



Restoring the Childs River: Water Quality Trends, Insights, and Questions for Consideration

PRESENTATION BY:

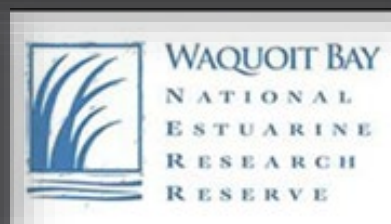
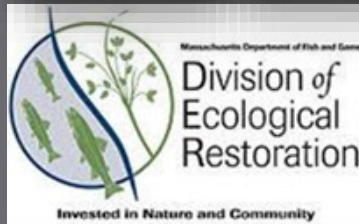
JORDAN MORA, ASSOCIATION TO PRESERVE
CAPE COD

RYAN CLARK, WAQUOIT BAY NATIONAL
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This project was completed with support from the following partners:



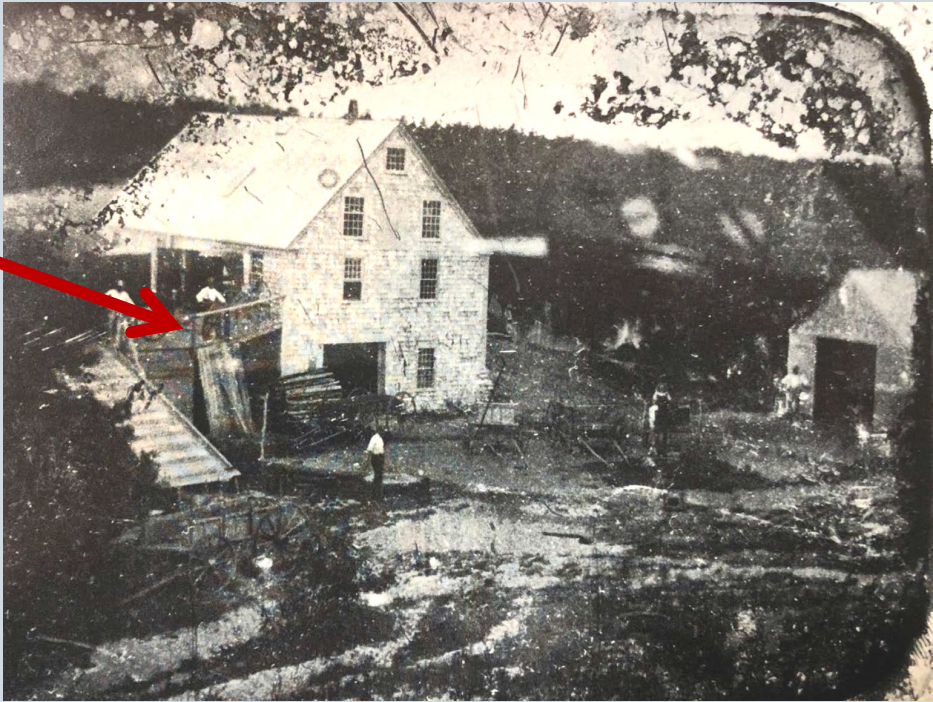
Project Team



Woolen Mill and Carriage Shop History (early to mid-1800s)



Circa 1880s



Circa 1860

Photos and interpretation provided by the Public
Archeology Laboratory (PAL)



River Herring & Cranberry Bog History (1850-1950)

Following collapse of mill, Waquoit River Herring Company was formed

- Constructed fishway around mill dam

Cranberry Cultivation ~ 1950s

- By 1920, there were 9 bogs on Childs River



Circa 1930s



Falmouth Rod and Gun Club

- Purchased land in 1968 and replaced the fish ladder

Fish ladder
(1968-2020)

Upper Childs River Restoration Goals & Actions

1

Restore fish habitat for sea run brook trout and other native anadromous species

- *Remove barriers to fish passage*
- *Reintegrate cold groundwater into reconstructed river channel*

2

Restore riparian and wetland habitat for migratory birds and other wildlife

- *Restore cranberry bogs to wetland systems by removing sand layers and creating new river channel*
- *Create shallow ponds for waterfowl that are separate from river channel*

3

Improve water quality to alleviate impairment in downstream Waquoit Bay estuary (impaired due to excess nitrogen loading)

4

Create public access



Childs River Near Carriage Shop Road

Inter-Fluve CONCEPT DESIGN



Clogged / Deteriorated Culvert

Before - 2018



After - 2021



Before - 2018



After - 2021



Southern Mill Pond

Before - 2018

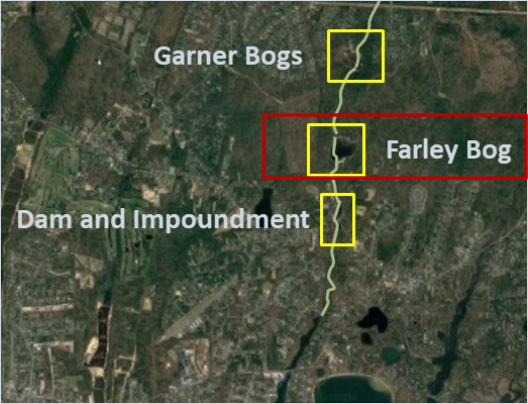


After - 2021



Farley Bog

Before - 2018

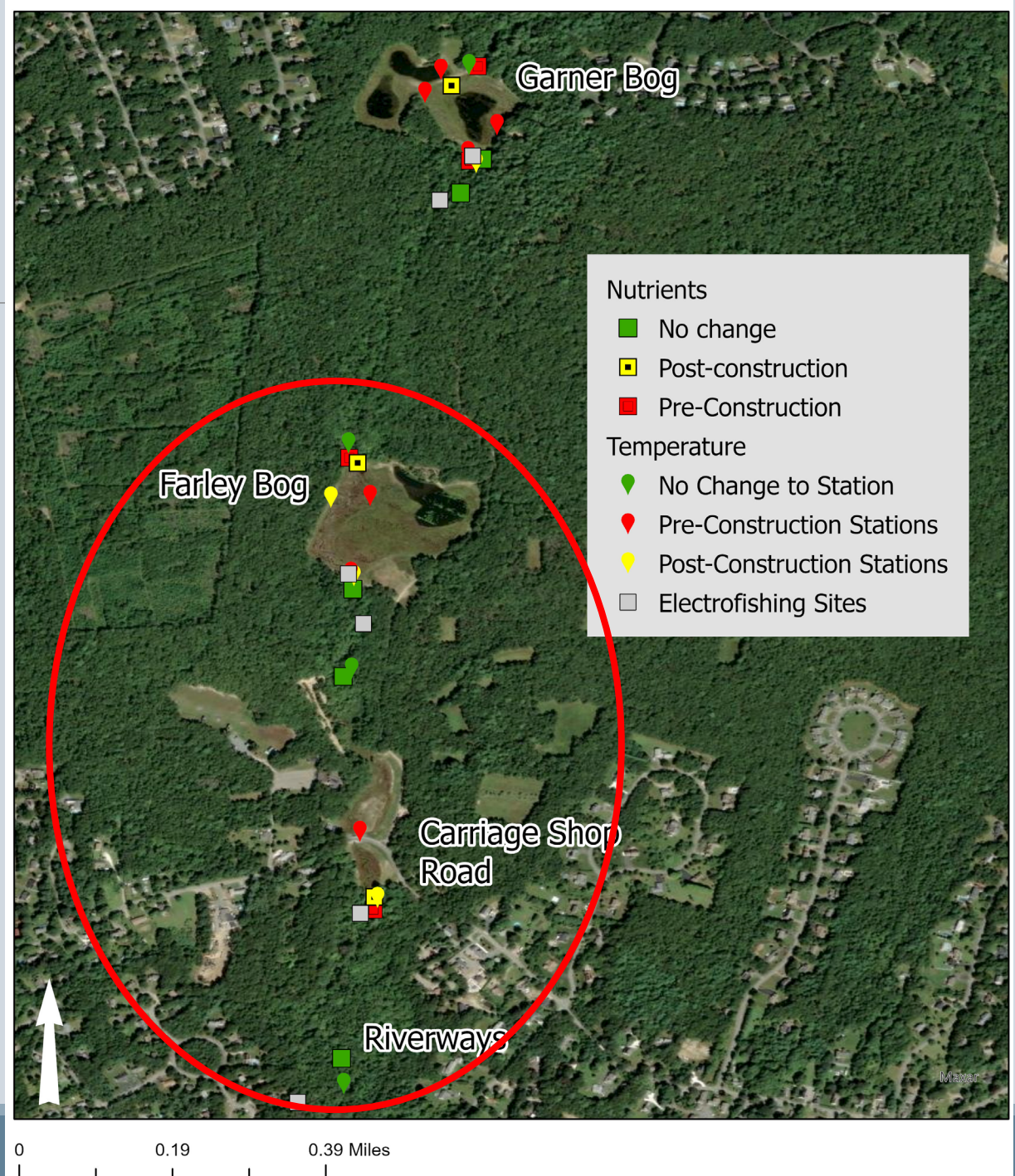


After - 2021



Monitoring

- Annual Fish Surveys
- Continuous water temperature and dissolved oxygen (DO) data
- Water quality sampling: Temp, DO, pH, nutrients
- Vegetation Cover
- Acoustic logger surveys



Nutrients

Discrete Sampling:

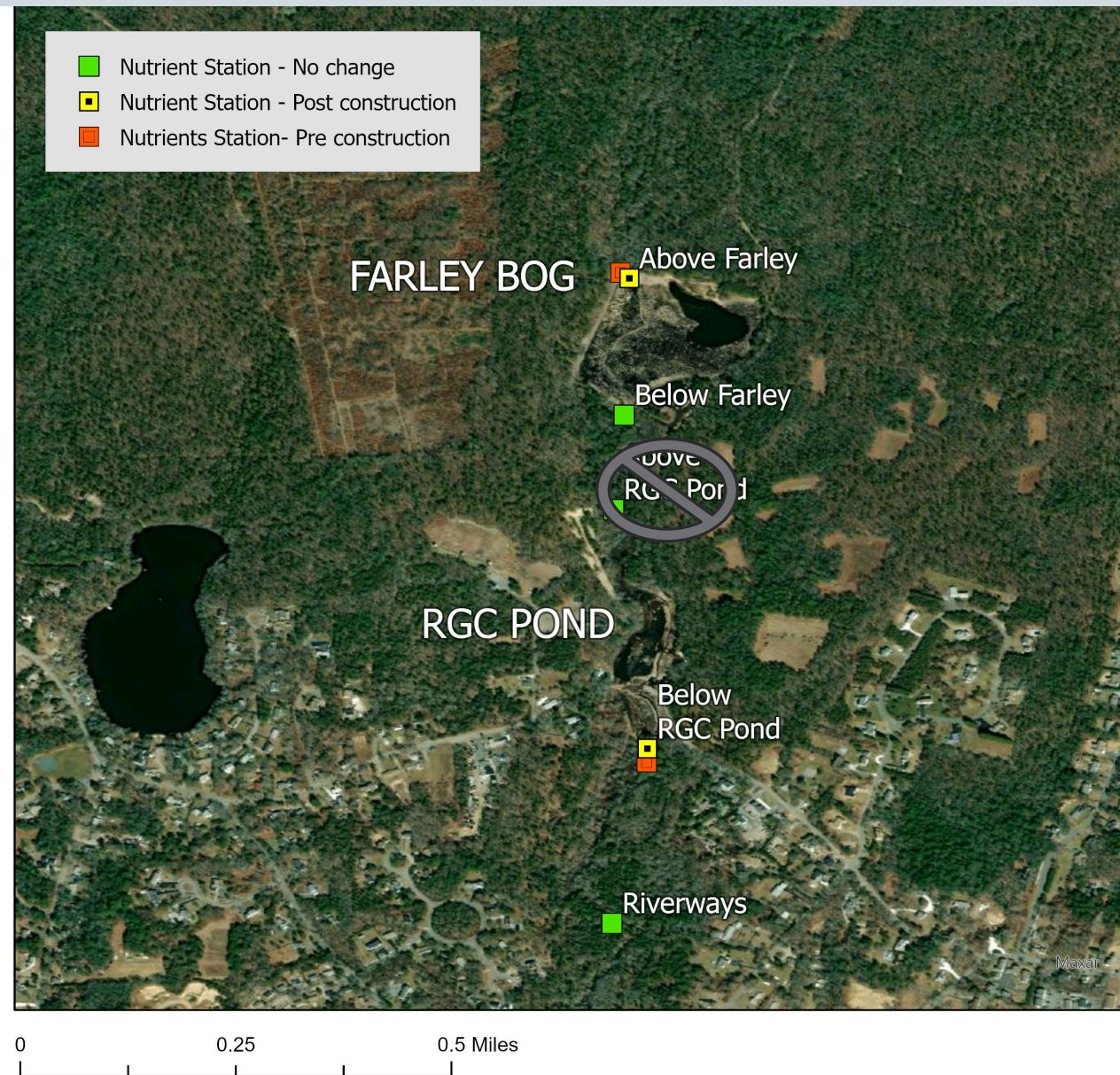
- Nitrate & Nitrite, Ammonium, Dissolved Organic Nitrogen
- Orthophosphate
- Silica
- Dissolved Organic Carbon (non-purgeable organic C)
- Temp, DO, Sp. Conductivity, pH

Frequency:

- Weekly: April 2019- Sept 2019*
- Biweekly: May – Sept (2020-2024)**
- Monthly: October – April (2020-2024)**

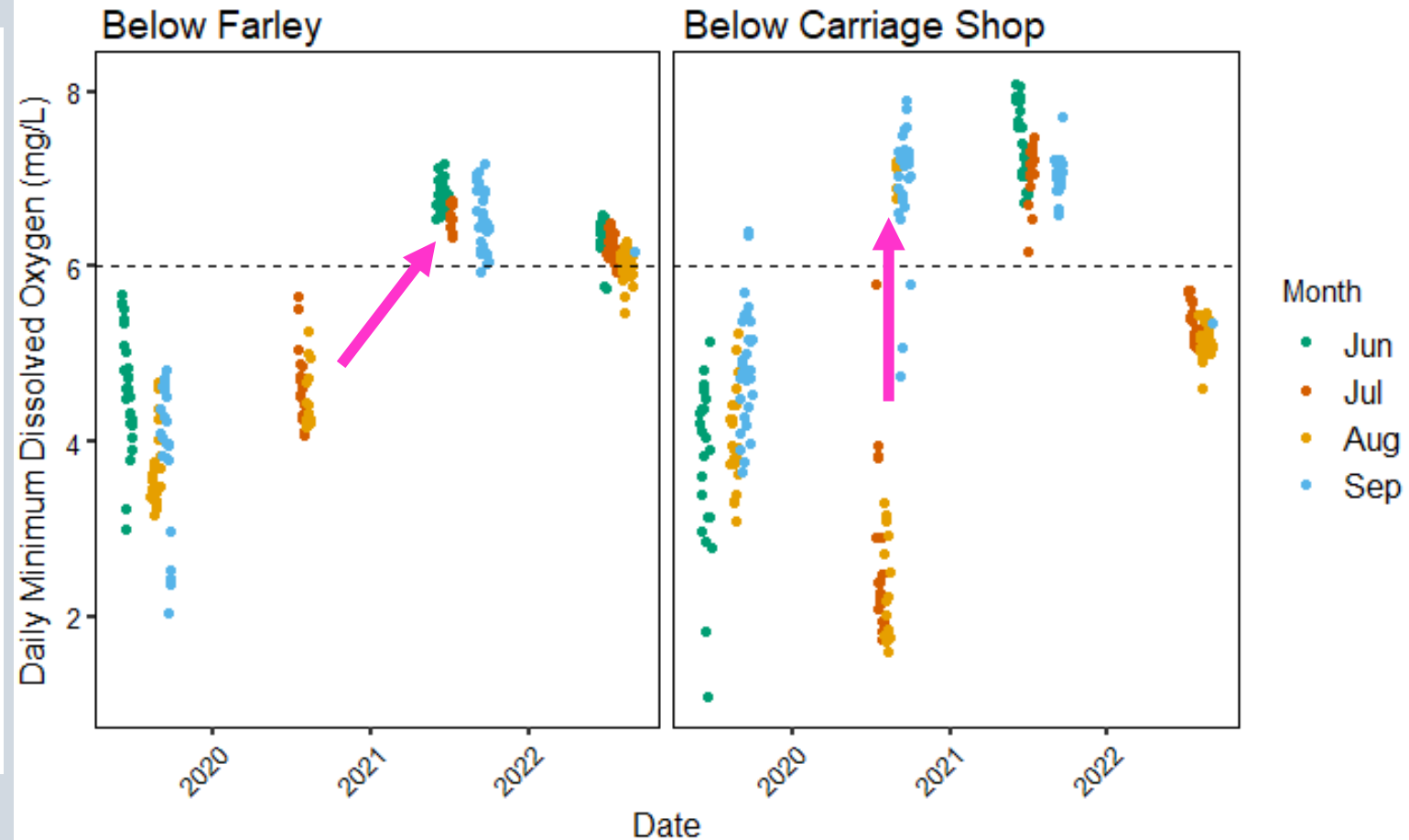
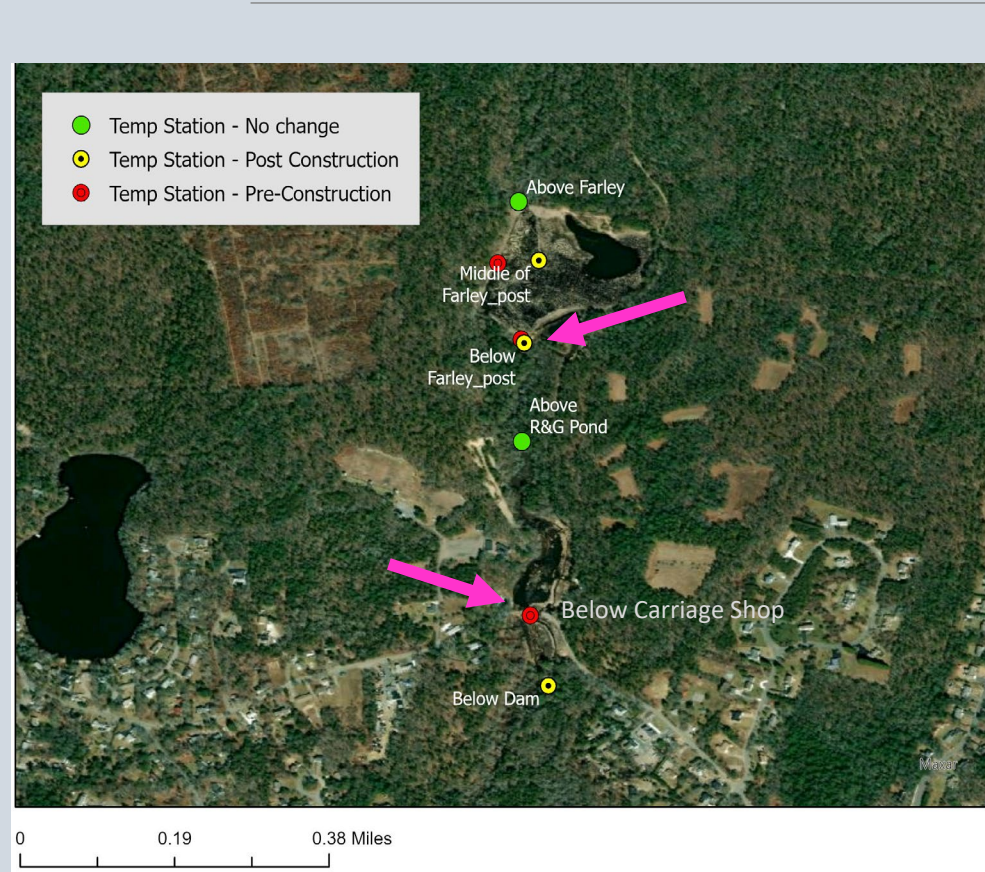
* Weekly sampling has continued at Riverways as part of Woodwell Cape Cod Rivers Observatory

** no sampling during spring 2020 due to COVID shutdown)



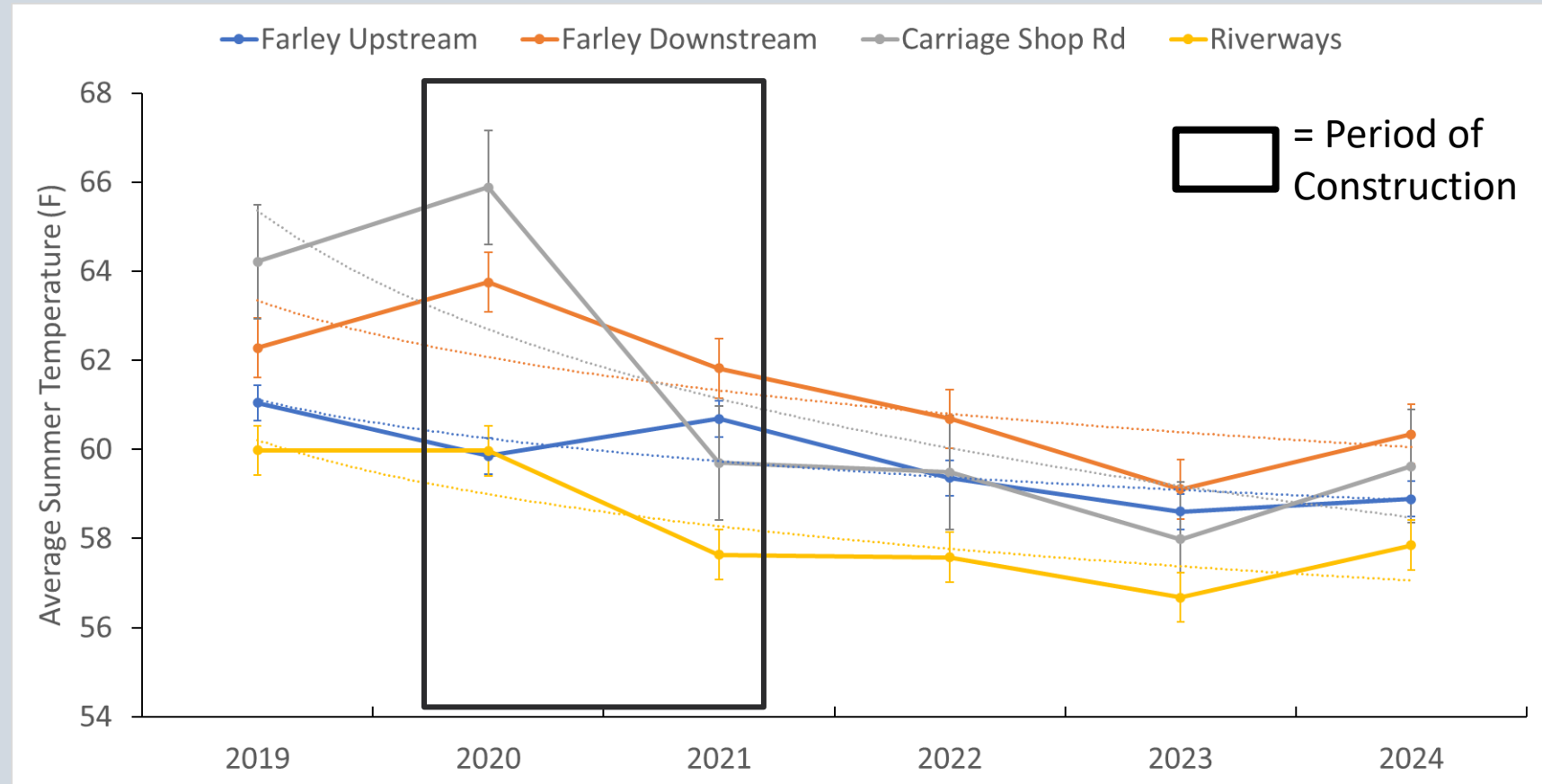
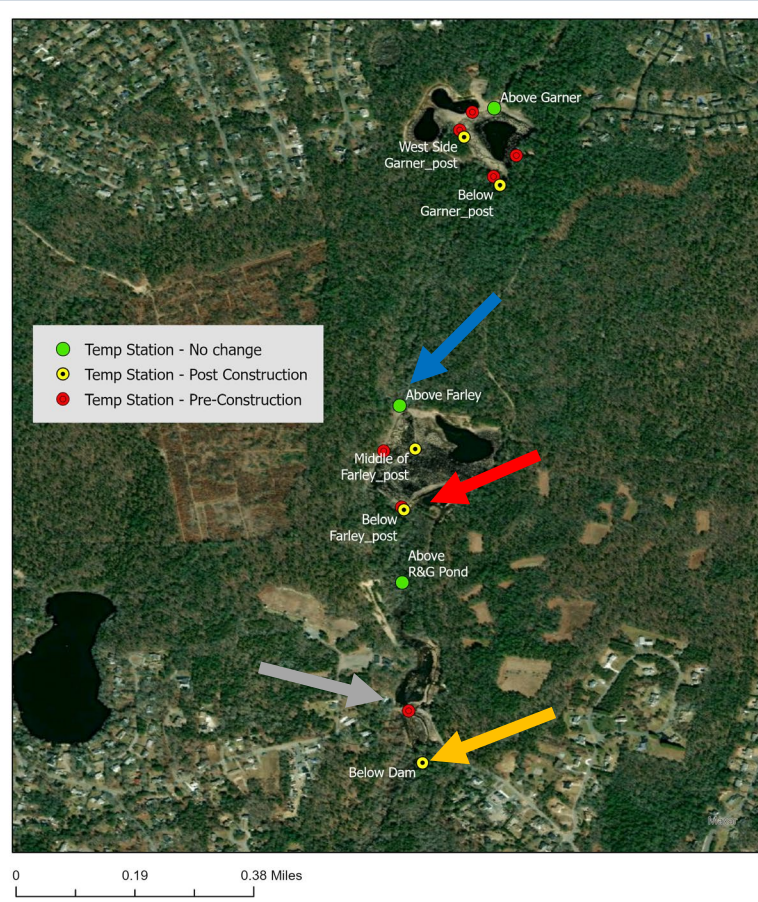
Dissolved Oxygen (continuous data)

- *Restored river flow provides immediate improvement to DO*



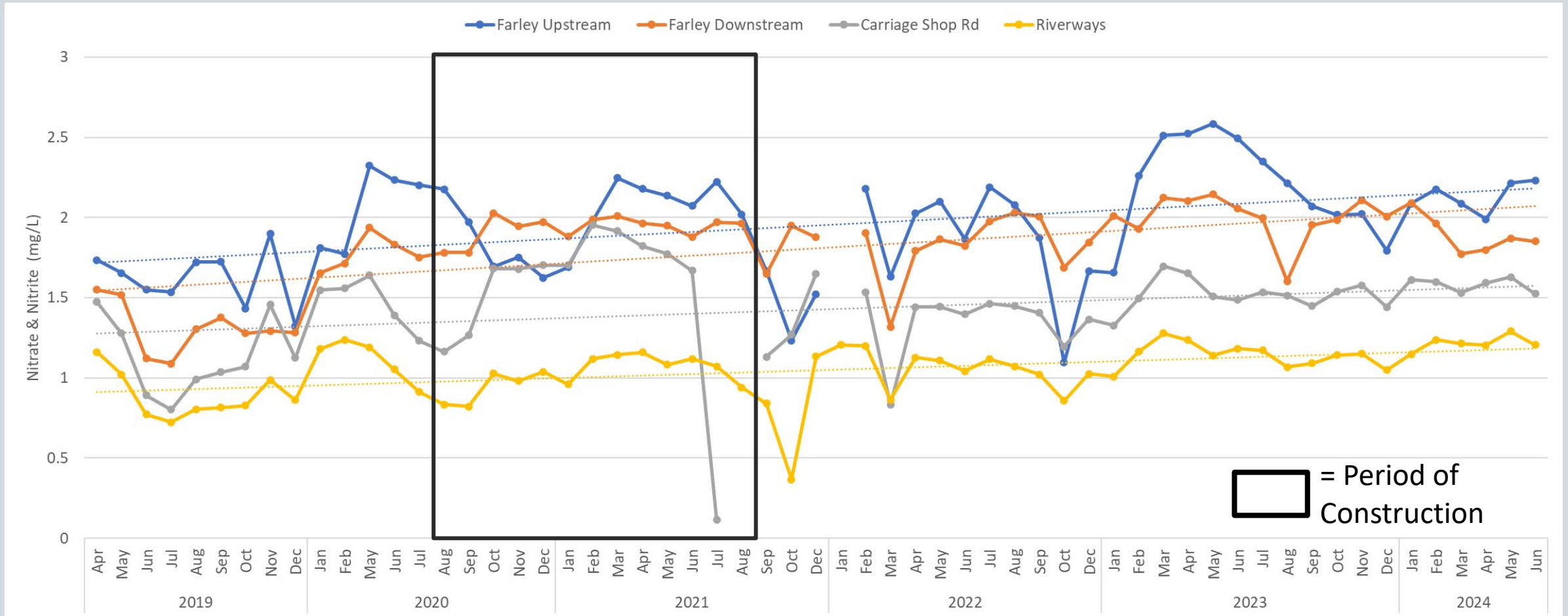
Temperature (discrete sampling)

- *Reintegration with groundwater decreases temperature*



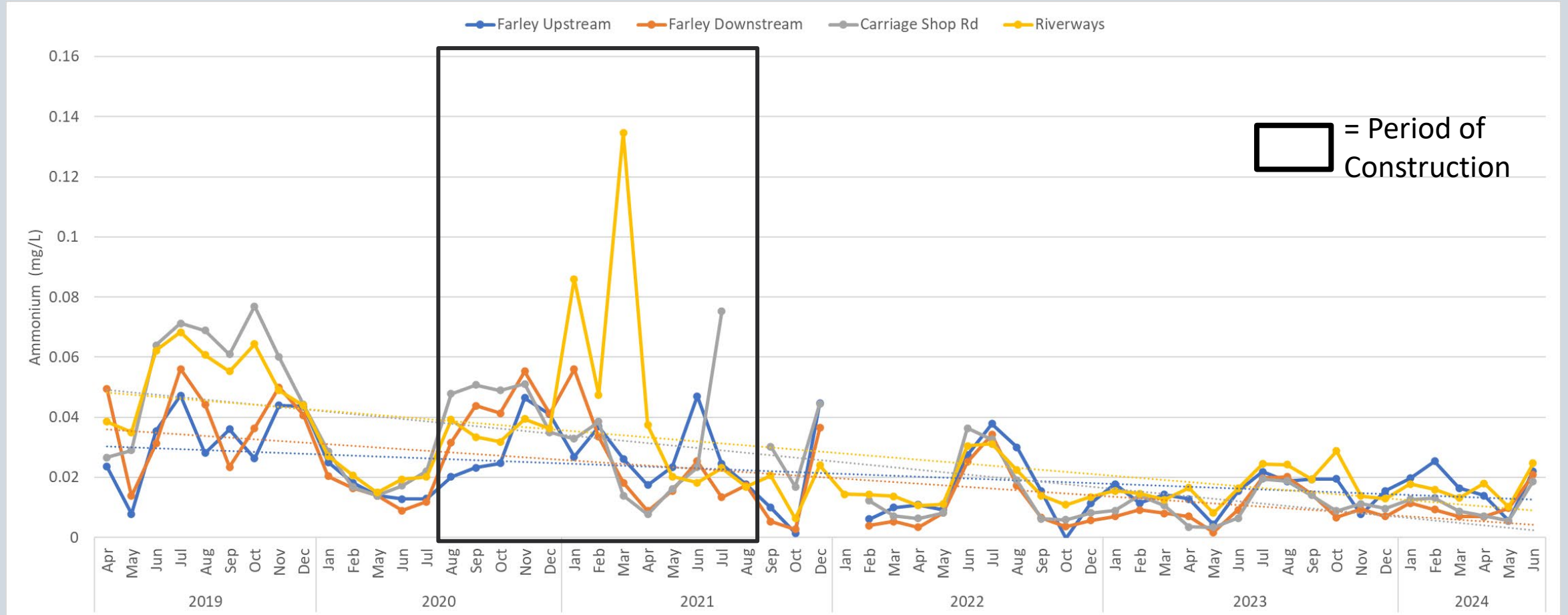
Nitrate & Nitrite (monthly averages)

- Increase may be related to increased rate of nitrification and/or reconnection to groundwater flow



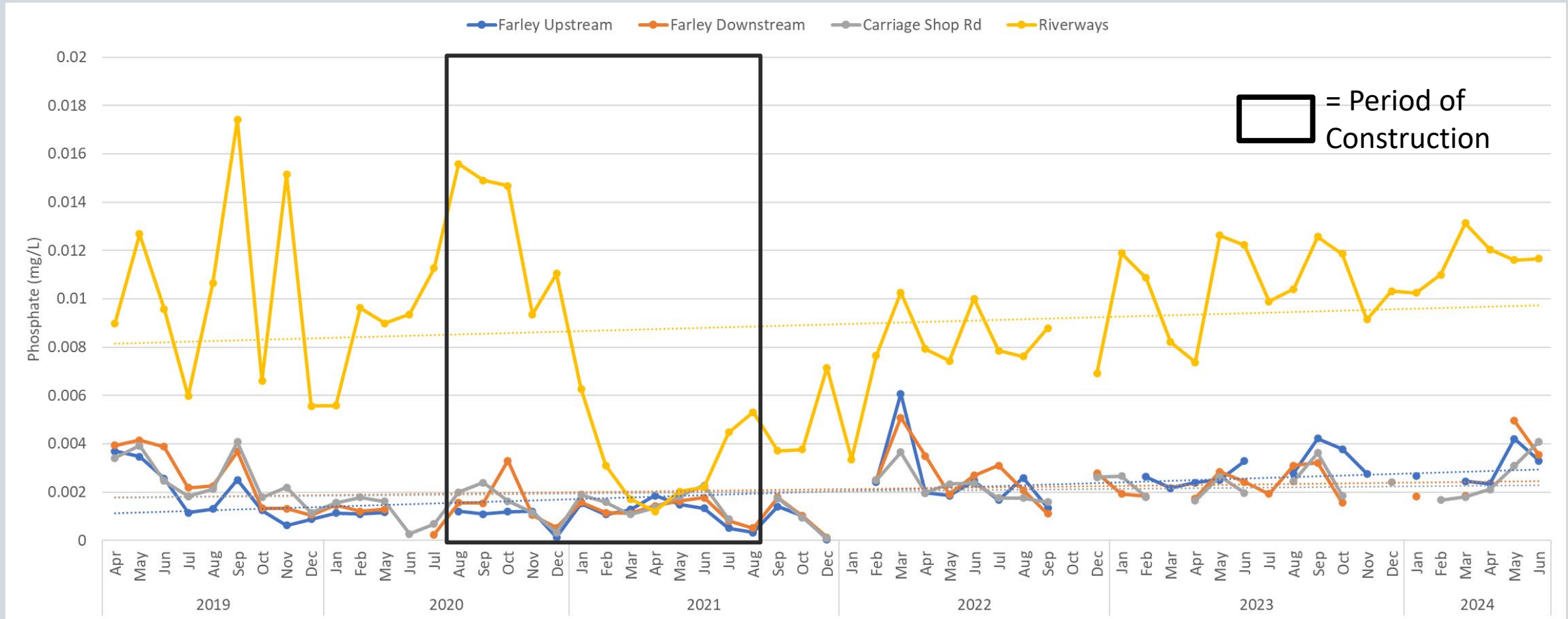
Ammonium (monthly averages)

- Spike is likely related to release of NH_4 from the sediments during construction;
- Overall decrease may be related to higher rate of nitrification



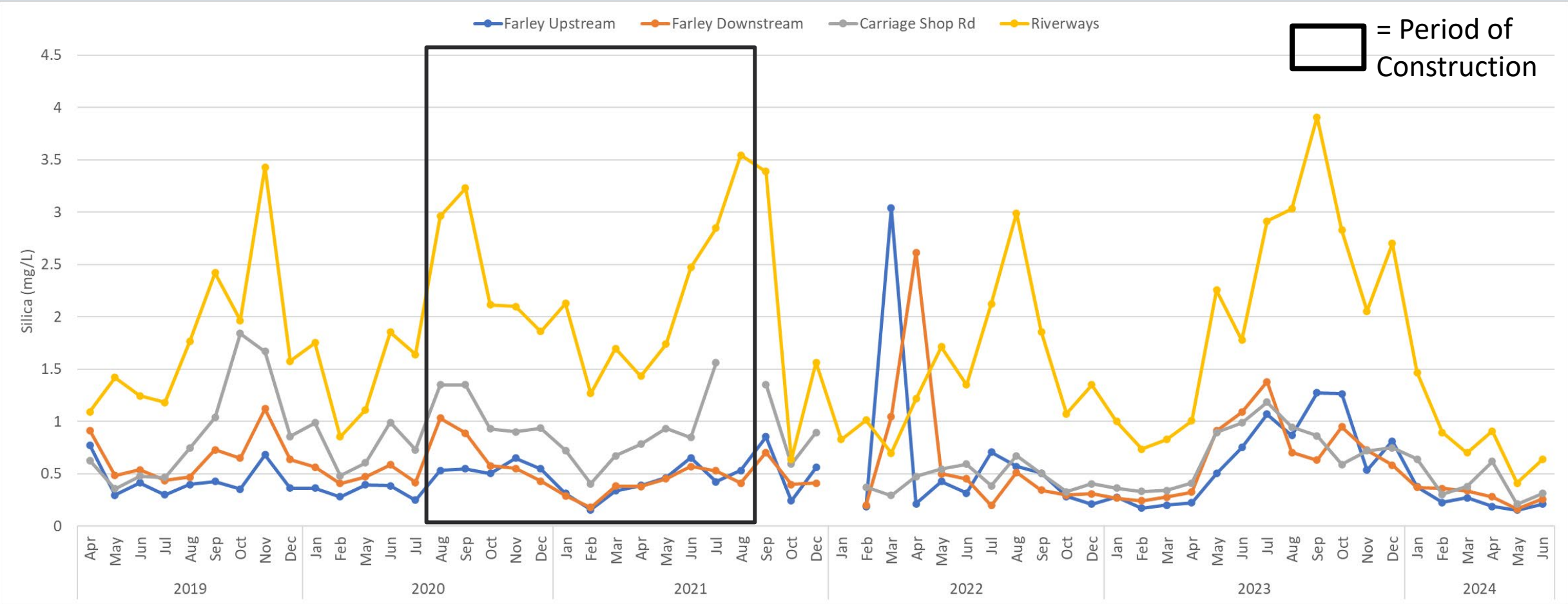
Orthophosphate (monthly averages)

- Drawdown during construction may be related to impeded groundwater flow
- Gradual increase could be related to groundwater recovery following 2022 drought



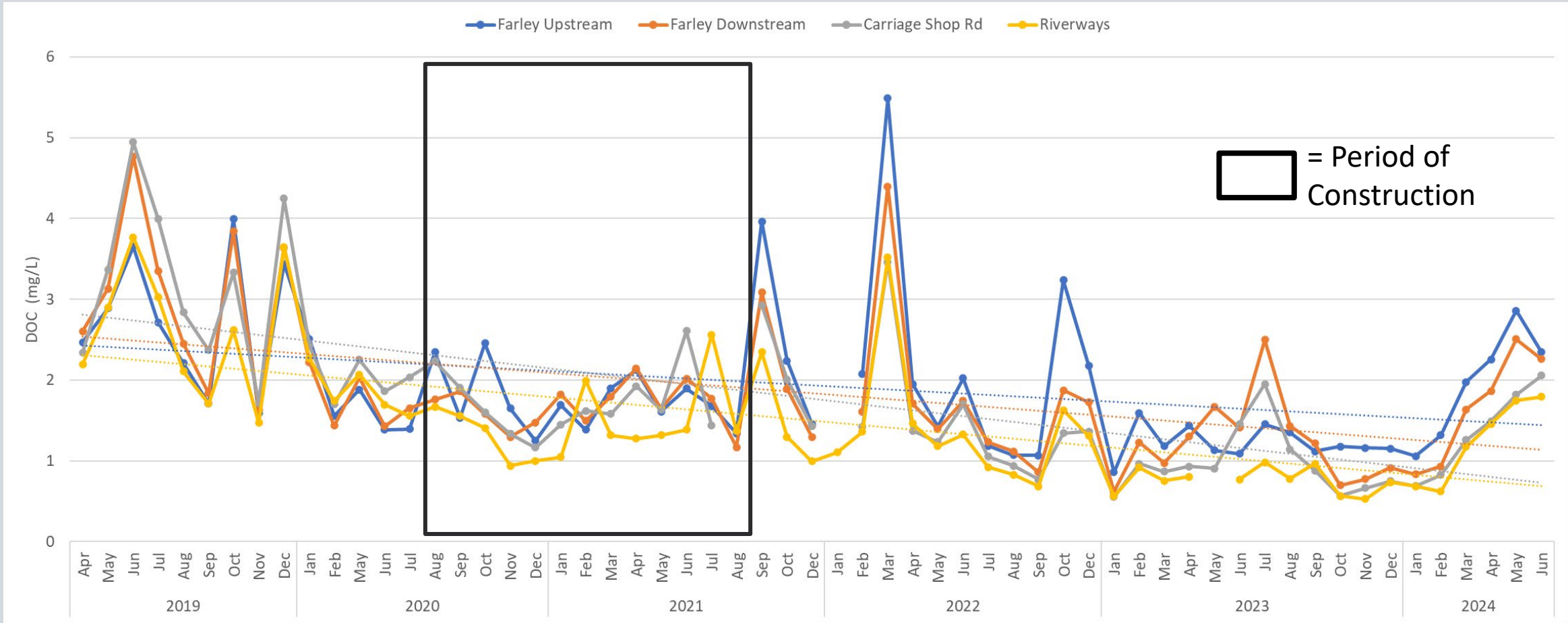
Silica (monthly averages)

- Removal of mill ponds reduced silicate levels at Carriage Shop Road



Dissolved Organic Carbon (monthly averages)

- Summer DOC relatively low 2020-2023 while vegetation cover reduced
- Flashy signals likely related to storms



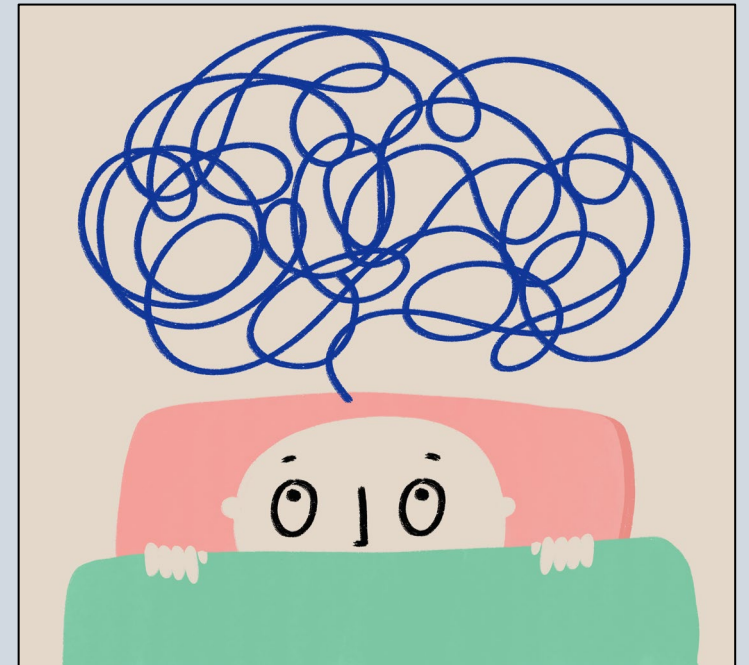
Data Caveats & Concerns

- Nutrients analysis changed from Woodwell Climate Research Center to Center for Coastal Studies in January 2023
- DOC: three lab changes (Woodwell → WHOI → UNH)
 - Glass vials required by WHOI lab were problematic – cracking/breaking during freeze/thaw
 - Woodwell and UNH lab both use brown HDPE bottles
- Variation in lag time to analysis: less than 30 days to more than 6 months
- Change in sonde: YSI ProDSS until March 2023, then In-Situ AquaTroll 500
- Station locations move after construction



Questions for consideration...

- Optimal timeframe/duration for monitoring? 1 year, 3 years, 5 years, longer?
 - Does this depend on the parameters and/or restoration objectives/goals?
- Which parameters are most important/informative?
 - Who is already running these data for bog restoration projects?
- Do we need standardized methods?
 - Containers (HDPE vs. Whirlpak vs. glass vials)
 - Pump vs. hand filtering
 - Filters (Geotech vs. Millipore)
 - Lab procedures
 - Storage time





Special thanks to water quality monitoring volunteers!

For more information:

- Check out our website:
<https://apcc.org/river-and-bog-restoration/>
- Design plan posters available

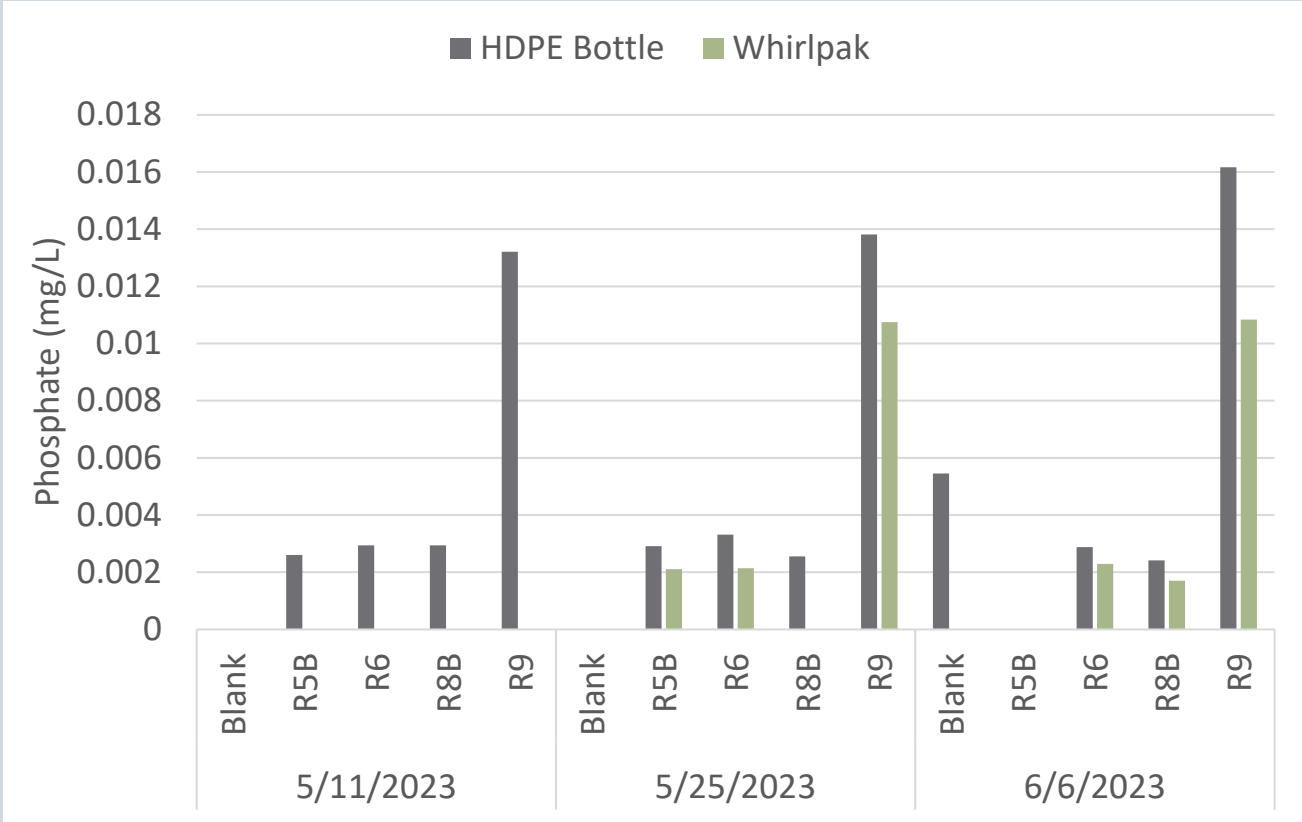
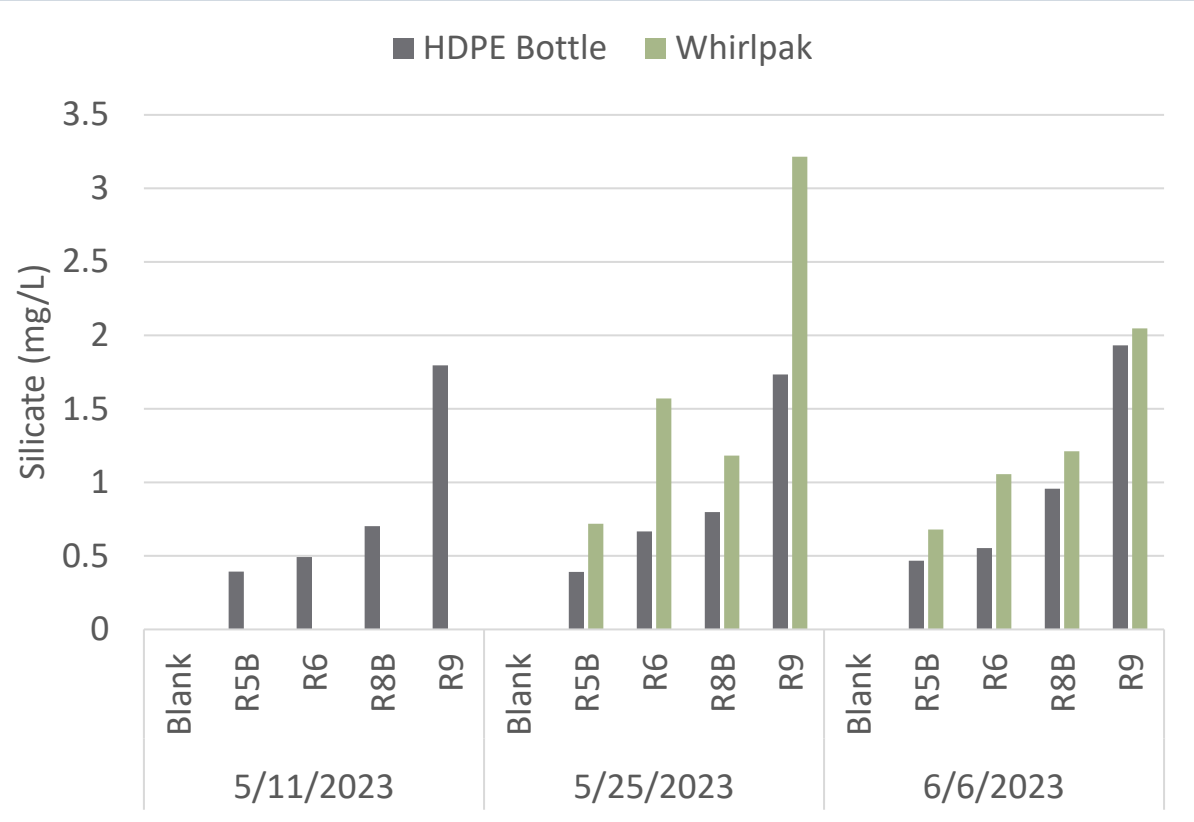
Contact us:

jmora@apcc.org or ryan.d.clark@mass.gov

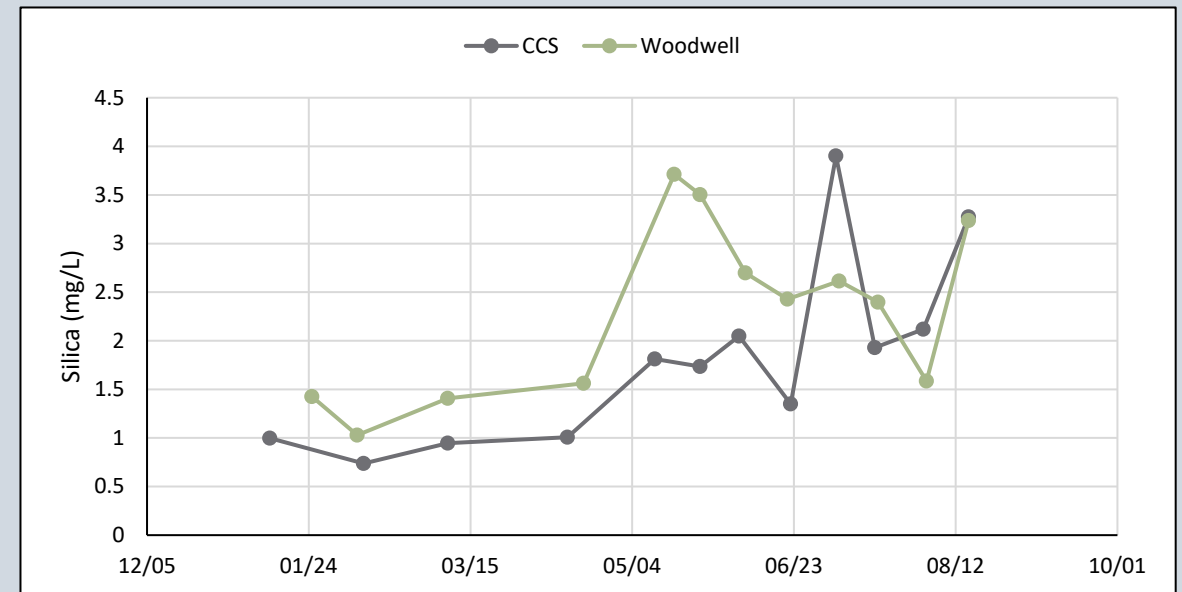
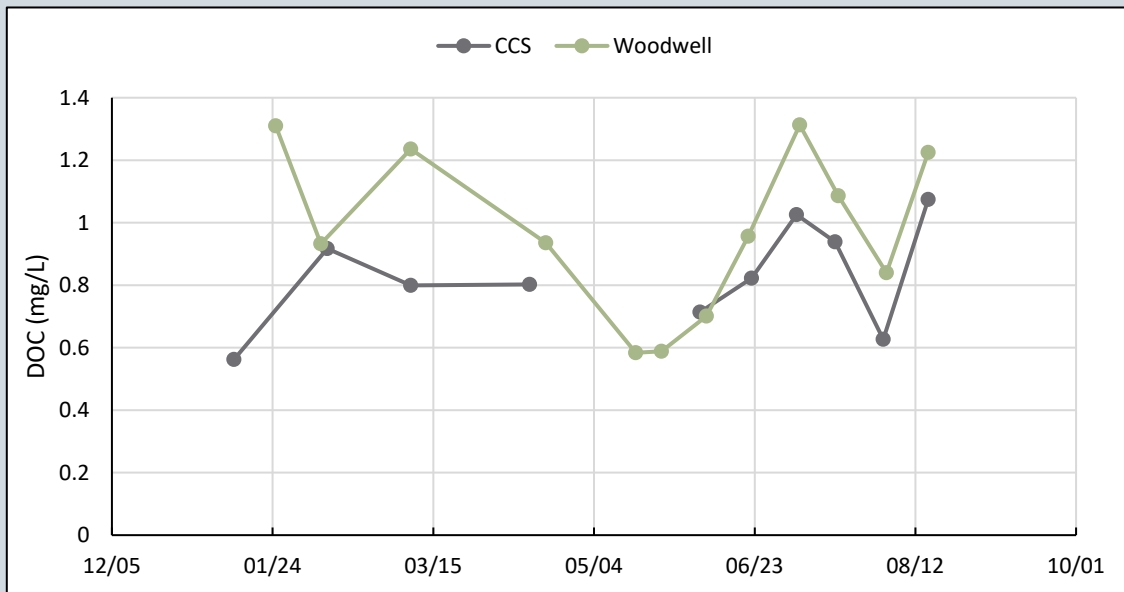
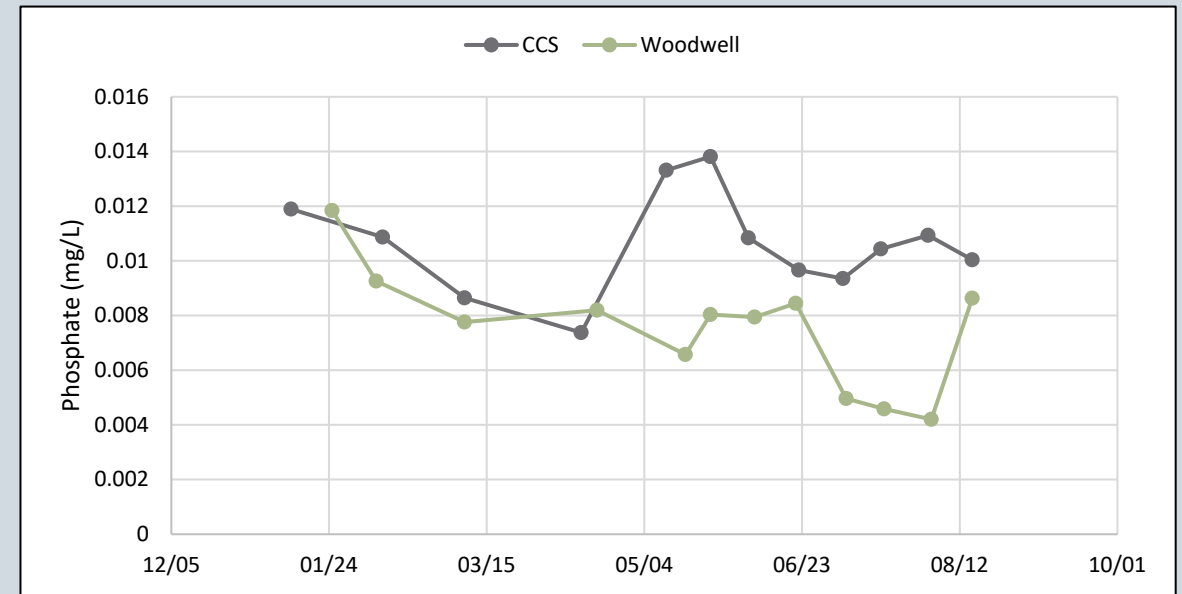
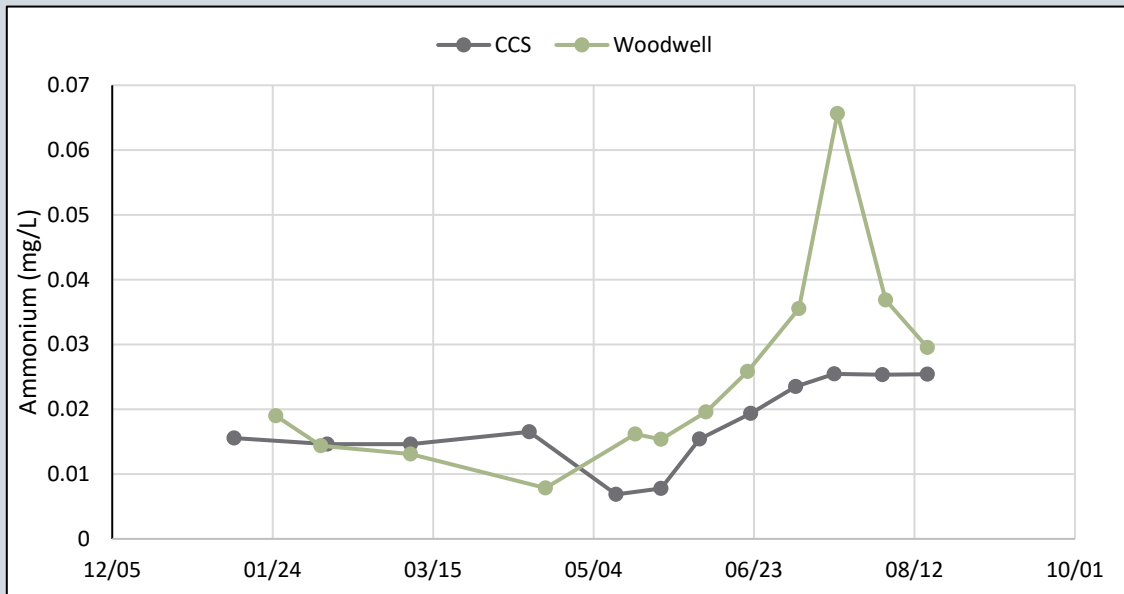
THANK YOU!



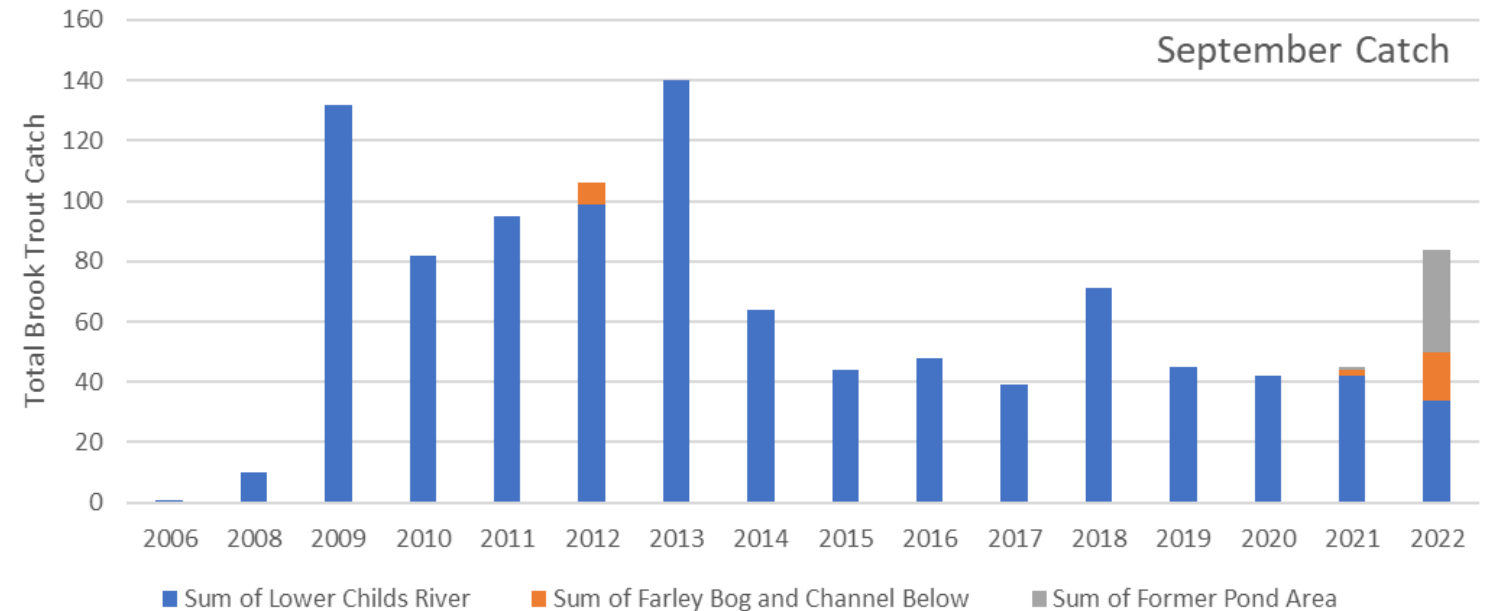
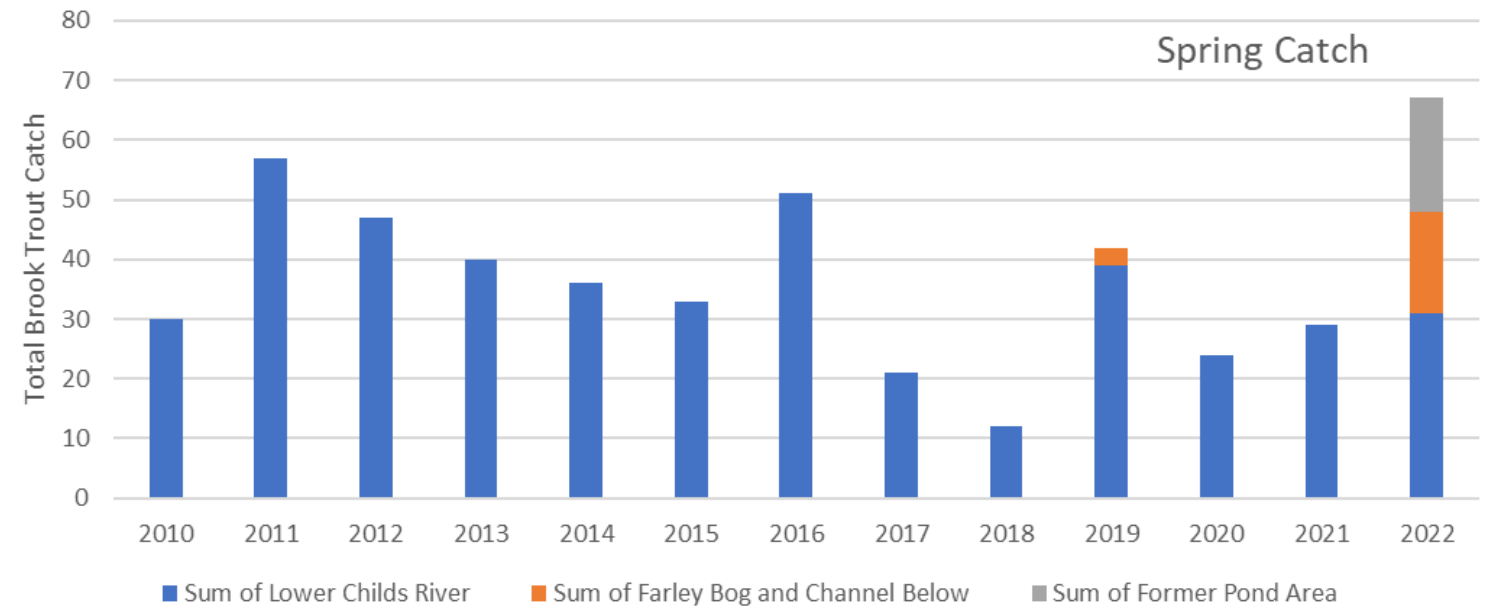
Difference in storage containers (run by CCS)



Difference in labs/filtering assemblies (Riverways/R9, 2023)



What about the Sea Run Brook Trout recovery?



What about the vegetation recovery?

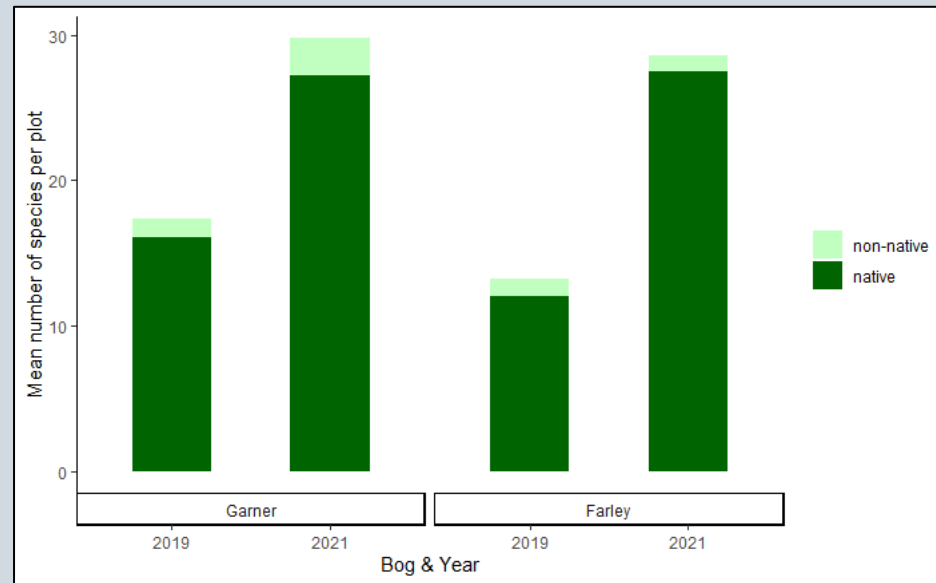
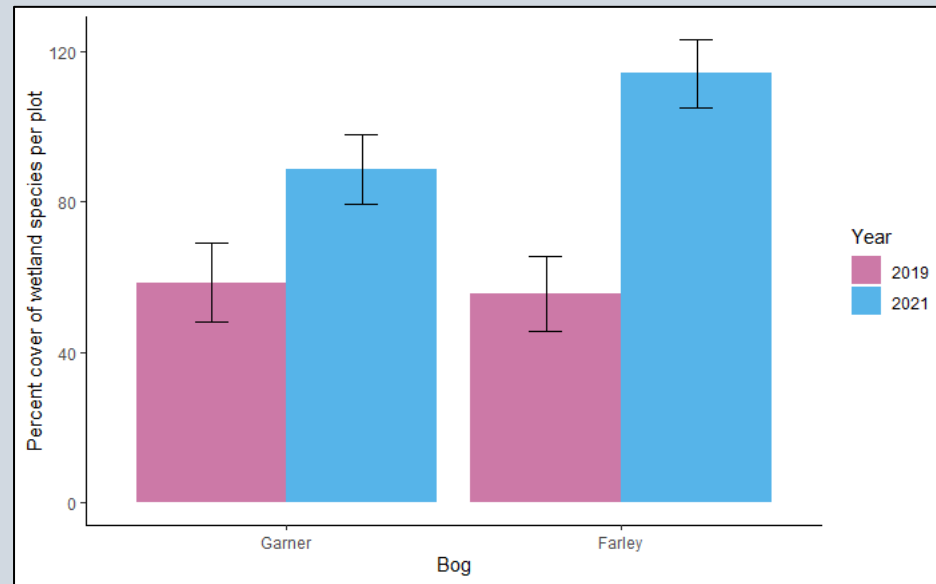
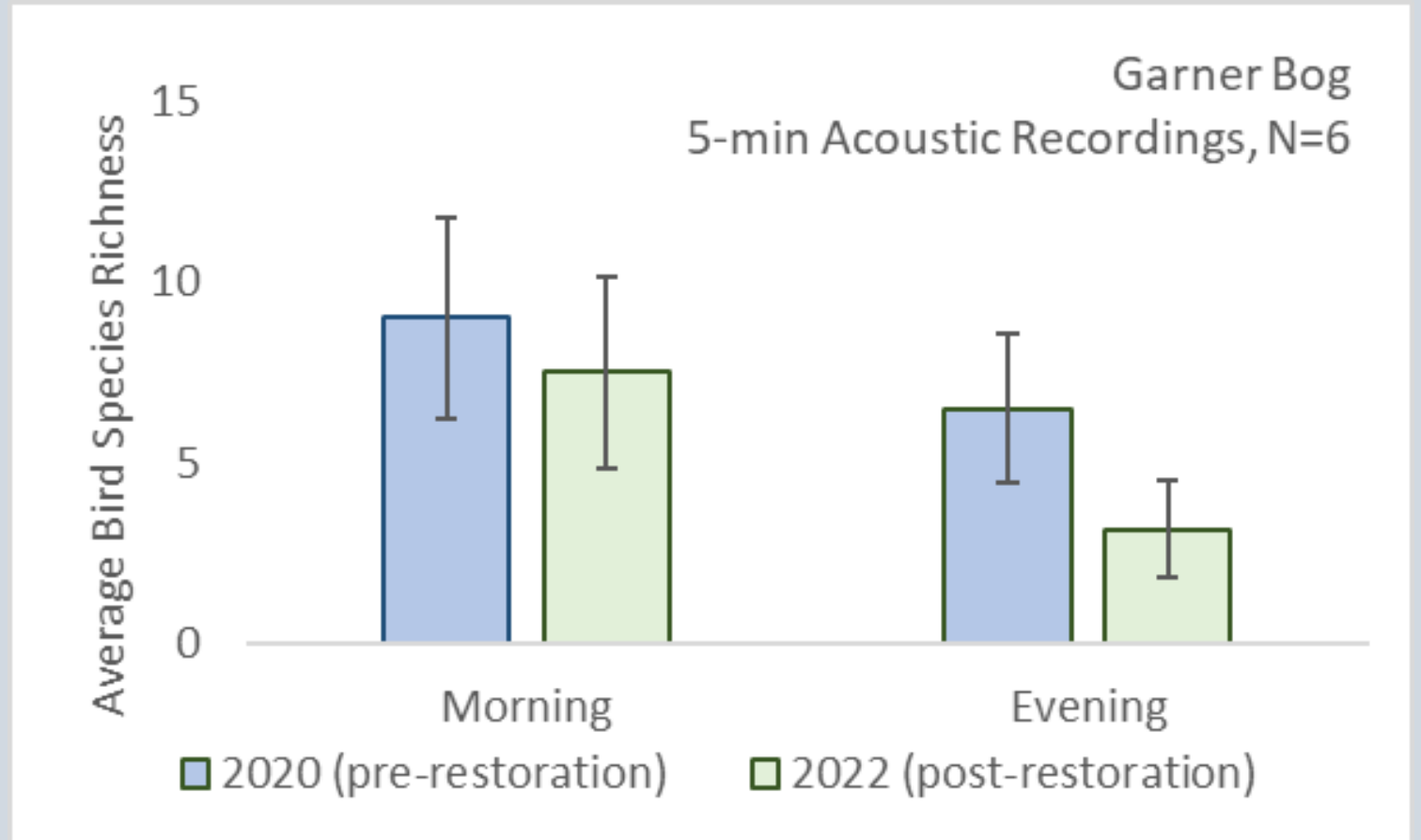


Photo credit: Chris Neill

*What about
the bird
species
recovery?*

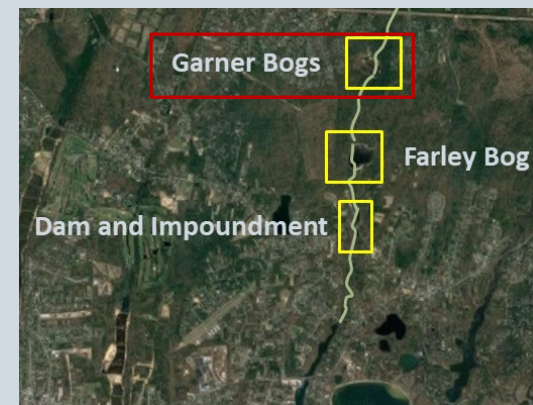
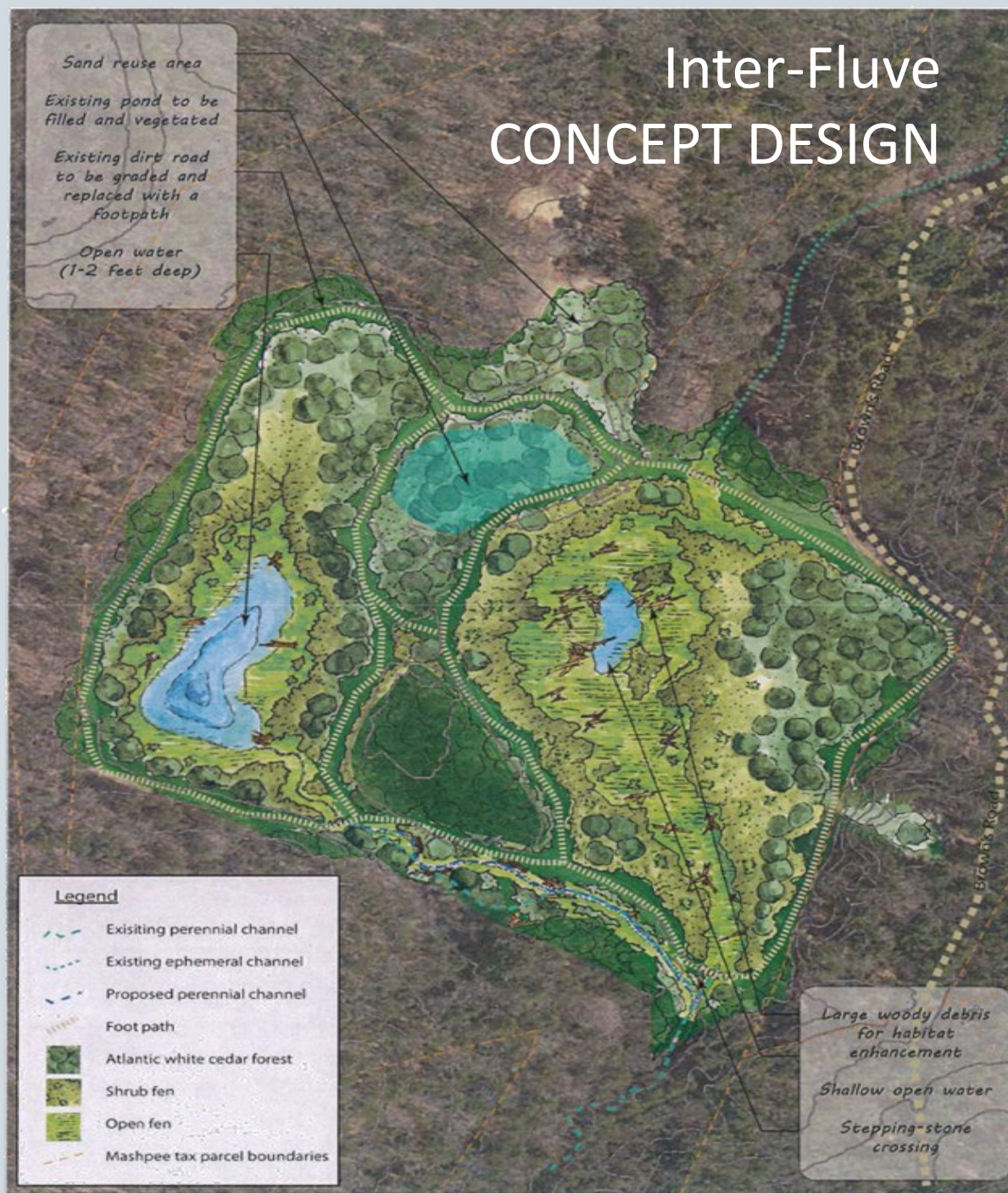


Garner Bogs

Before - 2018



Inter-Fluve CONCEPT DESIGN



After - 2021

