

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

July 26, 2021

Memorandum

To: Danny Smith – Water Resources Director

CC: Julie Grzyb
Scott Vinson

From: Sarah Segars

Through: Eric Morris

Subject: Study for the Ongoing Assessment of Water Quality in Falls of the Neuse Reservoir: 2020 Results

Purpose: The objective of this study is to evaluate progress in reducing nutrient and nutrient-related pollution in Falls of Neuse Reservoir (WS-IV,B;NSW,CA), as required by the Falls Lake water supply nutrient strategy (15A NCAC 02B.0275) (i.e. the “Falls Lake Rules”). This report summarizes results of *in situ* monitoring and chemical analyses of surface water samples collected in 2020.

Division of Water

Resources

Study for the Ongoing Assessment of Water Quality in Falls of Neuse Reservoir

Neuse River Basin

HUC: 03020201

Purpose

The objective of this study is to evaluate progress in the attainment of water quality standards and use support in Falls of the Neuse Reservoir (WS-IV,B;NSW,CA) as required by the Falls Lake water supply nutrient strategy (15A NCAC 02B.0275) (i.e. the “Falls Lake Rules”). Station L101 was added in April of 2011. This report summarizes sample results collected in 2020.

Methods

A detailed Falls Lake study plan can be found by following the URL at the end of this document. A total of 11 monitoring stations on Falls Lake were sampled monthly in 2020 (Figure 1), excluding the month of April due to restrictions related to Covid-19. All samples were collected in accordance with ISB’s *Standard Operating Procedures Manual: Physical and Chemical Monitoring v2.1, Dec. 2013* and *Ambient Lakes Quality Assurance Project Plan v2.0, March 2014*. Chemical samples were collected as a composite from the photic zone, defined here as the range from the water surface to a depth equal to two times the secchi depth. Each composite sample was analyzed for total phosphorus (TP), total nitrogen (TN), ammonia (NH₃), nitrate + nitrite (NO₃+NO₂), total Kjeldahl nitrogen (TKN), turbidity, and chlorophyll *a* (chl_a) (excluding site NEU013 due to high turbidity at this location). Duplicate samples were collected at one station per sampling event on a rotating schedule for quality control. Depth-stratified physical parameters were collected at the surface (0.15 m), then in one-meter (m) increments to a depth of 10 m, and every 5 m thereafter. Physical measurements of dissolved oxygen (DO), temperature, pH, and conductivity were collected with a multiparameter sonde. Surface readings (0.15m) for physical parameters were used in data analysis. Additional parameters collected at select sites include: total residue, suspended residue, phytoplankton, and microcystins.

Results

One-year summary results are presented by station for the two management areas: Lower Falls Lake (Figure 2) and Upper Falls Lake (Figure 3). The tables display annual mean, minimum, and maximum concentrations for TP (mg/L), TN (mg/L), chl_a (µg/L), and turbidity (NTU) from the photic zone; DO (mg/L) and pH (s.u.) from surface readings. Data summaries are calculated from 11 sampling events (n) for all sites. All stations were not sampled in April due to restrictions related to Covid-19. Percent exceedance of state fresh surface water quality standards is shown for each station. Exceedance is defined by chl_a >40 µg/L; turbidity >25 NTU; DO <4 mg/L; pH >9 or <6 s.u. All nitrate + nitrite and ammonia data below analytical detection limit (< 0.02 mg/L) were quantified as 0.01 mg/L to calculate TN values. Phytoplankton results showed cyanobacteria as the dominant algal group at sites NEU013B, NEU018E, and NEU019P. Cyanobacteria, or blue-green algae are common indicators of nutrient enrichment and are characterized by discoloration, surface films, flecks, mats, and foul odors. Results for additional parameters not provided in this report are available upon request. Please direct any question or comments to Eric Morris, Intensive Survey Branch Supervisor, at 919-743-8496 or eric.morris@ncdenr.gov.

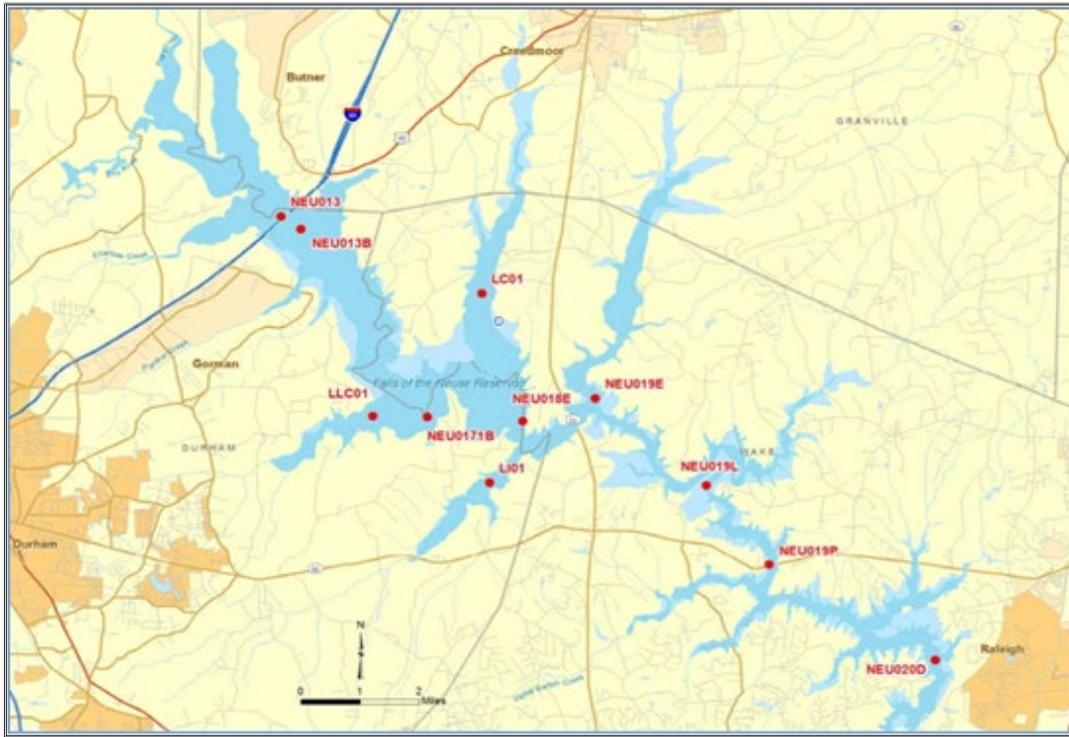


Figure 1: Falls Lake Monitoring Stations

NEU019E						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.04	0.76	34.5	7.28	8.68	7.53
Min	0.03	0.57	20.0	3.30	4.70	6.80
Max	0.07	1.05	60.0	17.0	11.60	8.80
n>Standard		3	0	0	0	0
% Exceedance		27.3%	0.0%	0.0%	0.0%	0.0%
% Confidence		91.0%	N/A	N/A	N/A	N/A

NEU019L						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.04	0.75	32.5	7.04	8.75	7.52
Min	0.02	0.53	23.0	3.30	3.10	6.60
Max	0.07	0.93	58.0	22.0	11.50	8.90
n>Standard		2	0	1	0	0
% Exceedance		18.2%	0.0%	9.1%	0.0%	0.0%
% Confidence		69.7%	N/A	31.4%	N/A	N/A

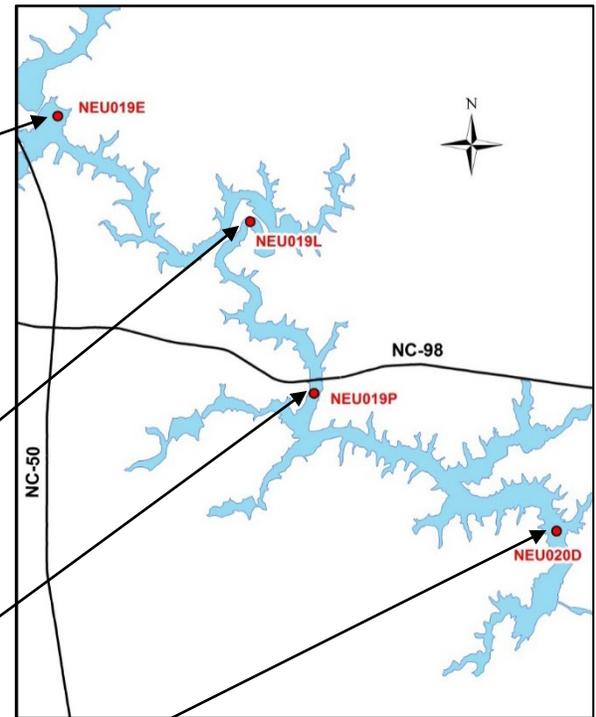


Figure 2. Lower Falls Lake

NEU019P						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.04	0.71	31.8	6.61	8.75	7.50
Min	0.02	0.51	14.0	3.30	4.90	6.70
Max	0.07	1.04	55.0	18.0	11.0	8.90
n>Standard		3	0	0	0	0
% Exceedance		27.3%	0.0%	0.0%	0.0%	0.0%
% Confidence		91.0%	N/A	N/A	N/A	N/A

NEU020D						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.03	0.72	30.5	5.49	8.67	7.65
Min	0.02	0.50	13.0	2.90	5.10	6.90
Max	0.08	1.08	66.0	14.0	11.60	9.10
n>Standard		2	0	0	1	1
% Exceedance		18.2%	0.0%	0.0%	0.0%	9.1%
% Confidence		69.7%	N/A	N/A	N/A	31.4%

NEU013						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	0	11	11	11
Mean	0.09	0.95	N/A	25.1	9.13	7.49
Min	0.06	0.73	N/A	14.0	6.70	6.60
Max	0.12	1.11	N/A	50.0	11.0	8.50
<i>n>Standard</i>			0	3	0	0
% Exceedance			0.0%	27.3%	0%	0.0%
% Confidence			N/A	91.0%	N/A	N/A

NEU013B						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.08	0.87	35.5	21.35	9.21	7.45
Min	0.06	0.75	16.0	9.90	6.30	6.70
Max	0.09	1.04	54.0	40.0	11.0	8.50
<i>n>Standard</i>			4	4	0	0
% Exceedance			36.4%	36.4%	0.0%	0.0%
% Confidence			98.1%	98.1%	N/A	N/A

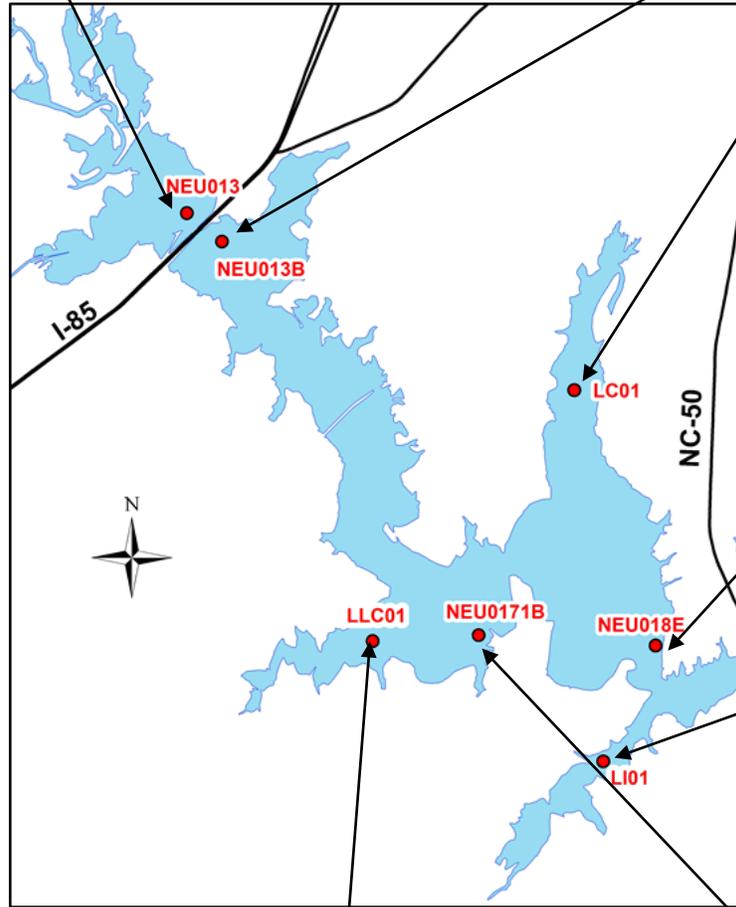


Figure 3. Upper Falls Lake

LC01						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.05	0.77	33.2	8.65	9.06	7.44
Min	0.04	0.63	22.0	4.0	6.80	7.10
Max	0.07	1.06	57.0	17.0	12.20	8.40
<i>n>Standard</i>			0	0	0	0
% Exceedance			0.0%	0.0%	0.0%	0.0%
% Confidence			N/A	N/A	N/A	N/A

NEU018E						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.05	0.80	39.4	8.55	9.56	7.63
Min	0.04	0.65	22.0	4.20	6.80	6.60
Max	0.07	1.07	71.0	22.0	12.40	8.70
<i>n>Standard</i>			7	0	0	0
% Exceedance			63.6%	0%	0%	0%
% Confidence			100.0%	N/A	N/A	N/A

LI01						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.05	0.76	34.9	11.57	8.70	7.48
Min	0.04	0.62	18.0	4.80	5.10	6.70
Max	0.06	0.94	49.0	23.0	11.80	8.60
<i>n>Standard</i>			4	0	0	0
% Exceedance			36.4%	0.0%	0%	0.0%
% Confidence			98.1%	N/A	N/A	N/A

LLC01						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.06	0.82	40.1	11.58	9.08	7.41
Min	0.05	0.66	20.0	7.10	5.40	6.60
Max	0.07	0.99	62.0	24.0	12.20	8.20
<i>n>Standard</i>			4	0	0	0
% Exceedance			36.4%	0.0%	0.0%	0.0%
% Confidence			98.1%	N/A	N/A	N/A

NEU0171B						
	TP	TN	Chla	Turbidity	DO	pH
n	11	11	11	11	11	11
Mean	0.05	0.81	35.5	11.75	8.93	7.40
Min	0.04	0.59	14.0	5.30	6.40	6.30
Max	0.07	0.98	54.0	24.0	12.20	8.50
<i>n>Standard</i>			3	0	0	0
% Exceedance			27.3%	0.0%	0.0%	0.0%
% Confidence			91.0%	N/A	N/A	N/A

<https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/intensive-survey-branch/falls-jordan-lakes-monitoring>

Key for data tables:

n: number of sampling events

n>standard: number of times sample exceeds water quality standards *chl*a >40 ug/L; turbidity >25 NTU; DO <4 mg/L; pH >9 or <6 s.u

% exceedance: percentage of samples that were in exceedance of water quality standards

% confidence: states the percent statistical confidence that the actual percentage of exceedances is greater than 10%. Low % confidence values are a result of a small sample size or exceedance values less than or equal to 10%.