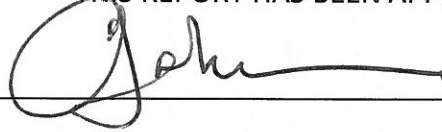


**CYANIDE & FLUORIDE MONITORING IN YADKIN-PEE DEE BASIN LAKES  
FEBRUARY 8, 2022**

**NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF WATER RESOURCES  
WATER SCIENCES SECTION**

THIS REPORT HAS BEEN APPROVED FOR RELEASE



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Chris Johnson  
Chief, Water Sciences Section

DATE: 4/5/2022

**NC Division of Water Resources**  
**Water Sciences Section**

February 8, 2022

**Memorandum**

**To:** Danny Smith – Division Director

**Cc:** Julie Grzyb

**From:** Sarah Segars *S.S.*

**Through:** Chris Johnson

**Subject:** Cyanide & Fluoride Monitoring in Yadkin-Pee Dee Basin Lakes Results  
HUC-8: 03040103, 03040104  
Stream Indices: 12-(124.5), 13-(1)

**Purpose:**

At the request of the NC Division of Water Resources (DWR), the Intensive Survey Branch (ISB) conducted a screening for cyanide and fluoride at two Yadkin-Pee Dee basin lakes. Samples were collected monthly from May through September as supplemental indicators during concurrent monitoring activities at Badin Lake and Lake Tillery for the Ambient Lakes Monitoring Program (ALMP).

**Background:**

Badin Lake and Lake Tillery are located on the Yadkin River and are two of a series of reservoirs constructed along the main stem of the river in the early to mid-1900s to provide hydropower to industries and residents of the area. The lakes straddle the border between Stanly and Montgomery Counties, with the Uwharrie National Forest comprising the majority of the eastern shoreline. The towns of Albemarle, Norwood and Badin lie to the west. Falls Lake is situated in between Badin Lake and Lake Tillery on the Yadkin River main stem. Both waterbodies are classified WS-IV and contain a total of three drinking water intakes. An intake in upper Badin Lake provides water to the City of Albemarle, while two intakes in lower Lake Tillery supply the Town of Norwood and the Montgomery County Water System. The lakes are also popular destinations for recreation including multi-use trails, fishing, swimming, and boating.

## Study Plan:

### Design

A total of six sampling sites were used to assess the presence and distribution of cyanide and fluoride in Badin Lake and Lake Tillery (Table 1 and Figure 1). Three of the sites (YAD178B, YAD178F1 and YAD189C) are historic monitoring sites where ALMP sampling has occurred since the program's inception in the early 1980s. Three additional sampling locations (YADBL0011, YADBL0012 and YADTILL0011) were established for this effort to better characterize conditions at a public swimming area in Badin Lake at the Town of Badin (Figure 2), and at the mouth of Mountain Creek in upper Lake Tillery.

### Parameters

All sites were sampled five times during May-September 2021 for cyanide, fluoride, chloride, bromide, and sulfate, as well as the physical *in situ* parameters of temperature, pH, dissolved oxygen, and specific conductivity (Table 2). The three historic sites were also sampled for chlorophyll *a*, total Kjeldahl nitrogen, nitrate + nitrite, ammonia, total phosphorus, turbidity, and total suspended solids based on their inclusion in the ALMP. Physical and chemical parameters were collected following the methods described in the Intensive Survey Branch Standard Operating Procedures Manual: Physical and Chemical Monitoring Version 2.1 December 2013. All chemical analyses were performed by the DWR Central Laboratory in Raleigh. The results table for each site outline the special study parameter values of cyanide, fluoride, chloride, bromide, and sulfate.

Site Name	Latitude	Longitude
YAD178B	35.4648°	-80.1244°
YAD178F1	35.4171°	-80.1096°
YADBL0011	35.4118°	-80.1149°
YADBL0012	35.4131°	-80.1143°
YADTILL0011	35.3441°	-80.0763°
YAD189C	35.2301°	-80.0866°

**Table 1.** Sample Locations

Physical Parameters	Special Study Parameters	ALMP Parameters
Temperature (°C)	Cyanide (mg/L)	Chlorophyll <i>a</i> (µg/L)
Dissolved oxygen (mg/L)	Fluoride (mg/L)	Total Kjeldahl nitrogen (mg/L)
Dissolved oxygen (% Sat.)	Chloride (mg/L)	Ammonia (mg/L)
pH (s.u.)	Bromide (mg/L)	Nitrate + nitrite (mg/L)
Conductivity (µS/cm)	Sulfate (mg/L)	Total phosphorus (mg/L)
		Turbidity (NTU)
		Total suspended solids (mg/L)

**Table 2.** Physical and Chemical Parameters





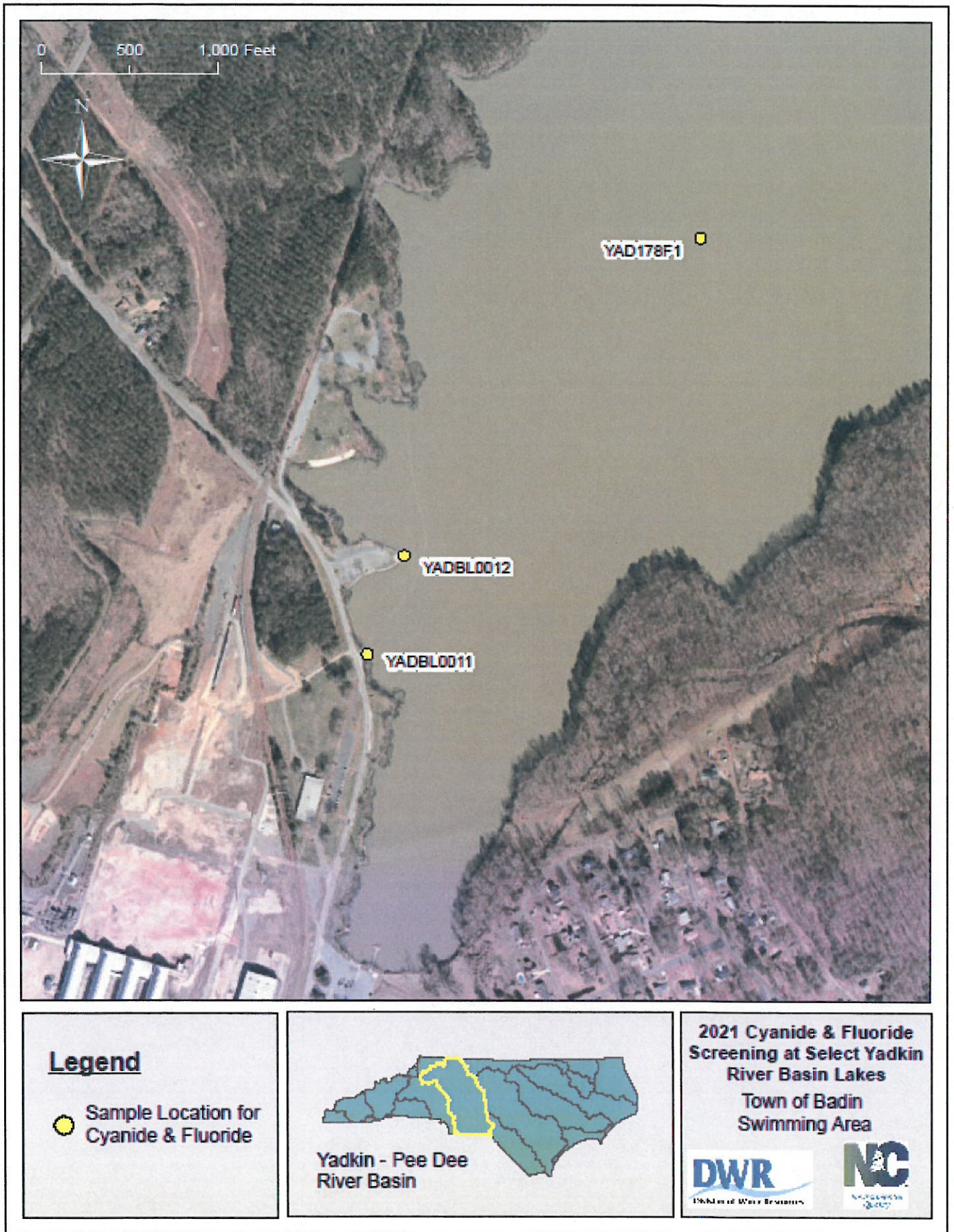


Figure 2. 2021 Cyanide & Fluoride Screening at Select Yadkin River Basin Lakes – Swim Area

## Reporting

YAD178B					
Collection Date	Cyanide (mg/L)	Fluoride (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Sulfate (mg/L)
5/24/2021	0.005	0.4	5.3	0.4	4.0
6/15/2021	0.005	0.4	5.7	0.4	3.9
7/26/2021	0.005	0.4	6.0	0.4	3.9
8/25/2021	0.005	0.4	6.1	0.4	3.8
9/23/2021	0.005	0.4	5.7	0.4	3.9

YAD178F1					
Collection Date	Cyanide (mg/L)	Fluoride (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Sulfate (mg/L)
5/24/2021	0.005	0.4	5.0	0.4	3.9
6/15/2021	0.005	0.4	5.5	0.4	3.9
7/26/2021	0.005	0.4	6.0	0.4	4.0
8/25/2021	0.005	0.4	6.0	0.4	3.7
9/23/2021	0.005	0.4	5.8	0.4	4.0

YADBL0011					
Collection Date	Cyanide (mg/L)	Fluoride (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Sulfate (mg/L)
5/24/2021	0.005	0.4	5.0	0.4	4.0
6/15/2021	0.005	0.4	5.6	0.4	4.1
7/26/2021	0.005	0.4	6.1	0.4	4.1
8/25/2021	0.005	0.4	6.0	0.4	3.7
9/23/2021	0.005	0.4	5.7	0.4	4.0

YADBL0012					
Collection Date	Cyanide (mg/L)	Fluoride (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Sulfate (mg/L)
5/24/2021	0.005	0.4	5.0	0.4	4.0
6/15/2021	0.005	0.4	5.5	0.4	4.0
7/26/2021	0.005	0.4	6.0	0.4	4.1
8/25/2021	0.005	0.4	6.1	0.4	3.7
9/23/2021	0.005	0.4	5.8	0.4	4.1

YAD189C					
Collection Date	Cyanide (mg/L)	Fluoride (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Sulfate (mg/L)
5/24/2021	0.005	0.4	4.8	0.4	4.2
6/30/2021	0.005	0.4	5.1	0.4	3.9
7/20/2021	0.005	0.4	5.5	0.4	4.1
8/19/2021	0.005	0.4	5.8	0.4	4.1
9/14/2021	0.005	0.4	5.9	0.4	3.8

YADTILL0011					
Collection Date	Cyanide (mg/L)	Fluoride (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Sulfate (mg/L)
5/24/2021	0.005	0.4	5.1	0.4	4.4
6/30/2021	0.005	0.4	5.6	0.4	4.2
7/20/2021	0.005	0.4	5.6	0.4	4.2
8/19/2021	0.005	0.4	5.9	0.4	4.1
9/14/2021	0.005	0.4	5.7	0.4	3.8

## Results

All parameters sampled were below the practical quantitation limit (PQL). Sites YAD189C and YADTILL0011 have different sample dates from the other four sites because they were sampled by a separate crew. At this time, the information provided shows a brief snapshot assessing the presence and distribution of cyanide and fluoride in Badin Lake and Lake Tillery.