Project ID: 18-0362

Falls Lake Nutrient Exchange & Sediment Oxygen Demand (SOD) Study
Final Project Report, Version 2

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Project Leader: Morris Flexner
Ecology Section
Field Services Branch
Science & Ecosystem Support Division
USEPA – Region 4
980 College Station Road
Athens, Georgia 30605-2720

The activities depicted in this report are accredited under the US EPA Region 4 Science and Ecosystem Support Division ISO/IEC 17025 accreditation issued by the ANSI-ASQ National Accreditation Board. Refer to certificate and scope of accreditation AT-1644.

Requester(s):

Chris McArthur
Environmental Protection Agency
Water Protection Division
Water Quality Planning Branch
Data and Information Analysis Section
61 Forsyth Street
Atlanta, GA 30303
(404) 562-9391

Eric Morris
North Carolina Department of
Environmental Quality
Division of Water Resources
Water Sciences Section
4401 Reedy Creek Road
Raleigh, NC 27607
(919) 743-8499

Science and Ecosystem Support Division (SESD) Laboratory:

Daniel Adams, Chemist
Analytical Support Branch
Inorganic Chemistry Section
980 College Station Road
Athens, GA 30605

Approvals:

Morris Flexner, SESD Project Leader
Ecology Section
Field Services Branch

2/01/19
Date

Stacey Box, Section Chief
Ecology Section
Field Services Branch

2/1/19
Date

Mel Parsons, Technical Reviewer
Ecology Section
Field Services Branch

2/1/19
Date

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1.0 Introduction

The North Carolina Department of Environmental Quality (NDEQ) requested the assistance of Region 4 Science and Ecosystem Support Division (SESD) Field Services Branch (FSB) in conducting a Nutrient Exchange (NUTX) and Sediment Oxygen Demand (SOD) analysis in the Falls of the Neuse Reservoir (Falls Lake). Data collection by SESD included:

- Sediment Oxygen Demand measurements
- Sediment Nutrient Exchange rates.

Falls of the Neuse Reservoir (Falls Lake) is a multipurpose impoundment of the Neuse River located in the Upper Neuse River basin. The reservoir is the primary water supply for the City of Raleigh and surrounding towns in Wake County. The Falls Lake dam was constructed and filled by 1983 and is currently operated by the United States Army Corps of Engineers (USACOE). The reservoir extends 28 miles to just above the confluence of the Eno and Flat Rivers. The uses for the reservoir include: water supply, flood control, recreation, wildlife enhancement, and augmentation of low flows for purposes of pollution abatement and water quality control in the Neuse River basin. Algal blooms and eutrophic conditions have been present in the lake since its impoundment.

Falls Lake was listed on North Carolina's 2008 303(d) list as impaired for chlorophyll *a*. The portion of the lake upstream of I-85 was also listed as impaired for turbidity. In 2005, the North Carolina General Assembly passed Session Law 2005-190 (also referred to as Senate Bill 981), which directed the Environmental Management Commission (EMC) to study drinking water supply reservoirs in general, and to develop and implement a nutrient management strategy based on a calibrated nutrient response model for certain reservoirs, including Falls Lake. In 2009, Senate Bill 1020 was ratified and signed into law as Session Law 2009-486. This revised the EMC adoption deadline to January 15, 2011 and added certain requirements for water quality improvements in the watershed. After developing a nutrient response model and engaging stakeholders for input, a nutrient management strategy was developed in March 2010. Section 5. (a) includes provisions for water monitoring as follows*: "The Division shall perform water quality monitoring throughout Falls Reservoir and shall accept reservoir water quality monitoring data provided by other parties that meets Division standards and quality assurance protocols. The Division shall utilize this data to produce load reduction estimates and to perform periodic use support assessments pursuant to 40 CFR 130.7(b)."* The results of this study will support the development of a water quality model for Falls Lake. Data collected by SESD will aid NCDEQ in an overall nutrient reduction plan for the reservoir.

2.0 Study Area and Sampling Plan

Table 1: Sampling Locations and Descriptions

Station ID	Latitude	Longitude	Site Description
FL01	36.02863°	- 78.74948°	Thin Layer, Upper-Lake Section, SOD/NUTX Site
FL03	36.02525°	- 78.71278°	Thick Layer, Mid-Lake Section, NUTX Site
FL04	36.01445°	- 78.67533°	Historic Channel, Lower-Lake Section, NUTX Site

3.0 Field Methods

Methodology for the SOD and NUTX measurements completed by SESD are summarized in the following sections. The measurement uncertainties associated with the field methods used can be found in Table 2. Station locations were recorded in field logbooks according to SESD Operating Procedure for Global Positioning Systems (SESDPROC-110-R4, 2015). The field logbooks were used and maintained after the project by the project leader with the project file according to SESD Operating Procedures for Control of Records (SESDPROC-1001-R0, 2017) and Logbooks (SESDPROC-1002-R0, 2017). This report will be distributed and stored per SESD Report Preparation and Distribution Operating Procedures (SESDPROC-003-R5, 2014) after final approvals. A 28' boat was used for chamber deployment in Falls Lake. Four contact chambers and two blank chambers were deployed at each site.

Table 2: Measurement Uncertainties

In Situ and Field Parameters	Units	Measurement Technology	Accuracy of Primary Equipment
Dissolved Oxygen	mg/l	Luminescent DO Probe	± 0.2 mg/l ± 1% Reading
Temperature	°C	LDO Thermistor	± 0.1 °C
Latitude/Longitude	decimal degrees	DGPS/GPS based on WGS84	± 3-4 m

3.1 Sediment Oxygen Demand

To evaluate sediment oxygen demand, SESD personnel followed procedures per SESD Operating Procedure for Sediment Oxygen Demand (SESDPROC-507-R4, 2015). SOD measurements were conducted at station FL01 since aerobic conditions were present at this site (DO ranged from 4-6 mg/l). At this sampling location, four replicate contact chambers of known volume and surface area were deployed over the bottom sediment. Multi-parameter sondes were used to monitor DO and temperature within each SOD chamber in accordance with SESD Operating Procedure for In Situ Water Quality Monitoring (SESDPROC-111-R4, 2018). SOD measurements were not collected at stations FL03 and FL04 since the overlying water was thermally stratified and the DO levels at the sediment-water interface were anaerobic (DO values < 1.0 mg/L). SOD chambers were monitored during the day from an adjacent boat but left in-place unattended overnight. SOD chambers were deployed by divers and sampled by divers and the dissolved oxygen levels (DO) in the SOD chambers at station FL01 were monitored with a mounted sonde in each chamber. Station FL02, a site in the historic channel of the upper lake, wasn't sampled due to the time needed to sample the other three stations. The study team decided to sample FL01 instead of FL02 to ensure representative data from a thin layer site within the lake.

The decline in dissolved oxygen concentration was measured within the multiple contact chambers for at least two hours to provide adequate data for linear regression analyses, with the DO decline expressed in mg/L/min. The DO decline was then multiplied by a factor of 1.44 to express the DO decline in grams O_2/L/day, then further multiplied by the chambers surface area to volume ratio of 240 yielding a SOD rate expressed in grams O_2/m^2/day. Simultaneously, 2 blank chambers (i.e. filled with bottom water but not in contact with sediment) were deployed in a similar fashion to determine water column DO respiration. The blank chambers were allowed to settle for 30 minutes prior to commencement of data collection. This allowed for suspended sediment to settle out and sufficient time to displace ambient surface water in the blank chamber with ambient bottom water. DO measurements were recorded at five-minute intervals for the duration of chamber deployment (incubation period).

3.2 Nutrient Exchange

To evaluate sediment nutrient exchange, an initial and final water sample was collected by divers from the SOD chambers utilizing a pre-cleaned underwater siphon system to siphon the sample from each of the chambers into a 250 mL pre-cleaned glass container, as outlined in the SESD Operating Procedure for Sediment Oxygen Demand (SESDPROC-507-R4, 2015). Aerobic conditions (DO 4-6 mg/L) existed at Station FL01, whereas anoxic conditions existed at stations FL03 and FL04 (DO < 0.2 mg/L). Therefore, chambers at FL01were allowed to incubate for as long as possible prior to the DO concentrations being depleted to anoxic levels in order to collect the final sample in aerobic conditions on June 7, 2018. Once the final aerobic sample was collected at FL01, the chambers were sealed and allowed to incubate overnight, driving the chambers to anoxic conditions. Therefore, nutrient exchange samples collected at station FL01 the following day, June 8th, were collected under anoxic conditions. Samples collected at station FL03, June 5-6, 2018, and station FL04, June 4-5, 2018 were collected entirely under anoxic conditions. DO was not monitored within the deployed chambers overnight, due to the anoxic conditions within the chambers.

Due to changes in microbial communities, pH and sediment chemistry from the depletion of oxygen within the chambers when transitioning from aerobic to anoxic conditions, and the potential change or even reversal of flux rates, it is not advisable to sample across the aerobic/anoxic transition unless each state is treated independently.

Nutrient exchange samples were analyzed for Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), Nitrate + Nitrite (NO_2 + NO_3), Total Phosphorous (TP) and Total Dissolved Phosphorus (TDP). Nutrient samples were preserved with 10% sulfuric acid (H_2SO_4). Samples were preserved with sufficient preservative to lower the sample pH to less than 2 and placed on ice. All sediment nutrient exchange samples were collected according to SESD Operating Procedure for Surfacewater Sampling (SESDPROC-201-R4, 2016). Analytical methods, minimum reporting limits, and holding times are provided in the Analytical Support Branch Laboratory Operations and Quality Assurance Manual (SESD ASB, 2017).

4.0 Field Results and Discussion

NUTX data were not included for Chamber 1 from station FL03 (6/5-6/18) and Chamber 3 from station FL01(6/8/18) during anoxic conditions due to the chambers becoming unsealed after deployment and leaking due to environmental conditions (heavy wind and waves). NUTX data for TKN and TP were not included for blank Chamber C0I from station FL04 due accidental breakage of the samples in the SESD laboratory. The data quality from the remaining replicates was not compromised.

4.1 Sediment Oxygen Demand

SOD measurements were conducted in Falls Lake at station FL01. Ambient DO measurements indicated aerobic conditions at this station where chamber SOD measurements were made. The SOD rate was measured at -1.15 grams O_2/m^2/day at station FL01, as summarized in Table 3. All logged data is provided in the digital appendix of the report. Detailed SOD data is presented in Appendix A.

Table 3: Mean SOD Rate Results

SOD Summary Data

STATION	CHAMBER	MEAN TEMP ºC	UNADJUSTED D.O. RATE (mg/l/min)	W. COLUMN RESP. (mg/l/min)	ADJUSTED* D.O. RATE (mg/l/min)	SOD* (gr O_2/m^2/d)	SOD* @ 20ºC (gr O_2/m^2/d)	STND. DEV. (gr O_2/m^2/d)
FL01	1	26.83	-0.00728		-0.00540	-1.87	-1.21	
6/7/2018	2	26.87	-0.00610		-0.00422	-1.46	-0.95	
Depth: 4.8'	3	26.80	-0.00721		-0.00533	-1.84	-1.20	
Sediment: Sandy Silt/Clay	4	26.86	-0.00745		-0.00557	-1.92	-1.25	
	0	26.95		-0.00188				
Station Mean:		26.86	-0.00701	-0.00188	-0.00513	**-1.77**	**-1.15**	**0.14**

* ADJUSTED FOR WATER COLUMN RESPIRATION

**Chambers 1 through 4 were in contact with the sediment. Chamber 0 was 'blank' and represents water column respiration.

4.2 Nutrient Exchange

Nutrient exchange measurements were collected at stations FL01, FL03 and FL04 (Appendix B, Tables B1-B4). The water column during this study was stratified with aerobic conditions above 2 meters and anaerobic conditions below 2 m overlying the sediments throughout the incubation period at stations FL03 and FL04. At station FL01, conditions were oxygenated and well mixed enough due to the shallow depth of the water column on June 7th, that SOD measurements were recorded within the chambers and nutrient exchange measurements were collected under aerobic conditions. On June 8th, a second set of nutrient

exchange measurements were collected at station FL01 under anoxic conditions (DO measurements made after sample collection in the contact chambers ranged from 0.62-1.25 mg/L). Because the chambers at station FL01 didn't appear to go completely anoxic overnight, the data was analyzed independently (July 7th vs. July 8th) to see if there were differences due to low oxygen levels, as well as combined (as one dataset from July 7th – July 8th), similar to the treatment of stations FL03 and FL04. Appendix B, Tables B1 and B2A present the data independently and table B2B presents the data combined. Each station will be discussed independently below.

A positive sediment nutrient exchange rate indicates the analyte being released by the sediment, while a negative rate indicates an uptake of the analyte by the sediment. When an exchange rate in a blank chamber has a value close to the exchange rate in the contact chambers, it indicates very little if any nutrient flux to or from the sediment. Results are considered inconclusive when one contact chamber yields a positive rate and the other a negative rate, as these inconsistencies indicate the values do not accurately reflect environmental conditions.

Measured nutrient exchange rates at station FL01 on June 7th under aerobic conditions showed a very slight sediment release rate of ammonia (NH_3), with little change in blank chamber NH_3 concentrations, yielding a mean rate of 0.016 grams NH_3/m^2/day (Appendix B, Table B1). Total Kjeldahl Nitrogen (TKN) results indicated a very slight sediment uptake, yielding a mean rate of -0.074 grams TKN/ m^2/day. Total Phosphorus (TP) rates were very low at station FL01, with one blank chamber having no change and the other with a similar TP rate (-0.0093 grams TP/m^2/day) as the TP rates in the contact chambers. This indicates very little if any phosphorus uptake in the sediment. This is probably due to TP being bound to suspended particles within the chambers. The mean rate for TP at station FL01 was -0.0083 grams TP/m^2/day. Total Dissolved Phosphorus (TDP) rates at Station FL01 under aerobic conditions were variable with some rates being positive and some being negative. Therefore, TDP results are inconclusive. Differences in TDP concentrations between initial and final samples were too small to provide reliable flux rates. All values for this station are presented in Appendix B, Table B1. NO_2+NO_3 results were not included in this discussion, since all NO_2+NO_3 results were reported as a non-detectable value of 0.05 mg/L.

Measured nutrient exchange rates at station FL01 on June 8th under anoxic conditions showed a very slight sediment release rate of NH_3, with no change in blank chamber NH_3 concentrations, yielding a mean rate of 0.041 grams NH_3/m^2/day (Appendix B, Table B2A). TKN results under anoxic conditions were variable and indeterminate. TP rates at station FL01 under anoxic conditions yielded a mean rate of -0.0062 grams TP/m^2/day. Total Dissolved Phosphorus (TDP) rates at Station FL01 under anoxic conditions were variable and inconclusive. Differences in TDP concentrations between initial and final samples were too small to provide reliable flux rates. All values for this station are presented in Appendix B, Table B2A. NO_2+NO_3 results were not included in this discussion, since all NO_2+NO_3 results were reported as a non-detectable value of 0.05 mg/L.

When data from station FL01 was analyzed by using the initial samples from June 7th and the final samples that were collected on June 8th under low oxygen conditions, the results showed a very slight sediment release rate of NH_3, with no change in blank chamber NH_3

concentrations, yielding a mean rate of 0.023 grams $NH_3/m^2/day$ (Appendix B, Table B2B). TKN results indicated a very slight sediment release, yielding a mean rate of 0.004 grams TKN/m²/day. Total Phosphorus (TP) rates within the blank chambers were very low. TP rates in the contact chambers were slightly higher, which yielded a mean rate of -0.0024 grams TP/m²/day. Total Dissolved Phosphorus (TDP) rates at Station FL01 under these conditions were very similar to earlier results with some rates being positive and some being negative. Therefore, TDP results are inconclusive. NO_2+NO_3 results were not included in this discussion, since all NO_2+NO_3 results were reported as a non-detectable value of 0.05 mg/L.

Measured nutrient exchange rates at station FL03 indicated a very slight sediment release of NH_3 at a rate of 0.070 grams $NH_3/m^2/day$. TKN results also indicated a very slight sediment release, yielding a mean rate of 0.086 grams TKN/m²/day. TP and TDP indicated very slight sediment releases as well, yielding mean rates of 0.0088 grams TP/m²/day and 0.0059 grams TDP/m²/day, respectively. NO_2+NO_3 results were not included in this discussion, since all NO_2+NO_3 results were reported as a non-detectable value of 0.05 mg/L.

Measured nutrient exchange rates at station FL04 indicated a sediment release of NH_3 at a rate of 0.161 grams $NH_3/m^2/day$. TKN results also indicated a sediment release, yielding a mean rate of 0.219 grams TKN/m²/day. TP and TDP indicated slight sediment releases as well, yielding mean rates of 0.0203 grams TP/m²/day and 0.0190 grams TDP/m²/day, respectively. NO_2+NO_3 results were not included in this discussion, since all NO_2+NO_3 results were reported as a non-detectable value of 0.05 mg/L.

5.0 Quality Assurance and Quality Control

Several sample analyses returned data qualifiers assigned by SESD Analytical Services Branch laboratory, as noted in the data tables from Appendix B. A *J* qualifier is assigned when the reported value of the sample is an estimate with acceptable identification of the analyte. A *U* qualifier is assigned when the analyte was not detected at or above the reporting limit. A *QM-1* qualifier is assigned when Matrix Spike Recovery is less than method control limits. A H-6 qualifier is assigned when the sample was originally analyzed within the holding time but some QC requirements for the sample that was run were not met

Quality control procedures were utilized in the field and during preparation of equipment to ensure reliable data was obtained. Per SESD's Field Branches Quality System, the Project Leader and Project Participants assisting with this project were deemed competent by SESD management under ISO 17025 accreditation to conduct the tasks required to fulfill the prescribed goals described. All calibration standards, field equipment, field supplies, and field consumables were maintained in accordance with SESD Operating Procedure's for Equipment Inventory and Management (SESDPROC-1009-R0, 2017), Field Temperature Measurement (SESDPROC-102-R5, 2018), and Field DO Measurement (SESDPROC-106-R4, 2017).

All instruments or equipment used by SESD personnel to conduct field sampling and measurement activities were calibrated and end-checked in accordance with SESD Operating Procedures for In-Situ Water Quality Monitoring (SESDPROC-111-R4, 2018), SESD Operating

Procedure for Surfacewater Sampling (SESDPROC-201-R4, 2016), and the SESD form for acceptance criteria (SESDFORM-060-R0, 2017).

All data derived from SESD field measurements and sampling were reviewed, verified, validated and deemed usable in accordance with the SESD Operating Procedure for Report Preparation and Distribution (SESDPROC-003-R5, 2014).

All samples were accompanied by a chain of custody (COC), handled and maintained according to the SESD Operating Procedures for Sample and Evidence Management (SESDPROC-005-R3, 2016) and Packing, Marking, Labeling, and Shipping of Environmental and Waste Samples (SESDPROC-209-R3, 2015). All critical supplies and consumables for this field investigation were inspected and maintained in accordance with SESD Operating Procedures for Purchasing of Services and Supplies (SESDPROC-1008-R0, 2017) and for Field Sampling Quality Control (SESDPROC-011-R5, 2017).

6.0 References

SESD ASB. (2017). Laboratory Operations and Quality Assurance Manual (ASB LOQAM). Athens, GA: U.S. EPA Region 4.

SESDFORM-060-R0. (2017). SESD Form for Acceptance Criteria. Athens, GA: U.S. EPA Region 4.

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SESDPROC-209-R3. (2015). SESD Operating Procedure Packing, Marking, Labeling, and Shipping of Environmental and Waste Samples. Athens, GA: U.S. EPA Region 4.

SESDPROC-507-R4. (2015). SESD Operating Procedure for Sediment Oxygen Demand. Athens, GA: U.S. EPA Region 4.

SESDPROC-1001-R0. (2017). SESD Operating Procedure for Control of Records. Athens, GA: U.S. EPA Region 4.

SESDPROC-1002-R0. (2017). SESD Operating Procedure for Logbooks. Athens, GA: U.S. EPA Region 4.

SESDPROC-1008-R0. (2017). SESD Operating Procedure for Purchasing of Services and Supplies. Athens, GA: U.S. EPA Region 4.

SESDPROC-1009-R0. (2017). SESD Operating Procedure for Equipment Inventory and Management. Athens, GA: U.S. EPA Region 4.

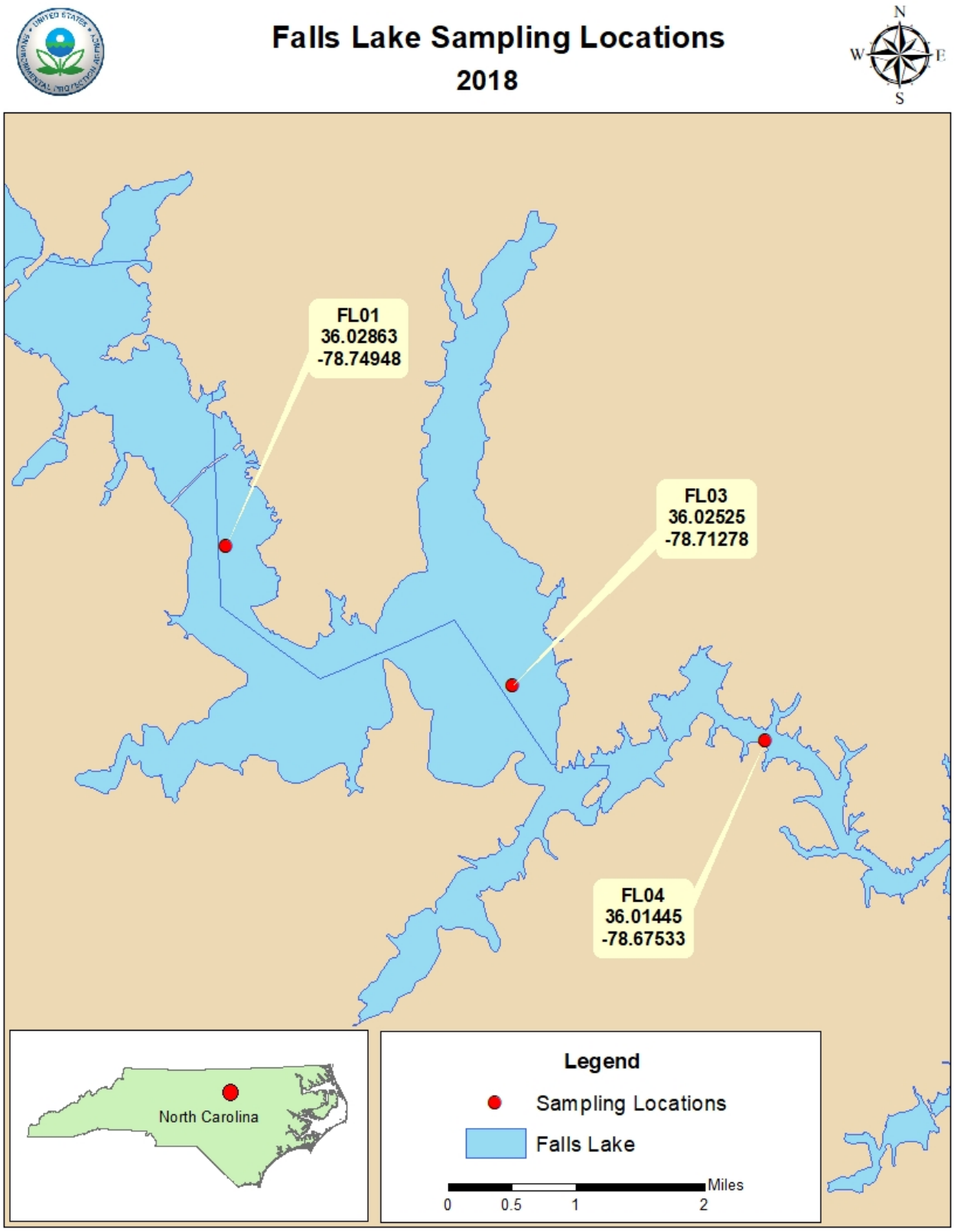

Figure 1: Falls Lake Sampling Locations

Appendix A: SOD Data

Table A1. Falls Lake SOD

STATION FL01 SUMMARY, June 7, 2018

Mean Adj.* D.O. rate of change (mg/l/min)	**-0.005127**	**Corrected to 20°C**
Mean Adj. SOD rate (gr O_2/m^2/day)	**-1.7720**	**-1.1504**

*Adj. - Adjusted for water column respiration rate

WATER COLUMN RESPIRATION CHAMBERS (Blanks)

Chamber	Mean Temp	D.O. rate (mg/l/min)
0	26.95	-0.00188

SEDIMENT CONTACT SOD CHAMBERS

Chamber	Mean Temp	Unadjusted D.O. rate (mg/l/min)	Adjusted D.O. rate (mg/l/min)
1	26.83	-0.007276923	-0.005396923
2	26.87	-0.006095385	-0.004215385
3	26.80	-0.007209231	-0.005329231
4	26.86	-0.007447692	-0.005567692

Chamber	26.86	SOD rate (gr O_2/m^2/day)	Adjusted SOD rate (gr O_2/m^2/day)
1		-2.514904615	-1.865176615
2		-2.106564923	-1.456836923
3		-2.491510154	-1.841782154
4		-2.573922462	-1.924194462

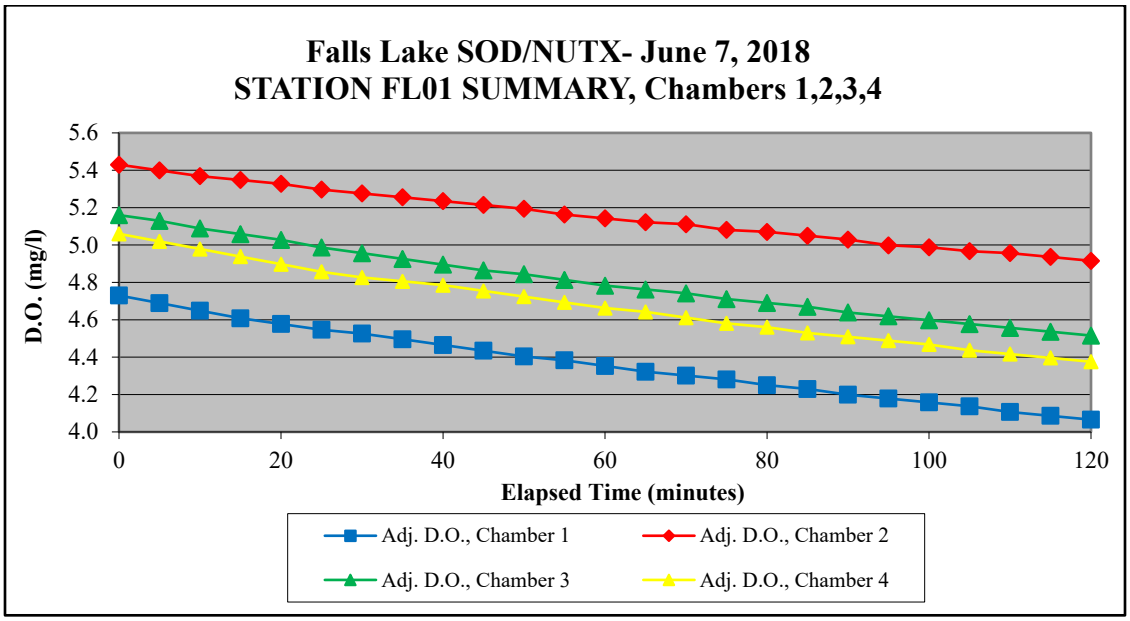

Figure A1: Station FL01 SOD Data

***Adj. - Adjusted for water column respiration rate; water depth = 4.8 ft.**

Appendix B: NUTX Data

Table B1: Station FL01 NUTX Summary - June 7, 2018 / Water Depth: 4.8 feet / Sediment Description: Sandy Silt-Clay												
Sample	Time	HOURS	MIN.	ET	NH_3	gr NH_3/m^2/day	TKN	gr TKN/m^2/day	TP	gr Total P/m^2/day	TDP	gr Total DP/m^2/day
FL01-060718-C01F	18:40	18	40		0.068		0.86		0.085		0.018	
FL01-060718-C01I	14:10	14	10	270	0.043J	0.032	0.95	-0.115	0.099	-0.0179	0.017	0.0013
FL01-060718-C02F	18:50	18	50		0.026UJ		0.77		0.069		0.018	
FL01-060718-C02I	14:00	14	0	290	0.026UJ	0.000	0.86	-0.107	0.071	-0.0024	0.018	0.0000
FL01-060718-C03F	18:55	18	55		0.041J		0.88		0.071		0.016	
FL01-060718-C03I	14:00	14	0	295	0.026UJ	0.018	0.92	-0.047	0.079	-0.0094	0.017	-0.0012
FL01-060718-C04F	18:40	18	40		0.044J		0.88		0.082		0.017	
FL01-060718-C04I	14:15	14	15	265	0.031J	0.017	0.94	-0.078	0.099	-0.0222	0.017	0.0000
FL01-060718-C0F	18:35	18	35		0.027J		0.66		0.059		0.017	
FL01-060718-C0I	14:15	14	15	260	0.026UJ	0.001	0.68	-0.027	0.066	-0.0093	0.016	0.0013
FL01-060718-C00F	18:35	18	35		0.026UJ		0.74		0.058		0.017	
FL01-060718-C00I	14:25	14	25	250	0.026UJ	0.000	0.74	0.000	0.058	0.0000	0.017	0.0000
STATION MEAN NUTRIENT EXCHANGE RATE (gr/m^2/day):						**0.016**		**-0.074**		**-0.0083**		**-0.0006**

*Chambers 1 - 4 were contact chambers, while chambers 0 & 00 were blank chambers, as indicated in the sample suffix.

***See Section 5.0 for data qualifier definitions.

Table B2A: Station FL01 NUTX Summary - June 8, 2018 / Water Depth: 4.8 feet / Sediment Description: Sandy Silt-Clay												
Sample	Time	HOURS	MIN.	ET	NH_3	gr NH_3/m^2/day	TKN	gr TKN/m^2/day	TP	gr Total P/m^2/day	TDP	gr Total DP/m^2/day
FL01-060818-C01F	14:00	14	0		0.140		0.95		0.076		0.016	
FL01-060818-C01I	11:45	11	45	135	0.120	0.051	0.97	-0.051	0.079	-0.0077	0.017	-0.0026
FL01-060818-C02F	14:05	14	5		0.110		0.92		0.073		0.018	
FL01-060818-C02I	11:50	11	50	135	0.093	0.044	0.90	0.051	0.075	-0.0051	0.019	-0.0026
FL01-060818-C04F	14:00	14	0		0.140		0.96		0.075		0.018	
FL01-060818-C04I	11:55	11	55	125	0.130	0.028	0.96	0.000	0.077	-0.0055	0.017	0.0028
FL01-060818-C0F	13:55	13	55		0.026UJ		0.82		0.058		0.016	
FL01-060818-C0I	11:40	11	40	135	0.026UJ	0.000	0.84	-0.051	0.059	-0.0026	0.019	-0.0077
FL01-060818-C00F	13:55	13	55		0.026UJ		0.62		0.056		0.016	
FL01-060818-C00I	11:50	11	50	125	0.026UJ	0.000	0.67	-0.138	0.055	0.0028	0.014	0.0055
STATION MEAN NUTRIENT EXCHANGE RATE (gr/m^2/day):						**0.041**		**0.095**		**-0.0062**		**0.0003**

*Chambers 1, 2 & 4 were contact chambers, while chambers 0 & 00 were blank chambers, as indicated in the sample suffix.

**Chamber 3 data not included due to the chamber leaking.

***See Section 5.0 for data qualifier definitions.

Table B2B: Station FL01 NUTX Summary - June 7-8, 2018/ Water Depth: 4.8 feet / Sediment Description: Sandy Silt-Clay												
Sample	Time	HOURS	MIN.	ET	NH_3	gr $NH_3/m^2/day$	TKN	gr TKN/m^2/day	TP	gr Total P/m^2/day	TDP	gr Total DP/m^2/day
FL01-060818-C01F	14:00	14	0		0.140		0.95		0.076		0.016	
FL01-060718-C01I	14:10	14	10	1430	0.043J	0.023	0.95	0.000	0.099	-0.0056	0.017	-0.0002
FL01-060818-C02F	14:05	14	5		0.110		0.92		0.073		0.018	
FL01-060718-C02I	14:00	14	0	1445	0.026UJ	0.020	0.86	0.014	0.071	0.0005	0.018	0.0000
FL01-060818-C04F	14:00	14	0		0.140		0.96		0.075		0.018	
FL01-060718-C04I	14:15	14	15	1425	0.031J	0.026	0.94	0.005	0.099	-0.0058	0.017	0.0002
FL01-060818-C0F	13:55	13	55		0.026UJ		0.82		0.058		0.016	
FL01-060718-C0I	14:15	14	15	1420	0.026UJ	0.000	0.68	0.034	0.066	-0.0019	0.016	0.0000
FL01-060818-C00F	13:55	13	55		0.026UJ		0.62		0.056		0.016	
FL01-060718-C00I	14:25	14	25	1410	0.026UJ	0.000	0.74	-0.029	0.058	-0.0005	0.017	-0.0002
STATION MEAN NUTRIENT EXCHANGE RATE (gr/m^2/day):						**0.023**		**0.004**		**-0.0024**		**0.0001**

*Chambers 1, 2 & 4 were contact chambers, while chambers 0 & 00 were blank chambers, as indicated in the sample suffix.

**Chamber 3 data not included due to the chamber leaking.

***See Section 5.0 for data qualifier definitions.

Table B3: Station FL03 NUTX Summary - June 5-6, 2018 / Water Depth: 14.3 feet / Sediment Description: Silty Pudding												
Sample	Time	HOURS	MIN.	ET	NH_3	gr NH_3/m^2/day	TKN	gr TKN/m^2/day	TP	gr Total P/m^2/day	TDP	gr Total DP/m^2/day
FL03-0618-C02F	16:25	16	25		0.96		1.90		0.16		0.052	
FL03-0618-C02I	17:25	17	25	1380	0.56	0.100	1.60	0.075	0.14	0.0050	0.018	0.0085
FL03-0618-C03F	16:20	16	20		0.82		1.90		0.16		0.04	
FL03-0618-C03I	17:10	17	10	1390	0.480	0.085	1.30	0.149	0.11	0.0124	0.017	0.0057
FL03-0618-C04F	16:10	16	10		0.86		1.80		0.16		0.04	
FL03-0618-C04I	17:00	17	0	1390	0.45	0.102	1.40	0.099	0.12	0.0099	0.0084J	0.0079
FL03-0618-C0F	16:05	16	5		0.38		1.10		0.088		0.019	
FL03-0618-C0I	16:45	16	45	1400	0.18	0.049	0.89	0.052	0.066	0.0054	0.011	0.0020
FL03-0618-C00F	16:05	16	5		0.27		0.97		0.063		0.016	
FL03-0618-C00I	16:45	16	45	1400	0.26	0.002	1.00	-0.007	0.082	-0.0047	0.012	0.0010
STATION MEAN NUTRIENT EXCHANGE RATE (gr/m^2/day):						**0.070**		**0.086**		**0.0088**		**0.0059**

*Chambers 2 - 4 were contact chambers, while chambers 0 & 00 were blank chambers, as indicated in the sample suffix.

**Chamber 1 data not included due to the chamber leaking.

***See Section 5.0 for data qualifier definitions.

Table B4: Station FL04 NUTX Summary - June 4-5, 2018 / Water Depth: 30.6 feet /Sediment Description: Silty Pudding												
Sample	Time	HOURS	MIN.	ET	NH_3	gr NH_3/m^2/day	TKN	gr TKN/m^2/day	TP	gr Total P/m^2/day	TDP	gr Total DP/m^2/day
FL04-0618-C01F	12:10	12	10		1.100		2.00		0.16		0.076	
FL04-0618-C01I	16:25	16	25	1185	0.630	0.137	1.3H-6	0.204	0.092	0.0198	0.021	0.0160
FL04-0618-C02F	12:20	12	20		1.100		1.9J,QM-1		0.15		0.088	
FL04-0618-C02I	16:35	16	35	1185	0.610	0.143	1.30	0.175	0.11	0.0117	0.017	0.0207
FL04-0618-C03F	12:20	12	20		1.000		1.90		0.15		0.078	
FL04-0618-C03I	16:35	16	35	1185	0.600	0.117	1.60	0.087	0.130	0.0058	0.018H-6	0.0175
FL04-0618-C04F	12:10	12	10		2.000		2.90		0.23		0.15H-6	
FL04-0618-C04I	16:25	16	25	1185	0.680	0.385	1.50	0.408	0.120	0.0321	0.024H-6	0.0367
FL04-0618-C0F	12:00	12	0		0.890		##		##		0.054H-6	
FL04-0618-C0I	16:10	16	10	1190	0.650	0.070	##		##		0.031H-6	0.0067
FL04-0618-C00F	12:00	12	0		0.620		1.30		0.078		0.027	
FL04-0618-C00I	16:10	16	10	1190	0.620	0.000	1.30	0.000	0.088	-0.0029	0.024	0.0009
STATION MEAN NUTRIENT EXCHANGE RATE (gr/m^2/day):						**0.161**		**0.219**		**0.0203**		**0.0190**

*Chambers 1 - 4 were contact chambers, while chambers 0 & 00 were blank chambers, as indicated in the sample suffix.

***See Section 5.0 for data qualifier definitions.

The initial samples from chamber C0 for TKN and TP were broken by the SESD laboratory by accident and not included in the analysis

END OF REPORT