

The Sustainable Rivers Program: Cape Fear River, North Carolina



Combined efforts by The Nature Conservancy North Carolina chapter (TNC),
The Army Corps of Engineers Wilmington District (Corps),
and many partners

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Sustainable Rivers Program, North Carolina Rivers



- Advance (creating e-flow prescriptions) (6,170 river miles)
- Implement (testing e-flows) (940 river miles)
- Incorporate (formalizing Corps' operations) (1,255 river miles)
- Newly proposed (+3,807 river miles; +24 sites)

- The goal of the Sustainable Rivers Program (SRP) is to identify, refine, and implement environmental strategies at Corps water infrastructure.
- The Cape Fear was added in 2016
- The Cape Fear and Roanoke are “Learning Watersheds” for the country.

The Cape Fear used an established SRP process

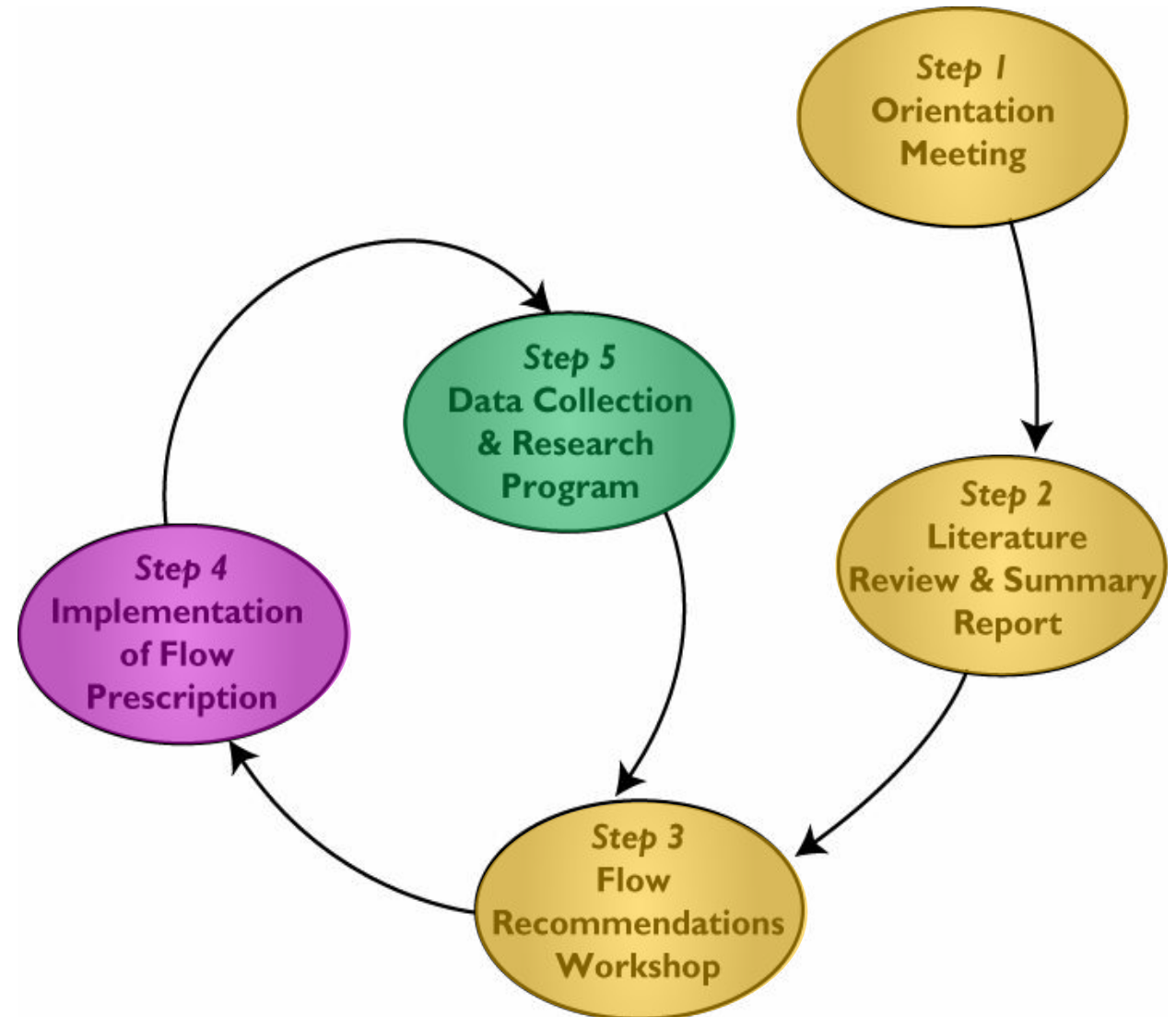
Launch meeting in 2017 to identify threats and opportunities in the basin.

Lit review complete in 2019 to investigate hydrology and ecology, especially for floodplains, water quality and rare fish.

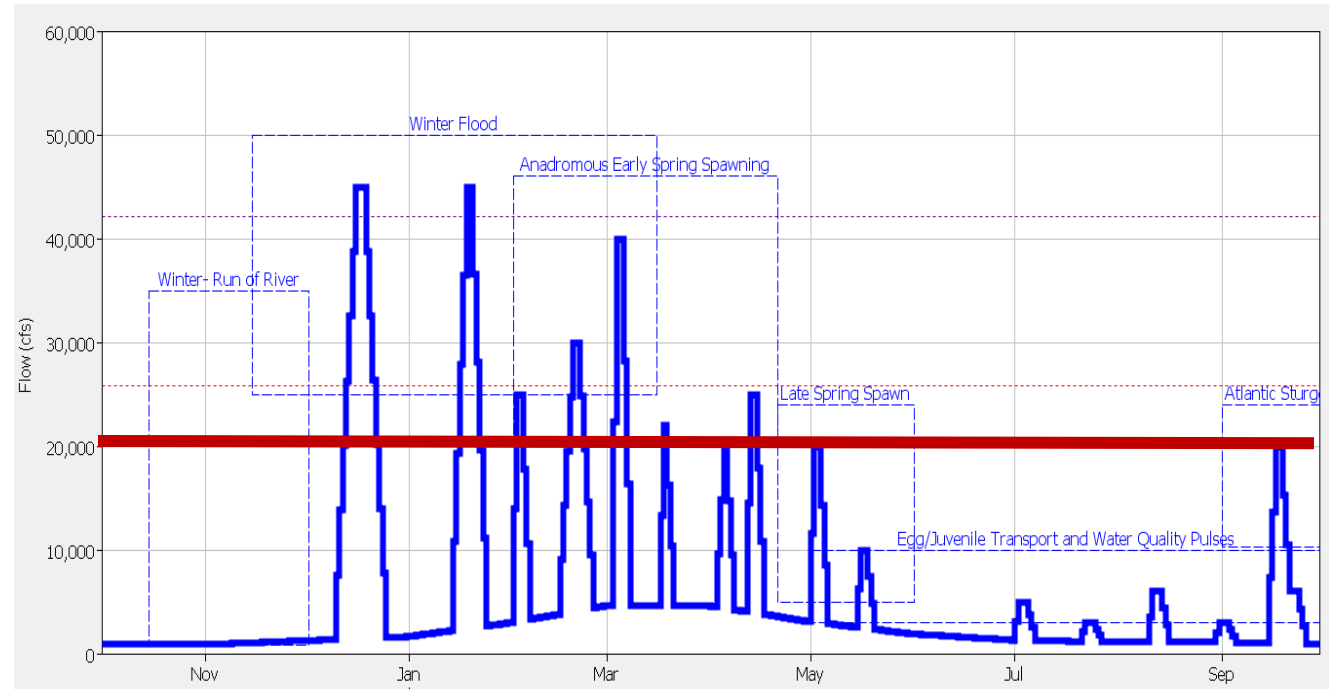
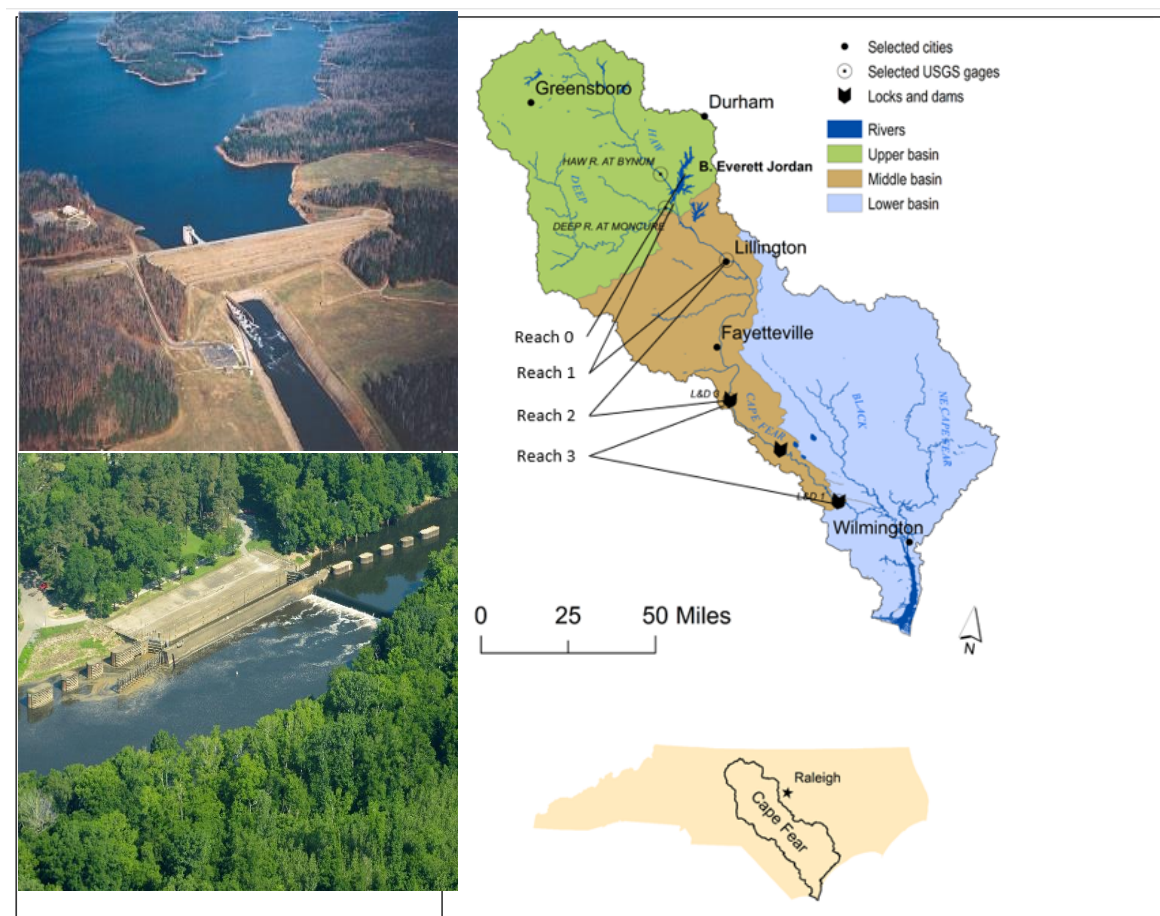
Technical e-flows workshop in 2019 with 45 experts to create flow prescriptions.

Began implementing and studying test pulses in 2020.

Long term goal: Formalize effective e-flows into the Corps' normal operating procedures



Cape Fear E-flow Prescription



From the prescription, the Corps determined they can conduct pulses out of the reservoir to assist diadromous fish and to reduce the potential for algal blooms within their operational constraints.

Fish: March to June

Goal: Send pulses to submerge the locks and dams when the fish are trying to get upstream to spawn (March-early June)

- Wet weather in the upper basin allows us to “surf the Deep” to send big pulses downstream
 - Median flows range from 3500-5000 cfs at LD3 during the spawn season.
 - We aim for flows of over 17,000 cfs to submerge the dams.
- Acoustic telemetry, eDNA, and traditional electrofishing are used to study shad, striped bass, sturgeon, and flathead catfish

Collaborators: Corps, TNC, NC WRC, NC DMF, UNC-W, Clemson

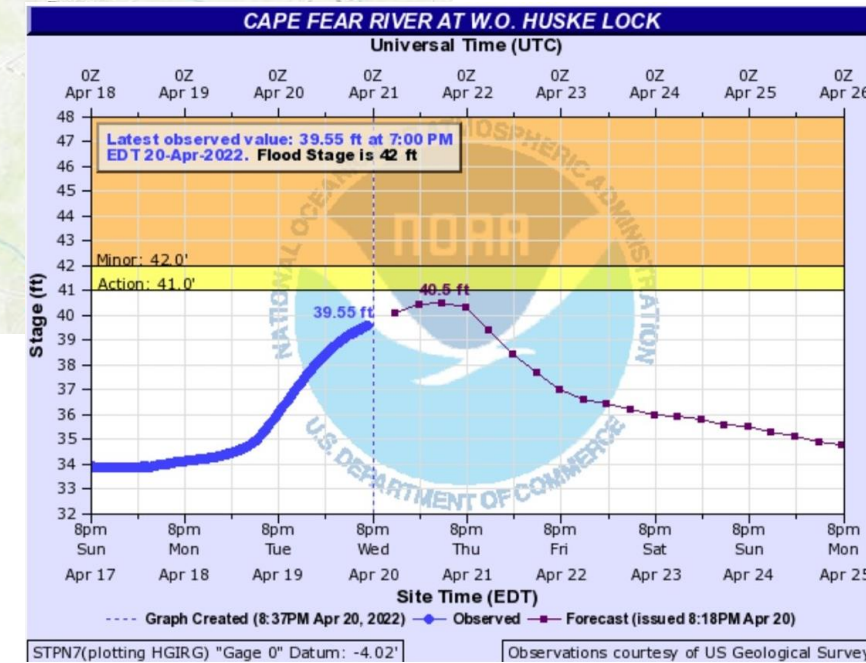
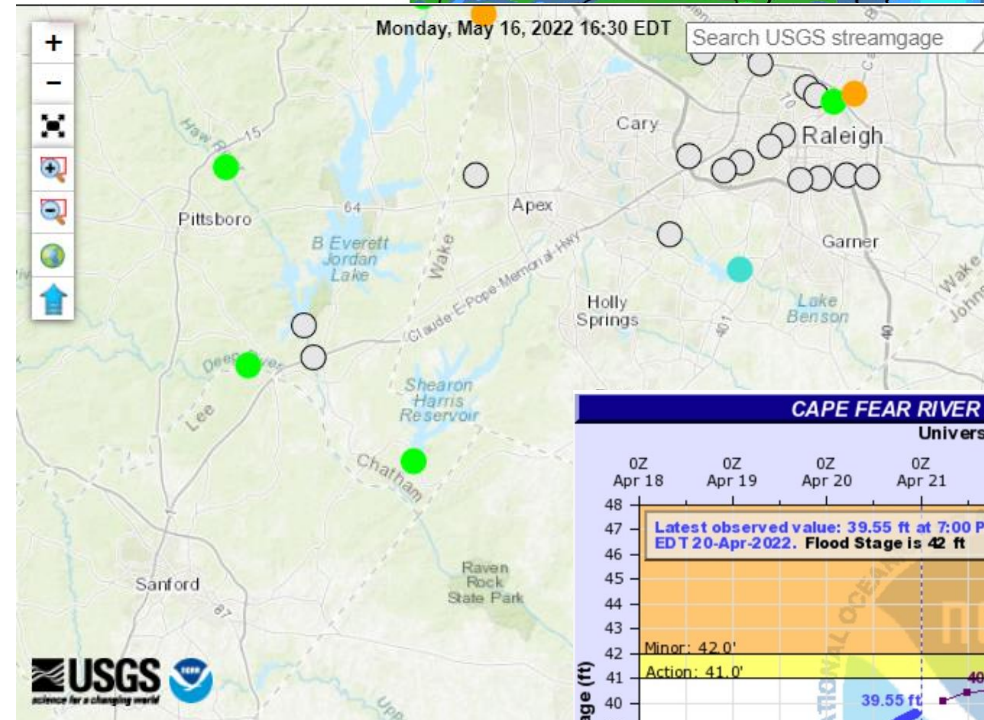
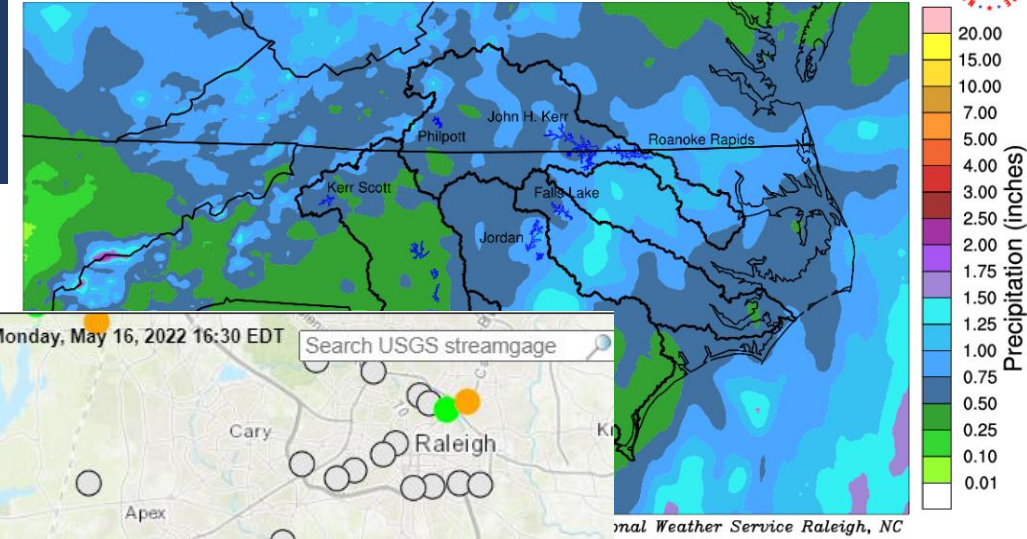


Lock # 3 - View over lock chamber towards dam and main channel

How does a fish pulse happen?

- A week out, watch the upcoming weather forecast for rain
- 3 days out, analyze river flows, model options, begin to communicate with researchers and basin users.
- 1 day out, prep dam operators with the gates to open and close. Tell basin stakeholders.
- During the pulse, get on-the ground info from researchers/ Corps lockmasters and take pictures.

Weather Prediction Center 7-Day Precipitation
Issued: Fri 05/13/22 8 AM ET Valid: 8 AM 05/13/22 - 8 AM 05/20/22 ET



2023 fish flows

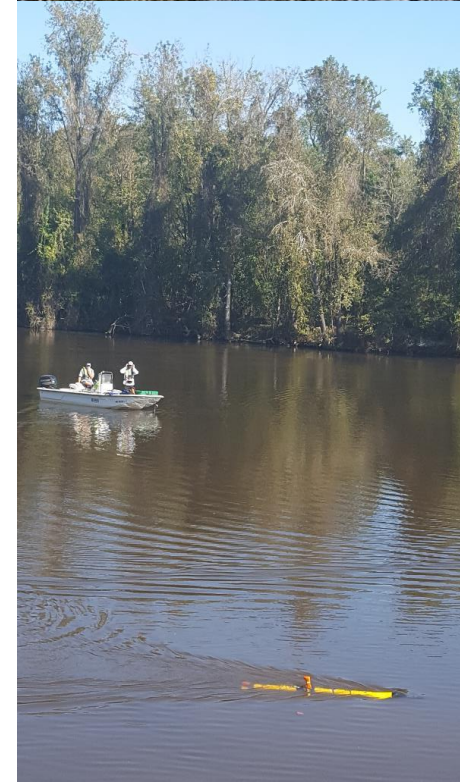
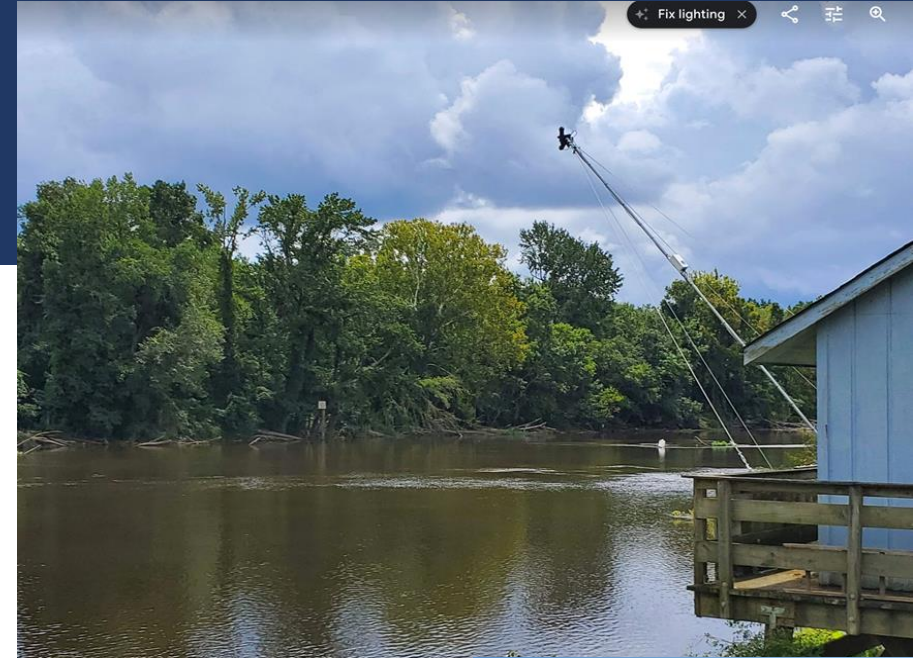
- The basin was very dry at the start of the season- the team focused on flows to get fish over LD1 and LD2.
- Big rain happened April 7-22. The Corps was in flood control operations. The LDs were submerged.
- The team did a big pulse on April 30- May 6, but we were constrained by LD3 construction. LD1 and LD2 were submerged. LD3 was briefly submerged.
- The afternoon panel will share fisheries results.



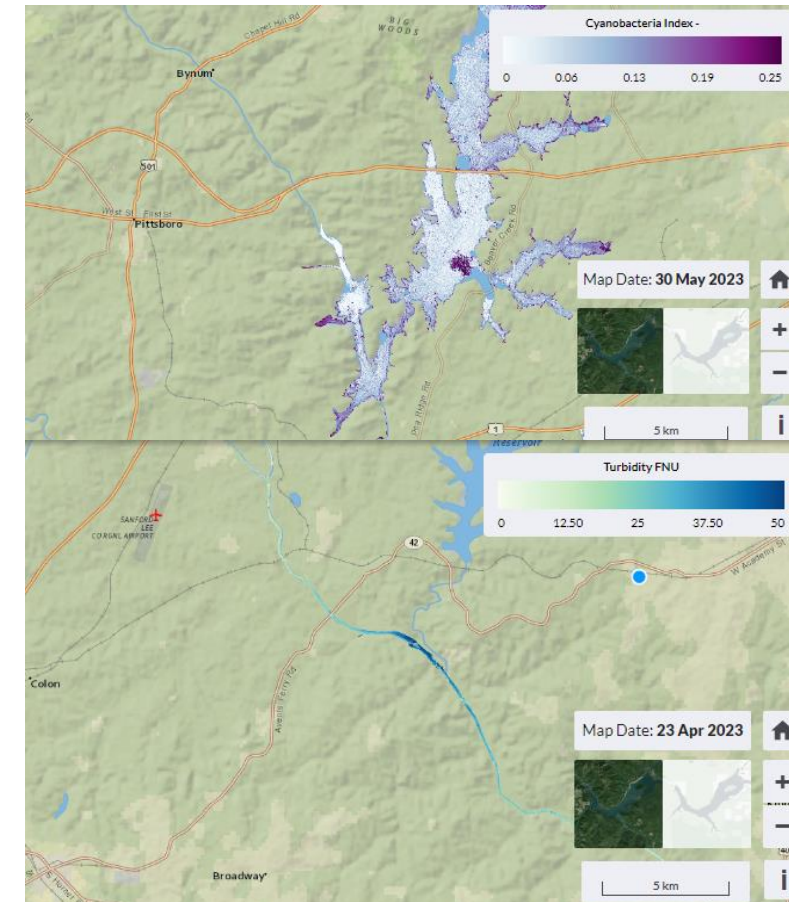
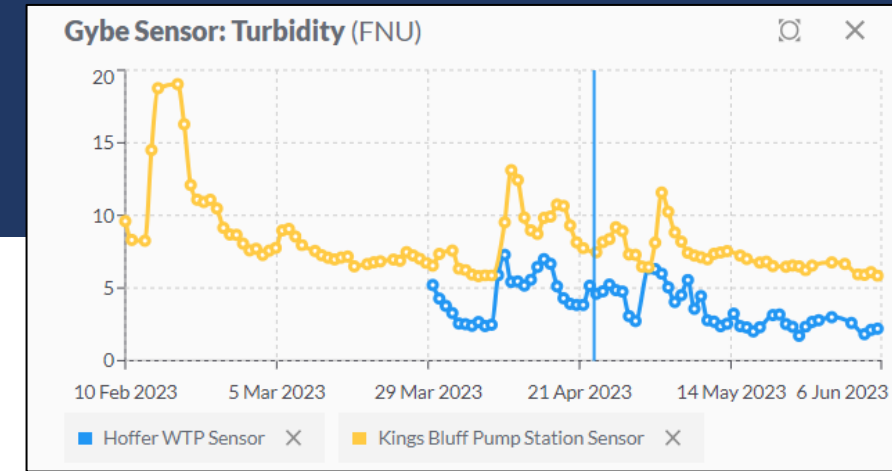
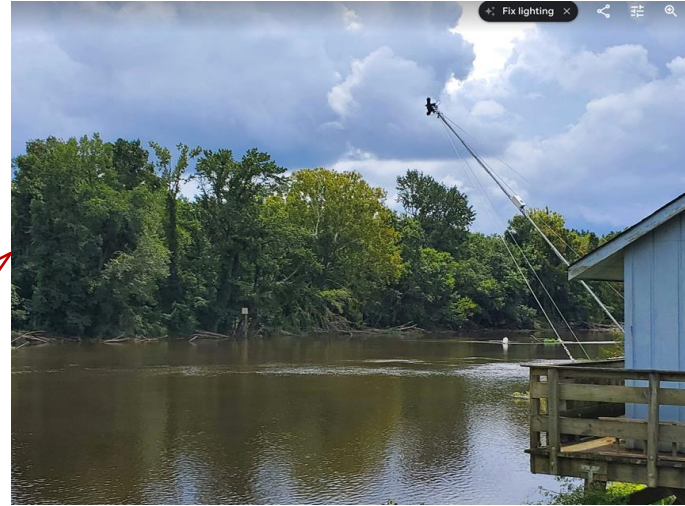
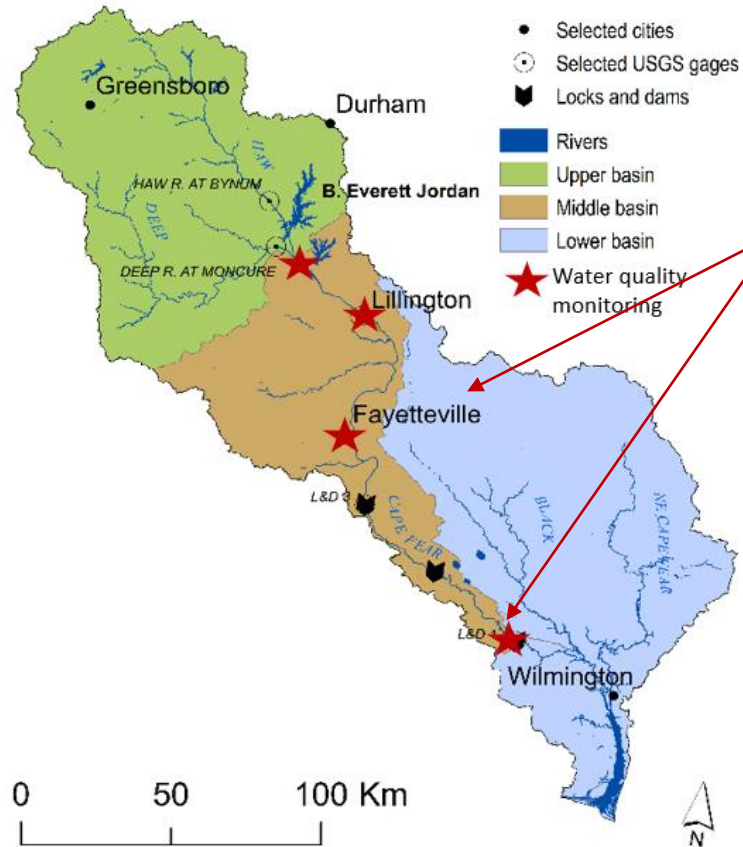
Water Quality: June to Sept

Goal: Send pulses to mix the water column in warm, low flow months to reduce the potential for harmful algal blooms.

- Blooms documented at low flows (<1800 cfs, especially below 1000 cfs at LD1) when temperatures are warm
- With rain, we aim for long, smooth Jordan releases that keep flows above ~2000 cfs for as long as possible.
- Without rain, we consider releases if blooms are reported.
 - Release 1500-3000 cfs for ~36 hours (with ramp up and down) to mix the water column. Weigh the benefit with drought risk.



Water Quality: Monitoring, Gybe

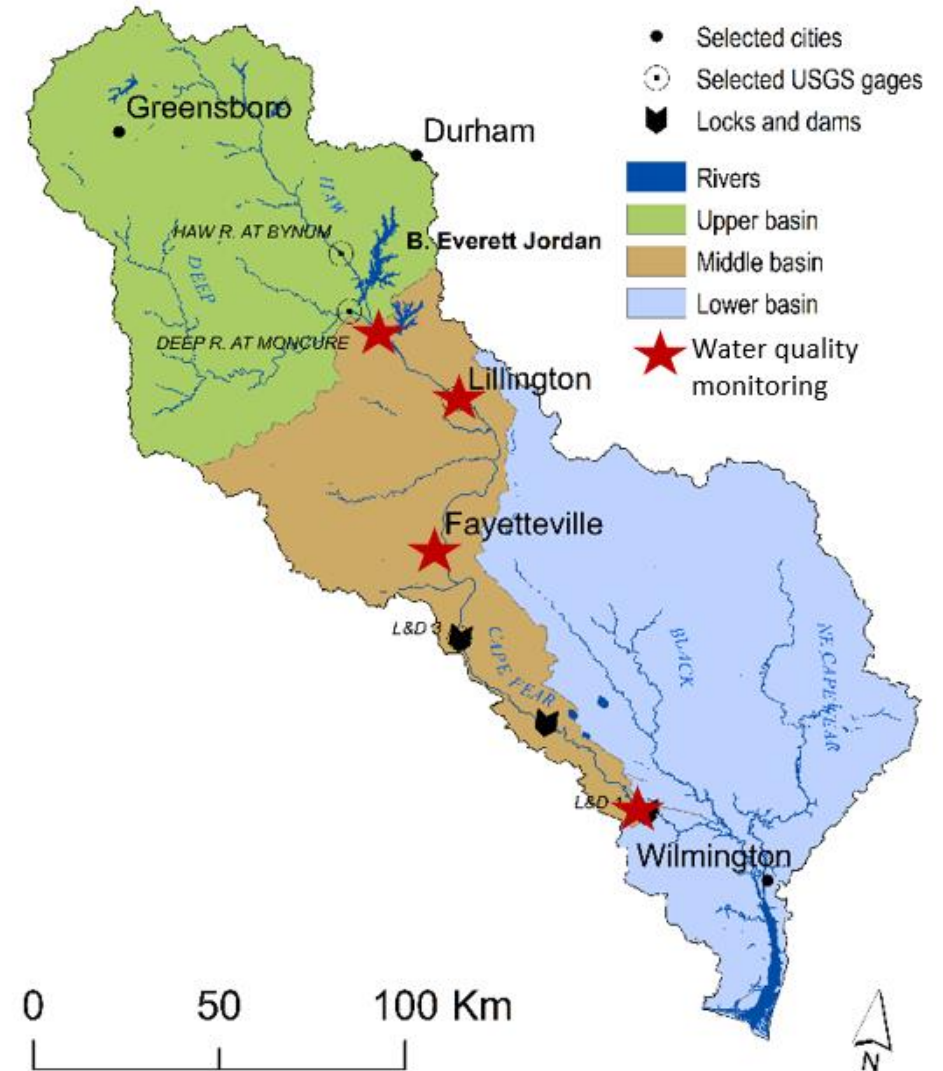


*From Jordan and the confluence to the mouth of the ocean,
Gybe captures: turbidity, suspended matter, cyanobacteria
index, chlorophyll *a*, CDOM*

Water Quality: Monitoring continued

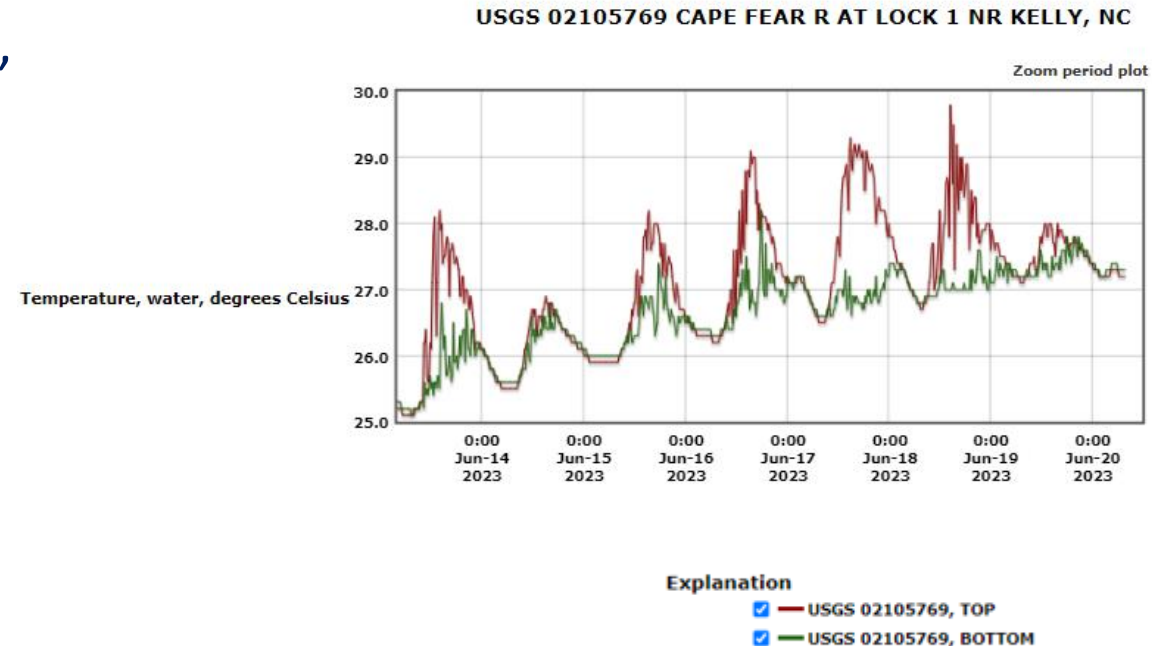
- Gybe satellite images capture Jordan Lake, the Deep and the confluence
- Dr. Nathan Hall (UNC-Ch) deploys temperature sondes throughout the water column upstream of Buckhorn at the 42 bridge
- Lillington has a [real-time sonde](#) on the USGS gage
- NEW! Fayetteville Hoffer plant has a local Gybe sensor measuring real-time water quality
(THANK YOU, MCFRBA!)

Collaborators: Corps, TNC, USGS, UNC-Ch, Gybe technologies, Brunswick Drinking Water Utility, Fayetteville Public Works Commission, more



Water Quality: Monitoring continued

- Brunswick Kings Bluff station has a local Gybe sensor measuring real-time water quality
- NEW! LD1 has two real-time sondes on the USGS gage, one at the surface and one at 13.5 feet depth
- Dr. Nathan Hall (UNC-Ch) deploys temperature sondes throughout the water column at LD1.
- The USGS runs the autonomous underwater vehicle near the confluence and LD1.



Collaborators: Corps, TNC, USGS, UNC-Ch, Gybe technologies, Brunswick Drinking Water Utility, Fayetteville Public Works Commission, more

How does a water quality pulse happen?

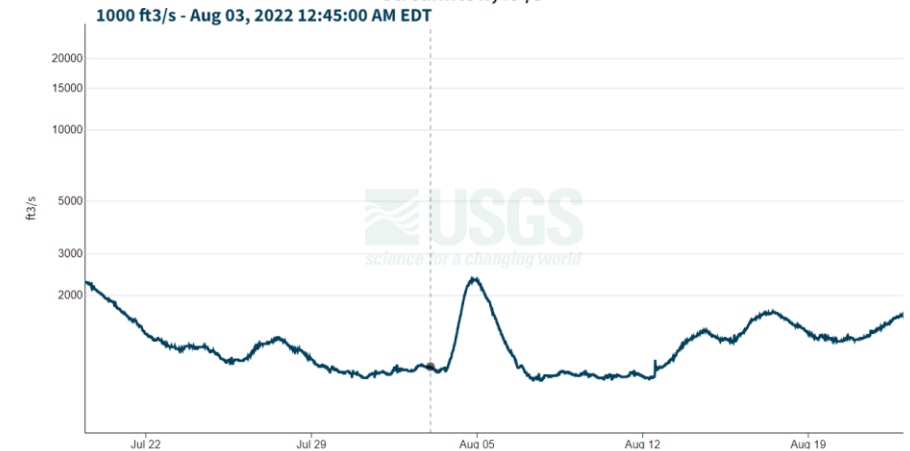


- Every Monday- the Corps and TNC check-in on basin conditions and forecasted rain. We are on alert when flows go below 1800 cfs at LD1.
- *** If anyone sends us a message that they see algal scum, we assess immediate options. ****
- Two tracks:
 1. If we see any forecasted rain, we model Jordan release options and begin to communicate with researchers and basin users (YOU!).
 2. If there is no forecasted rain, we run the Corps models to determine if a small, short-term pulse puts the basin at odds with drought contingency measures.
- IF Jordan is below guide curve, any releases require a deviation with DEQ approval.

Cape Fear R at Lock #1 NR Kelly, NC - 02105769

July 19, 2022 - August 23, 2022

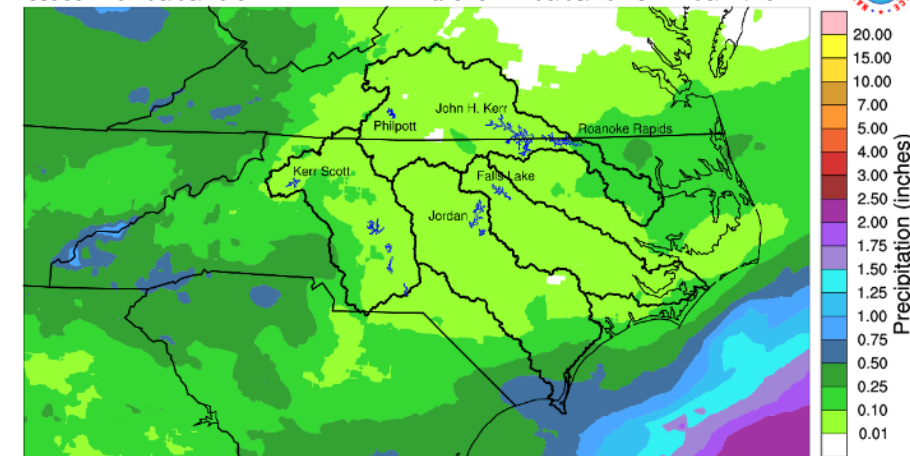
Streamflow, ft³/s ⓘ



Weather Prediction Center 7-Day Precipitation

Issued: Mon 06/05/23 8 AM ET

Valid: 8 AM 06/05/23 - 8 AM 06/12/23 ET



National Weather Service Raleigh, NC

A short, no-rain release out of Jordan worked for mixing LD1

- We released 3,000 cfs for 24 hours, plus ramp up and down
- Graph provided by Dr. Nathan Hall, UNC-Ch, showing thermal stratification at LD1
- Turbidity raised to 20 FNUs near Lillington- this was a lesson.
- The water appeared 2x as fast at LD1 as we expected- we think we created a small energy wave.
- Later in the summer, when algal scum was reported, it was tough to do a pulse. We are studying “risk” profiles this year.

Figure removed ahead of researcher publishing it- it showed the water temperature was mixed with the pulse!

Please join us to make this effort even better

- Add your contact info to the pulse notification list
- Let us know what you see on the river and give us feedback.

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THANK YOU!

