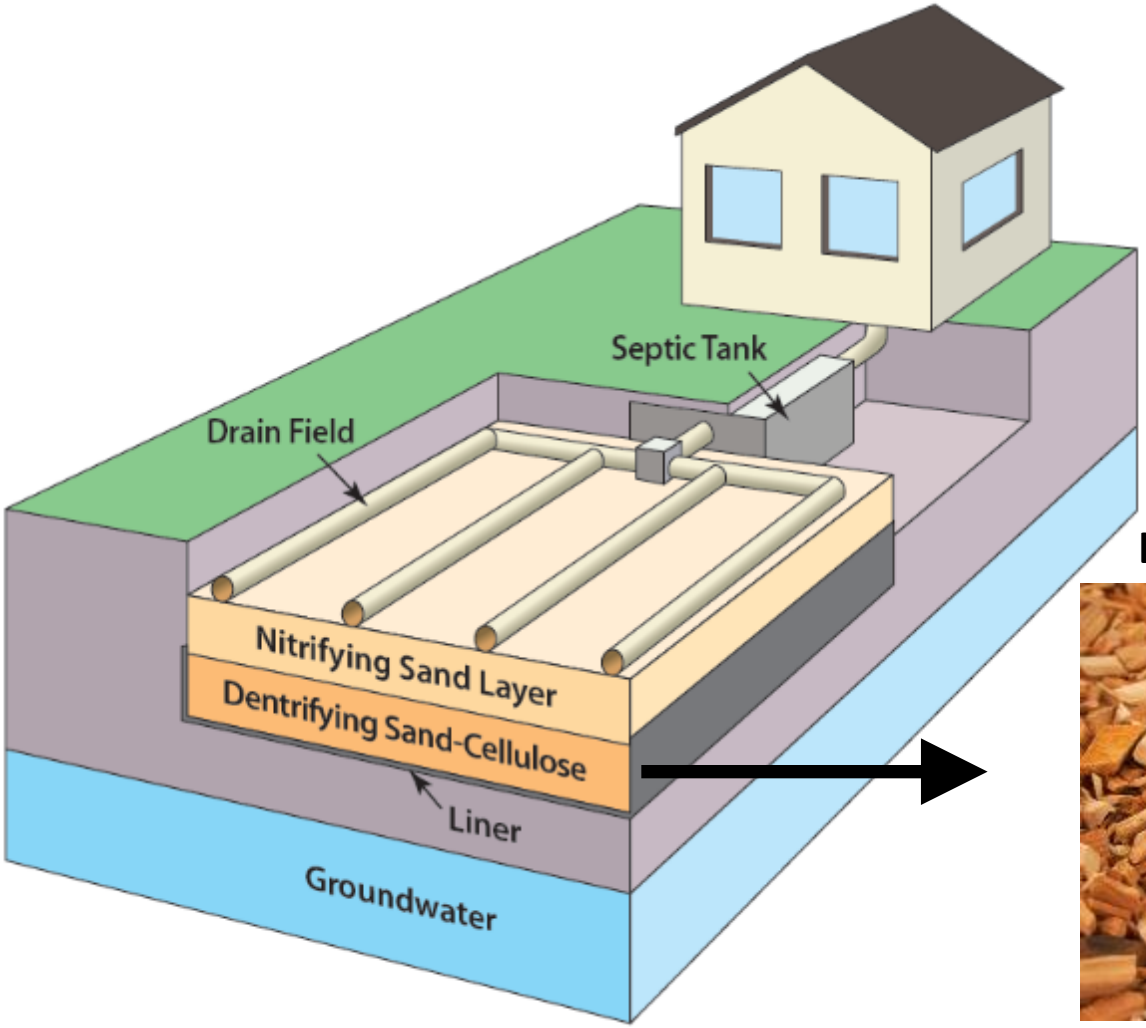
Norweco Singlair TNT

Stony Brook University

The New York State Center for Clean Water Technology: Innovating solutions to protect our most vital resource

Director, Dr. Chris Gobler

Nitrogen Removing Biofilters (NRB)

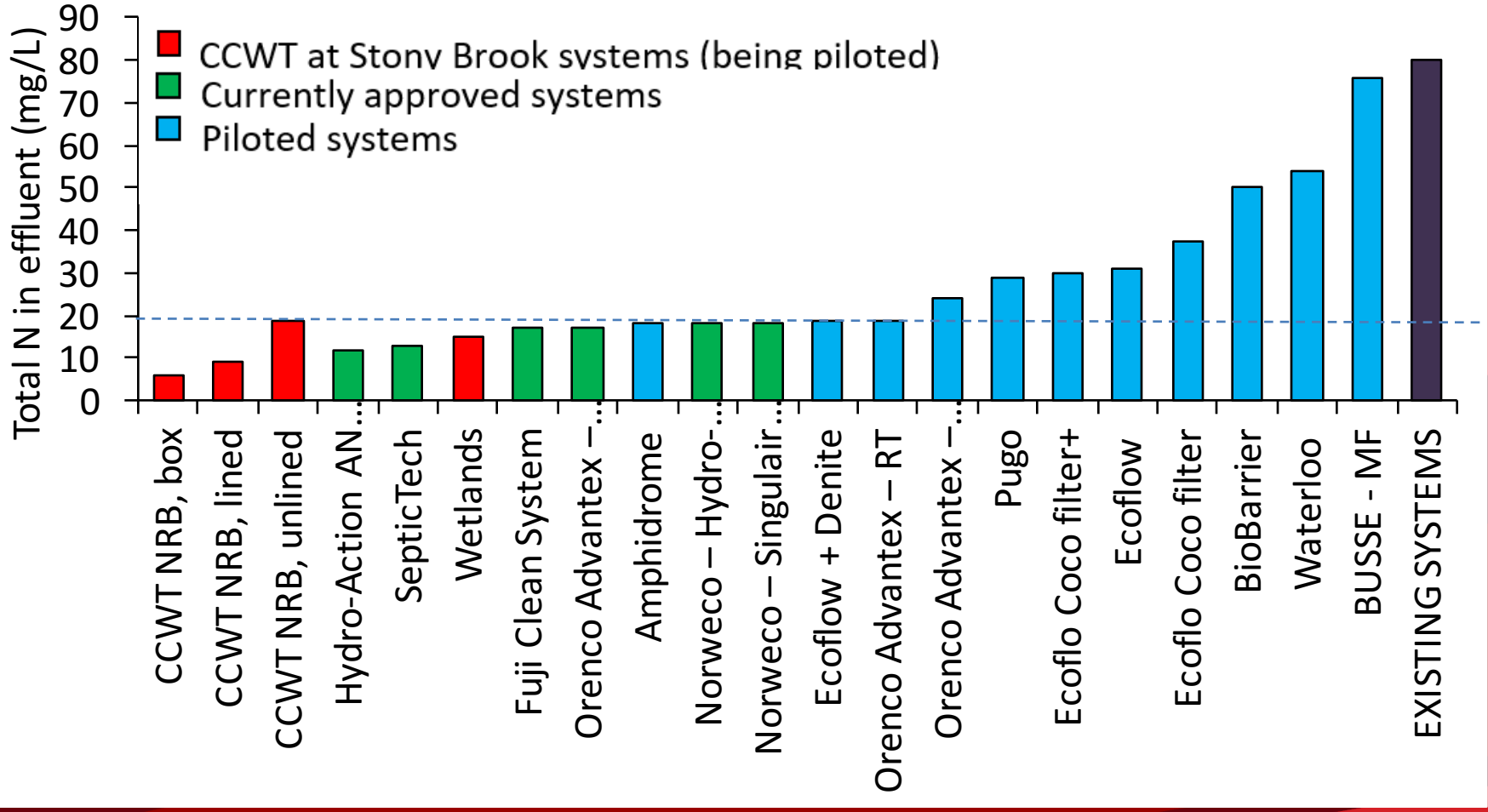


Provisional approval anticipated in 2021.

Lignocellulose = wood, chips

Carbon source to promote denitrification

Comparison of I/A performance in Suffolk County



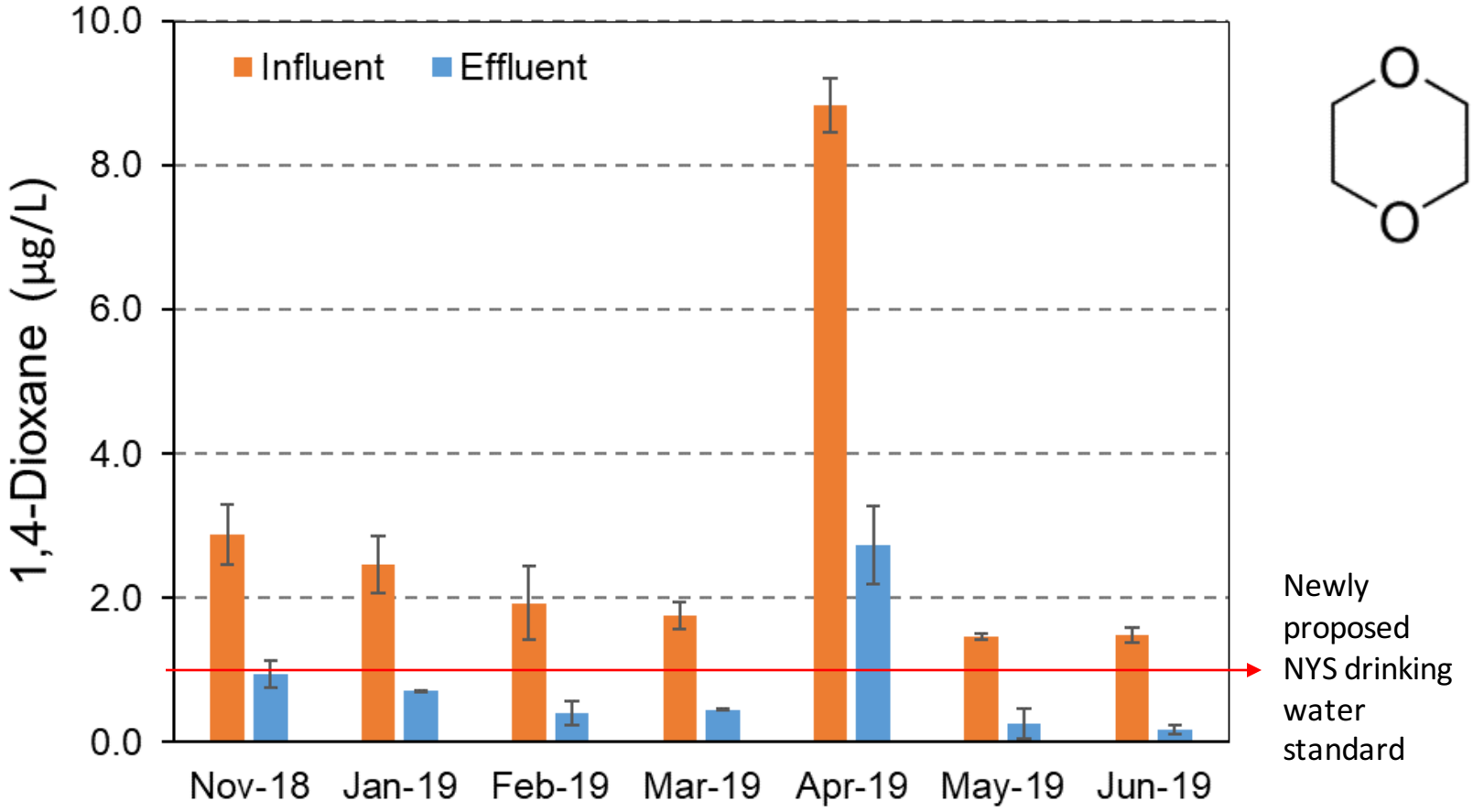
Removal of drugs and pharmaceuticals, Massachusetts Test Center

	Channel Influent (ng/L)	LINED Septic Tank Effluent (ng/L)	LINED Effluent (ng/L)	Removal Channel Influent To Effluent (%)
Acetaminophen	67,000	56,000	<MDL (75)	>99
Atenolol	380	250	21	94
Caffeine	65,000	38,000	<MDL (69)	>99
Cotinine	1,300	1,800	<MDL (48)	96
DEET	5,100	2,500	54	99
Diltiazem	<MDL (123)	<MDL (43)	<MDL (19)	84
Diphenhydramine	470	220	<MDL (23)	95
Metoprolol	350	280	27	92
Nicotine	1,700	1,100	<MDL (24)	99
Paraxanthine	30,000	9,300	<MDL (62)	>99
Sulfamethoxazole	1,000	3,200	50	95
Trimethoprim	560	430	<MDL (21)	96

<MDL values are calculated using the MDL

Data courtesy of Tricia Clyde

Removal of 1,4-Dioxane, expected carcinogen, by NRBs

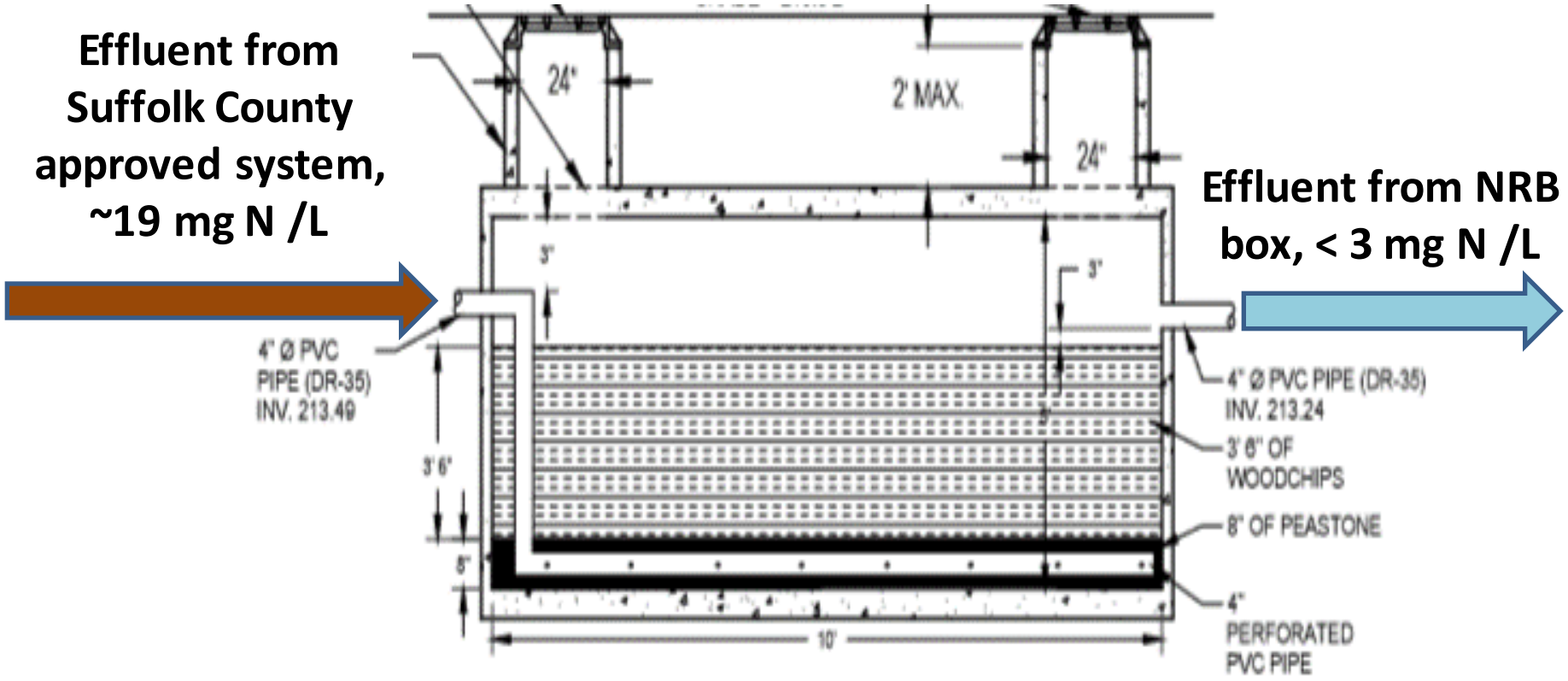


70% removal vs 10– 30% for sewage treatment plant and 0% for conventional septic systems

- Data courtesy of Drs. Arjun Venkatesan and Cheng-Shiuan Lee

Woodchip boxes as 'polishing units' for I/A systems across Suffolk County, ***available now***, full price covered grant

Effluent from Suffolk County approved system, ~19 mg N /L



Effluent from NRB box, < 3 mg N /L

Designed by Dr. Stuart Waugh and Frank Russo, P.E.

Conclusions:

- Georgica Pond suffers from algal blooms, blue-green algae, low oxygen, and fish kills.
- Harvesting macroalgae has been coincident with improved conditions.
- Algal blooms are promoted by excessive nitrogen.
- Suffolk County's 2020 Subwatersheds Study's findings closely match the 2015 study of Georgica Pond by Stony Brook University
- Most of the nitrogen entering Georgica Pond comes from wastewater.
- Accelerating the removal of nitrogen from wastewater is the central long-term solution.
- Long-term, significantly improved water quality can occur in < 10 years if rapid action is taken now.