North Carolina (NOC) **NERR Water Quality Metadata**
January 1, 2020 – December 31, 2020
Latest Update: **June 29, 2022**

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

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2) Entry verification –

Deployment data are uploaded from the YSI data logger to a personal computer with Windows 7 or newer operating system. Files are exported from EcoWatch in a comma-delimited format (.CDF) , EcoWatch Lite in a comma separated file (CSV) or KOR Software in an Excel File (.XLS) and uploaded to the CDMO where they undergo automated primary QAQC; automated depth/level corrections for changes in barometric pressure (cDepth or cLevel parameters); and become part of the CDMO's online provisional database. All pre- and post-deployment data are removed from the file prior to upload. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the reserve for secondary QAQC where it is opened in Microsoft Excel and processed using the CDMO's NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, remove any overlapping deployment data, append files, and export the resulting data file for upload to the CDMO. Upload after secondary QAQC results in ingestion into the database as provisional plus data, recalculation of cDepth or cLevel parameters, and finally tertiary QAQC by the CDMO and assimilation into the CDMO's authoritative online database. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is generally accepted as being the most accurate. For more information on QAQC flags and codes, see Sections 11 and 12. All QA/QC by the Reserve are performed by Heather Wells and Byron Toothman.

3) Research objectives –

Four long-term water quality monitoring stations have been established within the estuaries bordering Masonboro and Zeke's Islands of North Carolina's National Estuarine Research Reserve. Instruments are deployed vertically at all sites except East Cribbings, which was anchored to the bottom for the majority of

2012. The East Cribbings site was converted to a vertical deployment structure on December 4, 2012. Measurements are taken at 15-minute intervals for approximately two to four week periods continuously throughout the year. Parameters measured include Depth, Temperature, Salinity, Specific Conductivity, pH, Dissolved Oxygen, and Turbidity. The goal is to assess short-term variability and long-term changes (i.e., localized impacts of seasonal storm events, inter-annual differences from rainfall, magnitude of climatic influence from El Nino/La Nina events, etc.) in estuarine water parameters within relatively pristine sites.

4) Research methods –

The Estuarine Water Quality Monitoring Program began on March 2, 1992 at the Research Creek site of the Masonboro Island component. A second Masonboro Island site, Loosin Creek, was added on February 26, 2002. Data collection started on May 19, 1994 at the Zeke's Island component (East Cribbings site) and an additional site, Zeke's Basin, was added March 1, 2002. The procedures described below were instituted in June 1995 and thus do not cover data recorded previously.

Two data loggers are assigned to each of the four permanent monitoring stations and are generally not interchanged among sites unless malfunctions occur. Before each YSI EXO2 or YSI 6600EDS sonde is deployed, calibration and maintenance is performed following the manufacturer's instructions. Calibration standards are required for pH, turbidity and salinity; all other parameter calibrations are performed as described in the manual. Buffer solutions for a two-point pH calibration (pH 7 and 10) are purchased pre-made from a scientific supply house. The conductivity and turbidity standards are obtained from YSI. Chlorophyll probes are calibrated with deionized waterand rhodamine standard . The optical dissolved oxygen probes (ROX) require membrane changes yearly unless scratches or malfunctions occur prior to that time. All sites have been monitored using ROX dissolved oxygen probes since 2009, prior to that time rapid pulse dissolved oxygen probes were used. The rapid pulse membranes were replaced prior to each deployment and allowed to equilibrate prior to calibration.

Data sondes are wrapped in a wet, white towel and placed in a cooler for transport to the site. Monitoring stations are accessed using a small boat equipped with an outboard motor. During deployment the weather conditions and tide stage are recorded in the field observation log. The water quality instrument is placed inside a locked PVC tube that is attached to a piling if vertical deployment, and a steel cage if anchored horizontally approximately (15cm off the bottom). Every 15 minutes measurements are taken for Temperature, Specific Conductance, Salinity, Dissolved oxygen saturation, Dissolved oxygen concentration, Depth, pH, and Turbidity. All data are recorded in Eastern Standard Time. Vertical deployment structures were utilized at Research Creek beginning in 2008-2009, at Loosin Creek in 2009, and at Zeke's Basin in August 2010.

During 2020, chlorophyll data was collected at East Cribbings, Loosin Creek, and Research Creek stations. A two point (0 NTU and 66ug/L) chlorophyll calibration using DI water (0) and rhodamine standard (66 ug/L) was performed prior to sonde deployments. Chlorophyll spikes and negative values were rejected, while elevated values may be flagged as suspect depending on field conditions. Delete this last sentence - We do not currently calibrate with a known concentration of phytoplankton from fluorometric analysis, Rhodamine solutions, or adjust the data with any correction.

At the end of the sample period the water quality instrument is exchanged with a freshly calibrated instrument and transported back to the laboratory wrapped in a wet, white towel. The weather and water quality measurements are again noted in the field observation log. The calibration drift and the effect of biofouling on the water quality instrument are documented by post-calibration protocols. The water quality data are then uploaded, and sent to CDMO for primary QAQC, and the instrument is cleaned and calibrated as noted previously.

A Sutron Sat-Link2 transmitter was installed at the (*insert station name*) station on mm/dd/yy and transmits data to the NOAA GOES satellite, NESDIS ID #3B032698. The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen-minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in

Section 2 above. The "real-time" telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO's authoritative online database. Provisional and authoritative data are available at www.nerrsdata.org.

5) Site location and character –

The components of North Carolina's National Estuarine Research Reserve (from north to south) are: Currituck Banks, Rachel Carson, Masonboro Island, and Zeke's Island. They are located along the southeast Atlantic coast of the United States. Currently, only data from Masonboro Island and Zeke's Island components are transferred to the CDMO. The four monitoring sites are:

A. Research Creek, Masonboro Island

The first Masonboro Island site (formerly called Masonboro Island (MS)) is 0.72 km north east from the mouth of Whiskey Creek, and east of the Intracoastal Waterway (ICW), in a small navigable channel called Research Creek at 34°09'21.7" latitude and 77° 50'59.9" longitude. The site typically has a salinity range of 20-35 ppt and a tidal range that averages around 1.2 meters. The sole source of freshwater is rain and salinity values as little as 10 ppt have been recorded during periods of heavy rain. The creek bottom is characterized by sand and detritus based sediment with areas of soft mud with a depth ranging from 0.2 to 2.6 m. Spartina spp. marsh and dunes surround the site, which is relatively unimpacted by manmade perturbations and it is not accessible to road traffic. The site experiences minimal boat traffic.

B. Loosin Creek, Masonboro Island

The second Masonboro Island site (added in 2002) is 1.2 km east of the ICW, and 2.5 km south west of Masonboro Inlet, in a small navigable channel called Loosin Creek at 34° 10'20.0" latitude and 77° 49'58.1" longitude. The site generally has a salinity range of 22-35 ppt and a tidal range that averages 1.2 meters. The sole source of freshwater is rain and salinity values as little as 15 ppt have been recorded during periods of heavy rain. The creek bottom is characterized by sand and detritus based sediment with areas of soft mud with a depth ranging from 0.1 to 2.5 m. Spartina spp. marsh and dunes surround the site, which is relatively unimpacted by manmade perturbations and it is not accessible to road traffic. The site experiences minimal boat traffic.

C. East Cribbings, Zeke's Island

The first Zeke's Island site (formerly called Zeke's Island (ZI)) is located 1.8 km south of Federal Point boat launch in a tidal basin estuary at 33° 56'23.5" latitude and 77° 56'28.1" longitude. This site receives minimal freshwater input from leakage of the Cape Fear River through the 5.6 km rock jetty that separates the two bodies of water. The site typically has a salinity range of 15-33 ppt, although values as little as 10 ppt have been recorded. Tidal range averages 1.2 meters. Depth varies, but usually can be found to range from 0.5 to 2.7 meters. Bottom type substratum consists of large rocks ("the cribbings") with sand and detritus based sediment. There are no pollutants from land. Marsh and dunes surround the site. It is not accessible to road traffic but experiences minimal boat traffic.

D. Zeke's Basin, Zeke's Island

The second Zeke's Island site (added in 2002) is located 0.8 km south east of the Federal Point boat launch in a tidal basin estuary at 33° 57'17.0" latitude and 77° 56'6.0" longitude. This site receives minimal freshwater input from leakage of the Cape Fear River through the 5.6 km rock jetty that separates the two bodies of water The site has a characteristic salinity range of 12-30 ppt, but values below 10 ppt have been observed and are often associated with periods of heavy rainfall. Tidal range averages 1.2 meters. Depth varies, but typically it can be found to range from 0.1 to 1.8 meters. Bottom type substratum consists of sand and detritus based sediment with a layer of soft sulfuric mud. Marsh and dunes surround the site. It is not accessible to road traffic but experiences minimal boat traffic.

SWMP Station Timeline

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
NOCECWQ	P	East Cribbing	33° 56' 23.64 N, 77° 56' 27.96 W	01/01/2002 00:00 -	NA	NA
NOCLCWQ	P	Loosin Creek	34° 10' 19.92 N, 77° 49' 58.08 W	02/01/2002 00:00 -	NA	NA
NOCRCWQ	P	Research Creek	34° 9' 21.60 N, 77° 50' 59.64 W	01/01/2002 00:00 -	NA	NA
NOCZBWQ	P	Zeke's Basin	33° 57' 16.92 N, 77° 56' 6.00 W	03/01/2002 00:00 -	NA	NA

6) Data collection period –

East Cribbings

East Cribbings

Deployment		Retrieval		Sonde Model					
Date	Time	Date	Time	(Nickname)	pH	DO	Turb	Cond	Chloro
12/12/2019	10:30	1/14/2020	12:30	EXO2 (#1)	599702	599100-01	599101-01	599827	599102-01
1/14/2020	13:00	2/11/2020	12:30	EXO2 (#5)	599702	599100-01	599101-01	599827	599102-01
2/11/2020	12:45	3/24/2020	10:15	EXO2 (#1)	599702	599100-01	599101-01	599827	599103-01
3/24/2020	10:30	5/13/2020	16:00	EXO2 (#5)	599702	599100-01	599101-01	599827	599102-01
5/13/2020	16:15	6/23/2020	13:00	EXO2 (#1)	599702	599100-01	599101-01	599827	599103-01
6/23/2020	14:15	7/27/2020	16:45	EXO2 (#5)	599702	599100-01	599101-01	599827	599102-01
7/27/2020	17:00	*	*	EXO2 (#1)	599702	599100-01	599101-01	599827	599103-01
10/21/2020	15:15	11/19/2020	17:30	EXO2 (#5)	599702	599100-01	599101-01	599827	599103-01
11/19/2020	17:45	12/17/2020	15:15	EXO2 (#9)	599702	599100-01	599101-01	599827	599102-01
12/17/2020	15:45	1/19/2021	16:15	EXO2 (#5)	599702	599100-01	599101-01	599827	599103-01

* the 07/27/2020 deployment was not available for download as the sonde was lost during Hurricane Isaias

** deployments paused until temporary structure in place, no data collected 07/27/2020 - 10/21/2020

Loosin Creek

Deployment		Retrieval		Sonde Model					
Date	Time	Date	Time	(Nickname)	pH	DO	Turb	Cond	Chloro
12/11/2019	10:30	1/15/2020	12:45	EXO2 (#2)	599702	599100-01	599101-01	599827	599103-01
1/15/2020	13:00	2/12/2020	13:00	EXO2 (#3)	599702	599100-01	599101-01	599827	599103-01
2/12/2020	13:15	3/20/2020	16:15	EXO2 (#6)	599702	599100-01	599101-01	599827	599103-01
3/20/2020	16:30	5/13/2020	14:45	EXO2 (#3)	599702	599100-01	599101-01	599827	599103-01
5/13/2020	15:00	6/23/2020	11:00	EXO2 (#2)	599702	599100-01	599101-01	599827	599103-01
6/23/2020	12:15	7/27/2020	15:00	EXO2 (#3)	599702	599100-01	599101-01	599827	599103-01
7/27/2020	15:15	8/25/2020	15:00	EXO2 (#2)	599702	599100-01	599101-01	599827	599103-01
8/25/2020	15:30	9/22/2020	16:45	EXO2 (#3)	599702	599100-01	599101-01	599827	599103-01
9/22/2020	17:00	10/21/2020	13:00	EXO2 (#2)	599702	599100-01	599101-01	599827	599103-01
10/21/2020	13:15	11/5/2020	16:00	EXO2 (#3)	599702	599100-01	599101-01	599827	599103-01
11/5/2020	16:15	11/19/2020	15:45	EXO2 (#2)	599702	599100-01	599101-01	599827	599103-01
11/19/2020	16:00	12/17/2020	13:45	EXO2 (#2)	599702	599100-01	599101-01	599827	599103-01
12/17/2020	14:00	1/20/2021	15:45	EXO2 (#3)	599702	599100-01	599101-01	599827	599103-01

Research Creek

Deployment		Retrieval		Sonde Model					
Date	Time	Date	Time	(Nickname)	pH	DO	Turb	Cond	Chloro
12/11/2019	10:15	1/15/2020	15:15	EXO2 (#6)	599702	599100-01	599101-01	599827	599103-01
1/15/2020	15:45	2/12/2020	13:15	EXO2 (#8)	599702	599100-01	599101-01	599827	599103-01
2/12/2020	13:45	3/20/2020	16:30	EXO2 (#6)	599702	599100-01	599101-01	599827	599103-01
3/20/2020	16:45	5/13/2020	14:15	EXO2 (#8)	599702	599100-01	599101-01	599827	599103-01
5/13/2020	14:30	6/23/2020	11:15	EXO2 (#6)	599702	599100-01	599101-01	599827	599103-01
6/23/2020	12:45	7/27/2020	14:30	EXO2 (#8)	599702	599100-01	599101-01	599827	599103-01
7/27/2020	14:45	7/31/2020	12:15	EXO2 (#6)	599702	599100-01	599101-01	599827	599103-01
10/21/2020	12:45	11/5/2020	14:30	EXO2 (#8)	599702	599100-01	599101-01	599827	599103-01
11/5/2020	15:00	12/17/2020	13:30	EXO2 (#6)	599702	599100-01	599101-01	599827	599103-01
12/17/2020	13:45	1/20/2021	15:45	EXO2 (#8)	599702	599100-01	599101-01	599827	599103-01

* deployments paused until temporary deployment structure in place, no data collected 07/31/2020 - 10/21/2020

Zeke's Basin

Deployment		Retrieval		Sonde Model					
Date	Time	Date	Time	(Nickname)	pH	DO	Turb	Cond	Chloro
12/12/2019	12:00	1/14/2020	12:45	EXO2 (#9)	599702	599100-01	599101-01	599827	599103-01
1/14/2020	13:00	2/11/2020	12:45	EXO2 (#7)	599702	599100-01	599101-01	599827	599103-01
2/11/2020	13:00	3/24/2020	10:15	EXO2 (#9)	599702	599100-01	599101-01	599827	599103-01
3/24/2020	10:30	5/13/2020	16:15	EXO2 (#7)	599702	599100-01	599101-01	599827	599103-01
5/13/2020	16:30	6/23/2020	13:15	EXO2 (#4)	599702	599100-01	599101-01	599827	599103-01
6/23/2020	14:30	7/27/2020	17:15	EXO2 (#7)	599702	599100-01	599101-01	599827	599103-01
7/27/2020	17:30	8/25/2020	16:45	EXO2 (#4)	599702	599100-01	599101-01	599827	599103-01
8/25/2020	17:00	9/22/2020	18:00	EXO2 (#7)	599702	599100-01	599101-01	599827	599103-01
9/22/2020	18:15	10/21/2020	15:15	EXO2 (#4)	599702	599100-01	599101-01	599827	599103-01
10/21/2020	15:30	11/5/2020	13:00	EXO2 (#7)	599702	599100-01	599101-01	599827	599103-01
11/5/2020	13:15	12/17/2020	15:45	EXO2 (#4)	599702	599100-01	599101-01	599827	599103-01
12/17/2020	16:00	1/14/2021	12:45	EXO2 (#7)	599702	599100-01	599101-01	599827	599103-01

7) Distribution –

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The NERRS retains the right to be fully credited for having collected and process the data. Following academic courtesy standards, the NERR site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

Requested citation format:
NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: http://www.nerrsdata.org/; *accessed* 12 October 2020.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Principal Investigators and Contact Persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page www.nerrsdata.org. Data are available in comma delimited format.

8) Associated researchers and projects –

As part of the SWMP long-term monitoring program, NOC NERR also collects 15-minute meteorological data and monthly grab and diel samples for nutrient/pigment data which may be correlated with this water quality dataset. These data are available at www.nerrsdata.org.

Additional research projects are ongoing and continually changing. Check with the Research Coordinator or other contact person for an updated list of research.

II. Physical Structure Descriptors

9) Sensor specifications –

NOC NERR deployed Xylem Analytics EXO data sondes at all sites in 2020. All sondes used are the same model (EXO2) and employ the same sensor configuration.

YSI EXO Sonde:

Parameter: Temperature
Units: Celsius (C)
Sensor Type: CT2 probe, Thermistor
Model#: 599870
Range: -5 to 50 C
Accuracy: -5 to 35: +/- 0.01, 35 to 50: +/- .005
Resolution: 0.01 C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: CT2 probe, 4-electrode cell with autoranging
Model#: 599870
Range: 0 to 200 mS/cm
Accuracy: 0 to 100: +/- 0.5% of reading or 0.001 mS/cm; 100 to 200: +/- 1% of reading
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependant)

Parameter: Salinity
Units: practical salinity units (psu)/parts per thousand (ppt)
Sensor Type: CT2 probe, Calculated from conductivity and temperature
Range: 0 to 70 psu
Accuracy: +/- 1.0% of reading pr 0.1 ppt, whichever is greater
Resolution: 0.01 psu

OR

Parameter: Temperature
Units: Celsius (C)
Sensor Type: Wiped probe; Thermistor
Model#: 599827
Range: -5 to 50 C
Accuracy: ±0.2 C
Resolution: 0.001 C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: Wiped probe; 4-electrode cell with autoranging

Model#: 599827
Range: 0 to 100 mS/cm
Accuracy: ±1% of the reading or 0.002 mS/cm, whichever is greater
Resolution: 0.0001 to 0.01 mS/cm (range dependent)

Parameter: Salinity
Units: practical salinity units (psu)/parts per thousand (ppt)
Model#: 599827
Sensor Type: Wiped probe; Calculated from conductivity and temperature
Range: 0 to 70 ppt
Accuracy: ±2% of the reading or 0.2 ppt, whichever is greater
Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 599100-01
Range: 0 to 500% air saturation
Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 5% or reading
Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)
Units: milligrams/Liter (mg/L)
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 599100-01
Range: 0 to 50 mg/L
Accuracy: 0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater
20 to 50 mg/L: +/- 5% of the reading
Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)
Units: feet or meters (ft or m)
Sensor Type: Stainless steel strain gauge
Range: 0 to 33 ft (10 m)
Accuracy: +/- 0.013 ft (0.004 m)
Resolution: 0.001 ft (0.001 m)

Parameter: pH
Units: pH units
Sensor Type: Glass combination electrode
Model#: 599701(guarded) or 599702(wiped)
Range: 0 to 14 units
Accuracy: +/- 0.1 units within +/- 10° of calibration temperature, +/- 0.2 units for entire temperature range
Resolution: 0.01 units

Parameter: Turbidity
Units: formazin nephelometric units (FNU)
Sensor Type: Optical, 90 degree scatter
Model#: 599101-01
Range: 0 to 4000 FNU
Accuracy: 0 to 999 FNU: 0.3 FNU or +/-2% of reading (whichever is greater); 1000 to 4000 FNU +/-5% of reading
Resolution: 0 to 999 FNU: 0.01 FNU, 1000 to 4000 FNU: 0.1 FNU

Parameter: Chlorophyll
Units: micrograms/Liter
Sensor Type: Optical probe
Model#: 599102-01
Range: 0 to 400 ug/Liter
Accuracy: Dependent on methodology
Resolution: 0.1 ug/L chl a, 0.1% FS

Depth Qualifier:
The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either vented or non-vented depth/level sensors. Readings for both vented and non-vented sensors are automatically compensated for water density change due to variations in temperature and salinity; but for all non-vented depth measurements, changes in atmospheric pressure between calibrations appear as changes in water depth. The error is equal to approximately 1.02 cm for every 1 millibar change in atmospheric pressure, and is eliminated for vented sensors because they are vented to the atmosphere throughout the deployment time interval.

Beginning in 2006, NERR SWMP standard calibration protocol calls for all non-vented depth sensors to read 0 meters at a (local) barometric pressure of 1013.25 mb (760 mm/hg). To achieve this, each site calibrates their depth sensor with a depth offset number, which is calculated using the actual atmospheric pressure at the time of calibration and the equation provided in the SWMP calibration sheet or digital calibration log. This offset procedure standardizes each depth calibration for the entire NERR System. If accurate atmospheric pressure data are available, non-vented sensor depth measurements at any NERR can be corrected.

In 2010, the CDMO began automatically correcting depth/level data for changes in barometric pressure as measured by the reserve's associated meteorological station during data ingestion. These corrected depth/level data are reported as cDepth and cLevel, and are assigned QAQC flags and codes based on QAQC protocols. Please see sections 11 and 12 for QAQC flag and code definitions.

NOTE: older depth data cannot be corrected without verifying that the depth offset was in place and whether a vented or non-vented depth sensor was in use. No SWMP data prior to 2006 can be corrected using this method. The following equation is used for corrected depth/level data provided by the CDMO beginning in 2010:
((1013-BP)*0.0102)+Depth/Level = cDepth/cLevel.

Salinity Units Qualifier:
In 2013, EXO sondes were approved for SWMP use and began to be utilized by reserves. While the 6600 series sondes report salinity in parts per thousand (ppt) units, the EXO sondes report practical salinity units (psu). These units are essentially the same and for SWMP purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the NERR System will assign psu salinity units for all data regardless of sonde type.

Turbidity Qualifier:
In 2013, EXO sondes were approved for SWMP use and began to be utilized by reserves. While the 6600 series sondes report turbidity in nephelometric turbidity units (NTU), the EXO sondes use formazin nephelometric units (FNU). These units are essentially the same but indicate a difference in sensor methodology, for SWMP purposes they will be considered equivalent. Moving forward, the NERR System will use FNU/NTU as the designated units for all turbidity data regardless of sonde type. If turbidity units and sensor methodology are of concern, please see the Sensor Specifications portion of the metadata.

Chlorophyll Fluorescence Disclaimer:
YSI chlorophyll sensors (6025 or 599102-01) are designed to serve as a proxy for chlorophyll concentrations in the field for monitoring applications and complement traditional lab extraction methods; therefore, there are accuracy limitations associated with the data that are detailed in the YSI manual including interference from other fluorescent species, differences in calibration method, and effects of cell structure, particle size, organism type, temperature, and light on sensor measurements.

10) Coded variable definitions –

Sampling station: Sampling site code: Station code:

Sampling station:	Sampling site code:	Station code:
Research Creek	RC	nocrcwq
Loosin Creek	LC	noclcwq
East Cribbings	EC	nocecwq
Zeke's Basin	ZB	noczbwq

11) QAQC flag definitions –

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter's associated flag column (header preceded by an F_). During primary automated QAQC (performed by the CDMO), -5, -4, and -2 flags are applied automatically to indicate data that is missing and above or below sensor range. All remaining data are then flagged 0, passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range
-4 Outside Low Sensor Range
-3 Data Rejected due to QAQC
-2 Missing Data
-1 Optional SWMP Supported Parameter
0 Data Passed Initial QAQC Checks
1 Suspect Data
2 *Open - reserved for later flag*
3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
4 Historical Data: Pre-Auto QAQC
5 Corrected Data

12) QAQC code definitions –

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the deployment or YSI datasonde, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an * below) can be applied to the entire record in the F_Record column.

General Errors

GIC	No instrument deployed due to ice
GIM	Instrument malfunction
GIT	Instrument recording error; recovered telemetry data

GMC	No instrument deployed due to maintenance/calibration
GNF	Deployment tube clogged / no flow
GOW	Out of water event
GPF	Power failure / low battery
GQR	Data rejected due to QA/QC checks
GSM	See metadata

Corrected Depth/Level Data Codes

GCC	Calculated with data that were corrected during QA/QC
GCM	Calculated value could not be determined due to missing data
GCR	Calculated value could not be determined due to rejected data
GCS	Calculated value suspect due to questionable data
GCU	Calculated value could not be determined due to unavailable data

Sensor Errors

SBO	Blocked optic
SCF	Conductivity sensor failure
SCS	Chlorophyll spike
SDF	Depth port frozen
SDG	Suspect due to sensor diagnostics
SDO	DO suspect
SDP	DO membrane puncture
SIC	Incorrect calibration / contaminated standard
SNV	Negative value
SOW	Sensor out of water
SPC	Post calibration out of range
SQR	Data rejected due to QAQC checks
SSD	Sensor drift
SSM	Sensor malfunction
SSR	Sensor removed / not deployed
STF	Catastrophic temperature sensor failure
STS	Turbidity spike
SWM	Wiper malfunction / loss

Comments

CAB*	Algal bloom
CAF	Acceptable calibration/accuracy error of sensor
CAP	Depth sensor in water, affected by atmospheric pressure
CBF	Biofouling
CCU	Cause unknown
CDA*	DO hypoxia (<3 mg/L)
CDB*	Disturbed bottom
CDF	Data appear to fit conditions
CFK*	Fish kill
CIP*	Surface ice present at sample station
CLT*	Low tide
CMC*	In field maintenance/cleaning
CMD*	Mud in probe guard
CND	New deployment begins
CRE*	Significant rain event
CSM*	See metadata
CTS	Turbidity spike
CVT*	Possible vandalism/tampering
CWD*	Data collected at wrong depth
CWE*	Significant weather event

13) Post deployment information –

East Cribbings

Deployment	Sonde	SpCond	DO	pH	pH	Turb	Depth	Chlorophyll
Date	(nickname)	(50.0)	(100.0)	(7.0)	(10.0)	0.0	(varies)	0.0
12/12/2019	#1	51.19	100	7.1	9.83	1.74	0.096(-0.083)	0.14
1/14/2020	#5	50.13	100.5	7.02	10.08	0.52	0.083(0.079)	-0.03
2/11/2020	#1	49.85	99.8	8.38	11.01	-0.03	0.025(0.027)	-0.01
3/24/2020	#5	50.93	100.9	8.3	10.28	-0.93	0.037(0.0)	-0.04
5/13/2020	#1	51.23	99.1	7.14	10.36	0.15	0.0080(0.0060)	0.14
6/23/2020	#5	52.53	99.5	6.98	9.98	0.1	-0.022(-0.0040)	-0.49
10/21/2020	#5	51.33	98.2	6.93	9.93	1.46	0.081(0.058)	0.31
11/19/2020	#9	51.35	108.9	7.1	9.96	-1.07	0.214(0.0)	0.44
12/17/2020	#5	51.58	99.2	7.06	9.92	2.08	(0.025)	0.26

Loosin Creek

Deployment	Sonde	SpCond	DO	pH	pH	Turb	Depth	Chlorophyll
Date	(nickname)	(50.0)	(100.0)	(7.0)	(10.0)	0.0	(varies)	0.0
12/11/2019	#2	54.83	100.5	6.87	9.81	1.3	0.104(-0.084)	0.4
1/15/2020	#3	49.55	100.2	7.14	10.04	-0.77	0.077(0.079)	-0.18
2/12/2020	#6	50.4	98.3	7.13	9.99	0.35	0.076(0.038)	0
3/20/2020	#3	48.85	100.1	7.13	9.88	1.87	-0.027(0.0)	-0.44
5/13/2020	#2	47.75	99	7.19	10.05	9.16	0.0090(0.0060)	1.68
6/23/2020	#3	47.8	99.9	7.17	10.01	3.2	-0.019(-0.0040)	-0.25
7/27/2020	#2	51.57	101.2	6.97	10.07	0.38	0.076(0.12)	0.05
8/25/2020	#3	47.35	100	7.08	9.97	0.23	0.105(0.1)	-0.12
9/22/2020	#2	50.8	99.5	7.22	10.17	49.34	0.158(0.141)	6.67
10/21/2020	#3	51.67	100.7	7.02	10.01	1.15	0.06(0.058)	0.13
11/5/2020	#2	51.17	101.5	7.03	10.08	-0.22	0.107(0.131)	-2.52
11/19/2020	#2	*	*	*	*	*	*	*
12/17/2020	#3	51.84	102.1	7.01	10.07	1.43	0.051(-0.025)	0.22

* deployment log sheet not saved properly, no post claibration data available for 11/19/2020 deployment

Research Creek

Deployment	Sonde	SpCond	DO	pH	pH	Turb	Depth	Chlorophyll
Date	(nickname)	(50.0)	(100.0)	(7.0)	(10.0)	0.0	(varies)	0.0
12/11/2019	#6	50.85	100.6	7.19	10.1	1.08	0.075(-0.083)	0.61
1/15/2020	#8	50.05	100.1	7.31	10.18	-0.03	0.07(0.079)	-0.01
2/12/2020	#6	50.6	99.7	7.17	10.21	1.27	0.038(0.038)	0.26
3/20/2020	#8	51.31	99.6	7.01	9.91	1.07	-0.015(0.0)	-0.35
5/13/2020	#6	50.48	99.5	7.18	9.91	0.07	-0.036(-0.042)	0.29
6/23/2020	#8	50.05	100.8	7.19	10.01	0.03	0.055(0.0)	0.3
7/27/2020	#6	50.78	98.3	7.02	9.94	0.27	0.021(0.0070)	-0.19
10/21/2020	#8	51.14	100.2	6.98	9.98	0.79	0.084(0.058)	-0.34
11/5/2020	#6	51.62	100.7	7.06	10.06	-1.02	0.097(0.12)	0.74
12/17/2020	#8	51.76	99.8	7.07	10.02	1.03	-0.0060(-0.014)	-0.07

Zeke's Basin

Deployment	Sonde	SpCond	DO	pH	pH	Turb	Depth	Chlorophyll
Date	(nickname)	(50.0)	(100.0)	(7.0)	(10.0)	0.0	(varies)	0.0
12/12/2019	#9	51.45	100.3	6.76	6.7	-0.16	0.089(-0.083)	0.64
1/14/2020	#7	49.99	99.3	7.24	10.2	0.07	0.065(0.069)	0.03
2/11/2020	#9	49.72	51.5	7.35	10.24	5.77	-0.027	4.11
3/24/2020	#7	53.11	95.4	7.44	9.66	90.5	0.063(0.0)	0.5
5/13/2020	#4	50.71	99.5	7.17	9.94	0.61	-0.043(-0.042)	0.7
6/23/2020	#7	49.09	99.2	7.04	9.9	336.41	-0.0060(0.0)	3.54
7/27/2020	#4	51.44	101.1	7.0	10.09	1.22	0.117(0.12)	0.18
8/25/2020	#7	50.82	100.4	7.06	9.92	0.17	0.075(0.1)	0.01
9/22/2020	#4	50.67	100.7	7.1	9.94	0.08	0.145(0.141)	-0.22
10/21/2020	#7	51.93	100.8	7.02	9.95	1.81	0.037(0.058)	-0.08
11/5/2020	#4	51.26	101.2	7.23	10.11	-0.2	0.104(0.12)	-0.04
12/17/2020	#7	51.96	99.7	7.14	10.18	0.53	-0.0050(-0.014)	0.96

*Note: pH post-deployment readings are temperature dependent and minor variations are expected as a result.

14) Other remarks/notes –

Data are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. Any NANs in the dataset stand for "not a number" and are the result of low power, disconnected wires, or out of range readings. If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.

For all data
New deployments were flagged as <0> (CND).

Temperature affected measurements (SpCond/Salinity, pH) were rejected anytime the temperature sensor was affected by out of water events (pronounced change in temp values during extreme low tide readings).

Data affected by low tide were coded (CLT). Lower SpCond/Salinity was addressed with <1> (CLT) due to the probability of fresher surface waters being measured as the water level decreased. Salinities approaching zero or less were addressed as <-3> [GOW] (CLT) and affected data were also rejected accordingly.

All depth data corresponding to rejected or suspect SpCond/Salinity data (due to low tide) were also rejected <-3> [SOW] (CLT) or flagged as suspect <1>[SOW](CLT). Depth sensor is located above Conductivity/Temperature (C/T) sensor and will be exposed when SpCond approaches 0.0. It is possible that some probes were still in the water during out of water events. The vertical orientation of the sondes means that shorter probes (pH, C/T) will be affected before longer probes (dissolved oxygen, turbidity).

All negative depth flagged and rejected unless affected by barometric pressure and coded as suspect <1> [SNV] (CAP).

Dissolved oxygen concentrations < 3 mg/L were coded <0> (CDA) along with corresponding values for DO% during hypoxic events.

Increased turbidity readings occurred throughout many deployments with unknown causes and were coded as such:
<-3> [STS] (CCU) = rejected turbidity spike
<1> [STS] (CCU) = Suspect turbidity spike

Small negative turbidity values < -2 NTU were flagged as suspect, <1> (CAF).

Negative chlorophyll values were flagged as <-3> [SNV] (CSM).

Chlorophyll spikes were flagged as suspect <1> [SCS] (CCU), or rejected <-3> [SCS] (CCU).

All sites were impacted by a time stamp error, temporarily showing missing data for one hour on 06/23/2020. There is a possibility that the time stamp error occurred during 03/20/20 and 03/24/20 or 05/13/2020 deployments. During this time, the COVID 19 pandemic impacted our research facilities. As facility resources were limited to essential workers, the laboratory was moved and a newer version of the KOR software was utilized. The 03/20/2020 and 03/24/20 deployments were programmed and began logging with an older version of KOR for all sondes. Time stamp errors were corrected during quarterly QA/QC but an error is still present and will be corrected with ongoing QAQC and updated in corrected data.

Hurricane Isaias affected the NC NERR SWMP stations 8/3/2020 – 8/5/2020. F_Record column flagged <0> (CWE) for East Cribbings and Zeke's Basin. A small storm surge was associated with this storm.

East Cribbings

General

This station was converted to EXO2 sondes during 2015, beginning with the 09/15/2015 deployment.

This site has had increasing problems with mud and silt in the deployment tube, affected readings and filling the guard above the level of the sensors. Affected data are flagged suspect or rejected with the CMD comment code indicating mud in sensor guard. This particularly affects turbidity, chlorophyll, and optical sensors. Chlorophyll may spike with turbidity in part by benthic microalga adsorbing to suspended sediment particles.

This site is within a shallow lagoonal system and the sonde is subject to out of water events, especially at spring low tides. (Vertical deployment has been in place since 12/04/12.)

The sonde and deployment structure were not recovered following Hurricane Isaias in early August 2020. The last collected data prior to this event was 07/27/2020. There was no in situ water quality data collected from 07/27/20 – 10/20/20. A temporary deployment structure was installed at the same location on 10/17/2020 and data collection resumed on 10/21/2020. Data following this time may have fluctuations in depth due to the anchored deployment structure that may shift between deployments, during storms or periods of high current activity.

Sonde was removed for maintenance and calibration check 02/12/2020 11:30 – 02/12/2020 14:15.

Data was missing sue to sonde swap on 12/17/2020 15:30.

Missing data due to a time stamp error, temporarily showing missing data for one hour on 06/23/2020. EC data missing 06/23/2020 13:15- 14:00. There is a possibility that the time stamp error occurred during 03/20/20 and 03/24/20 deployments or 05/13/2020 deployments. During this time, the COVID 19 pandemic impacted our research facilities. As facility access were limited to essential workers, the laboratory was moved and a newer version of the KOR software was utilized. The 03/20/2020 and 03/24/20 deployments were programmed and began logging with an older version of KOR for all sondes. Attempts were made to correct the timestamp error during quarterly QA/QC but an error is still present and will be corrected with ongoing QAQC and updated in corrected data.

Depth

There were several times that changes in barometric pressure affected the depth sensor. The depth records were flagged as suspect, <1> [SNV] (CAP) when the values were negative but the sensors were still in the water.

A temporary deployment structure was installed at the same location on 10/17/2020 and data collection resumed on 10/21/2020. Data following this time may have fluctuations in depth due to the anchored deployment structure that may shift between deployments, during storms or periods of high current activity.

During the use of the anchored deployment structure, out of water events occurred during some low tides: 11/29/2020 – 12/17/2020

SpCond/Salinity
This site experiences out of water events and may sample a fresh water lens in advance or following this events.

During the use of the anchored deployment structure, out of water events occurred during some low tides from 11/29/2020 – 12/17/2020. There were sometimes lower salinity values that may have been a result of sampling a fresh water lens.

Dissolved Oxygen
Dissolved oxygen data can be quite variable. These cycles often correlate with tidal fluctuation, and may be accentuated by presence of invasive drift algae, *Gracilaria vermiculophylla.*

Values above 100% saturation are not uncommon and values above 200% may occur during warmer months. These reflect conditions at the site, occurring at the same time as elevated pH values and data were retained (unless affected by out of water events, potentially driven by *G. vermiculophylla* presence). Data were not flagged as suspect though some of the upper limits for percent saturation were surpassed.

The following deployments did not pass post calibration with acceptable values with rejected or suspect data:
11/19/2020 post calibration values were elevated, data flagged as suspect

During the use of the anchored deployment structure, out of water events occurred during some low tides: 11/29/2020 – 12/17/2020

pH
pH postcal was unacceptable for the following deployments causing data to be flagged as suspect or rejected:
03/24/2020 pH values elevated in both 7 and 10 standards
05/13/2020 pH values elevated in 10 standard

During the use of the anchored deployment structure, out of water events occurred during some low tides: 11/29/2020 – 12/17/2020

Turbidity
Elevated turbidity readings were rejected or flagged as suspect.
Turb postcal was unacceptable for the following deployments causing data to be flagged as suspect or rejected.

03/24/2020 deployment, passed post calibration within acceptable range but had elevated values that were rejected 05/10/2020 through the end of deployment 05/13/2020.

During the use of the anchored deployment structure, out of water events occurred during some low tides: 11/29/2020 – 12/17/2020

Chlorophyll
Occasional chlorophyll spikes occurred and were flagged as suspect or rejected, cause unknown.

03/24/2020 deployment, passed post calibration within acceptable range but had elevated values that were rejected 05/10/2020 through the end of deployment 05/13/2020.

During the use of the anchored deployment structure, out of water events occurred during some low tides: 11/29/2020 – 12/17/2020. During this deployment, chlorophyll values were elevated compared to the previous and following deployments. This may be due to the sonde being in a slightly shallower location. Sensors passed post calibration within acceptable ranges for these deployments.

Loosin Creek

General

There were several times that changes in barometric pressure affected the depth sensor. The depth records were flagged as suspect, <1> [SNV] (CAP) when the values were negative but the sensors were still in the water.

Missing records due to sonde swap:
08/25/2020 15:15

Missing data due to a time stamp error, temporarily showing missing data for one hour on 06/23/2020. LC data missing 06/23/2020 11:15- 12:00. There is a possibility that the time stamp error occurred during 03/20/20 and 03/24/20 deployments or 05/13/2020 deployments. During this time, the COVID 19 pandemic impacted our research facilities. As facility access were limited to essential workers, the laboratory was moved and a newer version of the KOR software was utilized. The 03/20/2020 and 03/24/20 deployments were programmed and began logging with an older version of KOR for all sondes. Attempts were made to correct the timestamp error during quarterly QA/QC but an error is still present and will be corrected with ongoing QAQC and updated in corrected data.

The deployment log sheet was not saved properly for LC111920 deployment, there are no records for pre and post calibration values. The data appear to fit conditions for the site. We may be able to get calibration data off the sonde when it returns from repairs at YSI/Xylem.

SpCond/Salinity

Following Hurricane Isaias, which passed over the area on 08/03/2020 – 08/05/2020, the salinity data appeared particularly impacted.

The SpCond/Salinity post-calibration values were unacceptable for several deployment periods. All data were flagged as suspect or rejected for the following affected deployments:

12/11/2019 deployment, 01/01/2020 – 01/15/2020 post cal elevated, data flagged as suspect
05/13/2020 deployment, post cal low data from 05/13/2020 – 6/15/2020 suspect
06/15/2020 – 06/23/2020 data values low for the site, rejected
06/23/2020 – 07/27/2020 data values low for the site, rejected
08/25/2020 – 09/22/2020 entire deployment flagged as suspect

Turbidity

Elevated turbidity readings were rejected or flagged as suspect.
Turb postcal was unacceptable for the following deployments causing data to be flagged as suspect or rejected.

05/13/2020 post calibration values elevated
06/23/2020 post calibration values elevated,
data elevated and rejected from 06/28/2020 – 06/30/2020, other data fit conditions
09/22/2020 post calibration values elevated, suspect or rejected towards end of deployment

Chlorophyll
Occasional chlorophyll spikes occurred and were flagged as suspect or rejected, cause unknown.

09/22/2020 values were elevated beginning around 10/01/2020, flagged as suspect possibly biofouling. Beginning 10/12/2020 values continued to increase, also during elevated turbidity. This could have been due to increased biofouling and data was rejected through the end of the deployment. This sensor passed post calibration within acceptable range.

11/05/2020 deployment, some slightly negative values were rejected, this sensor passed post calibration within acceptable range.

Research Creek

General
There were several times that changes in barometric pressure affected the depth sensor. The depth records were flagged as suspect, <1> [SNV] (CAP) when the values were negative but the sensors were still in the water.

Sonde out of water for GPS occupation
01/29/2020 10:30 – 1/29/12:15

Data missing due to sonde swap 01/15/2020 15:30, 02/12/2020 13:30

Data were missing for unknown reason, battery voltage seemed adequate:
07/30/2020 02:30 – 05:30, 13:30 – 15:00, 16:15, 17:00 and 07/31/2020 03:00 – 07:00

Missing data due to a time stamp error, temporarily showing missing data for one hour on 06/23/2020. LC data missing 06/23/2020 11:15- 12:00. There is a possibility that the time stamp error occurred during 03/20/20 and 03/24/20 deployments or 05/13/2020 deployments. During this time, the COVID 19 pandemic impacted our research facilities. As facility access were limited to essential workers, the laboratory was moved and a newer version of the KOR software was utilized. The 03/20/2020 and 03/24/20 deployments were programmed and began logging with an older version of KOR for all sondes. Attempts were made to correct the timestamp error during quarterly QA/QC but an error is still present and will be corrected with ongoing QAQC and updated in corrected data.

Data were missing beginning 07/31/2020 from deployment structure failure. Piling was listing during routine service, staff returned to secure the piling prior to Hurricane Isaias, and structure was horizontal in the water. No sonde was deployed at this site for August – October. A temporary anchor mounted deployment structure was fabricated and deployed on 10/21/2020. Data following this time may have fluctuations in depth due to the anchored deployment structure that may shift between deployments, during storms or periods of high current activity.

Sonde maintenance resulted in out of water event on 11/04/15:00- 15:15, data rejected.

Turbidity
Elevated turbidity readings were rejected or flagged as suspect.

Some slightly negative turbidity values were reported in November 2020, flagged as suspect and within the calibrated accuracy of the sensor

Chlorophyll
Occasional chlorophyll spikes occurred and were flagged as suspect or rejected, cause unknown.

Zeke's Basin

General

There were several times that changes in barometric pressure affected the depth sensor. The depth records were flagged as suspect, <1> [SNV] (CAP) when the values were negative but the sensors were still in the water.

Sensors exposed during low tide. All affected data rejected
01/28/2020 12:00 - 01/28/2020 14:15

Missing data due to a time stamp error, temporarily showing missing data for one hour on 06/23/2020. LC data missing 06/23/2020 11:15- 12:00. There is a possibility that the time stamp error occurred during 03/20/20 and 03/24/20 deployments or 05/13/2020 deployments. During this time, the COVID 19 pandemic impacted our research facilities. As facility access were limited to essential workers, the laboratory was moved and a newer version of the KOR software was utilized. The 03/20/2020 and 03/24/20 deployments were programmed and began logging with an older version of KOR for all sondes. Attempts were made to correct the timestamp error during quarterly QA/QC but an error is still present and will be corrected with ongoing QAQC and updated in corrected data.

SpCond/Salinity

This site experiences out of water events and may sample a fresh water lens in advance or following this events.

The SpCond/Salinity post-calibration values were unacceptable for several deployment periods. All data were flagged as suspect or rejected for the following affected deployments:
03/24/2020 deployment, suspect through 05/03/2020
05/03/2020 – 05/13/2020 rejected due to QAQC checks and heavily fouled upon retrieval

pH

pH postcal was unacceptable for the following deployments causing data to be flagged as suspect or rejected.
03/24/2020 suspect until 05/03/2020, rejected decreased values from 05/03/2020 – 05/13/2020

12/31/2019 10:15 - 01/14/2020 12:45 pH sensor experienced random mid-deployment malfunction. Affected data rejected. Data appear to fit conditions through the end of the deployment but post calibrated lightly elevated beyond acceptable tolerance and flagged suspect.

Turbidity

Elevated turbidity readings were rejected or flagged as suspect.
Turb postcal was unacceptable for the following deployments causing data to be flagged as suspect or rejected.

03/24/3030 deployment, turbidity data flagged as suspect due to biofouling 05/04/2020 through 05/06/2020, then rejected 05/06/2020 through the end of deployment 05/13/2020
06/23/2020 deployment, suspect through 07/10/2020 then rejected until 07/27/2020

Chlorophyll

Occasional chlorophyll spikes occurred and were flagged as suspect or rejected, cause unknown.

03/24/3030 deployment, chlorophyll data rejected due to biofouling 05/06/2020 through the end of deployment 05/13/2020.

Depth
Missing depth data for unknown reasons following sonde deployment. Data began reporting spontaneously. Flagged -2 [SSM] (CSM) 02/13/2020 11:00 - 02/13/2020 11:00.