1.0 TITLE: Continuous water quality monitoring in Barnegat Bay, Version: v 2.0 January 2024

Significant changes in v 2.0

- Revised distribution list and project task organization
- Discontinued use of high precision pH monitoring using the SeaFET
- Removal of discreet samples for pCO2
- Data Quality Objectives:
    - Removal of depth, SeaFET pH, and Salinity
    - Changes in turbidity precision, and addition of specific conductivity
- Addition of Post deployment accuracy checks using criteria in Table 2 and how data are handled as a result of the change
- Update to Table 3 to follow the current manufacturers sensitivities
- Changes to the QA/QC process
    - Addition of alarms on real-time data platform to show data that fall outside of the expected ranges (Table 6)
    - Adjusted Temperature validation range and spiking test value to better represent conditions observed
    - Updated QA/QC guidelines including an SOP stating process and actions

QUALITY ASSURANCE PROJECT PLAN

Prepared by Nicole Petersen and Andrew McGowan, Barnegat Bay Partnership Original QAPP (2017) Prepared by James Vasslides, Barnegat Bay Partnership

Effective Date: 2/16/24

Project Duration: Ongoing.

Signatories: My signature below indicates my approval of the plan and my commitment to follow the procedures noted herein. I understand that changes to this plan shall not be made without approval/signature by all below signatories.

Approved by: Jenna Majchrzak 2024.02.16 08:18:27 -05'00' _____

Jenna Majchrzak, Quality Assurance Officer — date
NJDEP Office of Quality Assurance

Approved by: Eric Ernst Digitally signed by Eric Ernst Date: 2024.02.15 10:42:26 -05'00' _____

Eric Ernst, Project Officer — date
NJDEP Bureau of Marine Water Monitoring

Approved by: Nicole Petersen Digitally signed by Nicole Petersen Date: 2024.01.30 10:53:01 -05'00' _____

Nicole Petersen, Principal Investigator — date
Barnegat Bay Partnership

Approved by: Andrew McGowan Digitally signed by Andrew McGowan Date: 2024.01.30 11:05:27 -05'00' _____

Andrew McGowan, Quality Assurance Officer — date
Barnegat Bay Partnership

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3.0 QAPP DISTRIBUTION LIST:

Signed copies of this Quality Assurance Project Plan (QAPP) and all subsequent revisions will be sent to the following individuals by electronic mail from the BBP QA Officer:

Barbara Spinweber, Project Officer, U.S. EPA, spinweber.barbara@epamail.epa.gov Eric Ernst, Project Officer, NJDEP, eric.ernst@dep.nj.gov

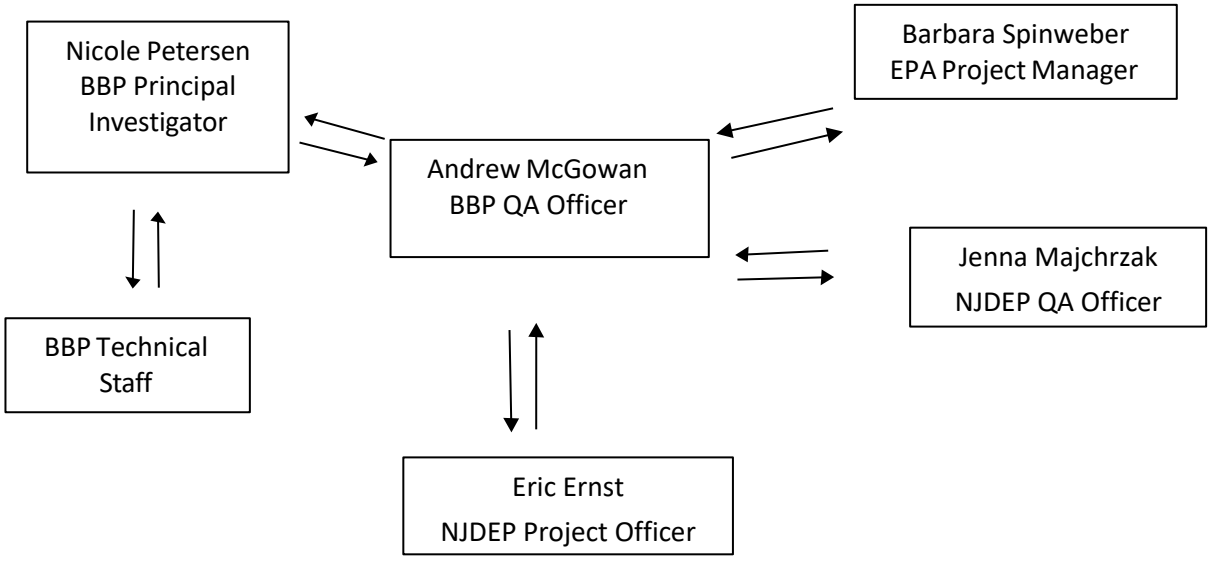
Jenna Majchrzak, Quality Assurance Officer, NJDEP, Jenna.Majchrzak@dep.nj.gov

Nicole Petersen, Principal Investigator, Barnegat Bay Partnership, npetersen@ocean.edu
Andrew McGowan, Quality Assurance Officer, Barnegat Bay Partnership, amcgowan@ocean.edu

4.0 PROJECT TASK ORGANIZATION:

The objective of this project is to continue to provide continuous water quality monitoring at three sites in Barnegat Bay. These sites have been monitored by the BBP since 2016, and are operated annually from March through November, but may remain active year-round depending on weather conditions and staff time. This QAPP covers monitoring from 2024 through 2028. Overall project management will be the responsibility of Ms. Nicole Petersen. Ms. Petersen will oversee the deployment and maintenance of the continuous water quality instruments and will be responsible for maintenance of the approved QA Project Plan. Mr. Andrew McGowan will provide quality assurance management, reviewing data acquisition and data analysis protocols, and ensuring compliance with all elements of the QA Project Plan.

Organizational Chart-Lines of Communication



5.0 SPECIAL TRAINING/CERTIFICATIONS:

All staff conducting maintenance and calibration activities on the long-term continuous water quality datasondes will have successfully completed the web-based Exo University training program offered by YSI. This program will ensure a base level of knowledge in critical components of maintenance and calibration activities. All processes are conducted per the manufactures directions and specifications as well as following BBP's Standard Operating Procedures (SOP's). New Jersey Department of Environmental Protection does not certify the operation of continuous monitors, thus the BBP laboratory is not a NJ State certified laboratory and as such data collected may not be used for regulatory purposes.

6.0 PROBLEM DEFINITION/BACKGROUND:

6.1 Problem Definition:

Coastal water quality impacts many commercial and recreational activities within the Barnegat Bay, including recreational and commercial fishing and shell fishing, swimming and ecotourism. These activities depend on a healthy ecosystem for their continued success. However, New Jersey's coastal waters are adversely impacted by a variety of stressors, potentially leading to decreased water quality, including algal blooms and low dissolved oxygen. To understand the impacts of these stressors on the water quality of Barnegat Bay, it is necessary to collect water quality data at appropriate temporal and spatial resolutions. The availability of continuous water quality data on a near real-time basis will provide environmental managers and researchers with a valuable tool for understanding estuarine processes and the impacts described above. Simultaneous measurement of parameters such as temperature, salinity, oxygen, pH, turbidity, and water depth will allow correlations to be made between these parameters and meteorological conditions, tidal conditions, and diurnal conditions. Real-time data collection eliminates the need for frequent trips to monitoring sites and benefits scientists and managers by allowing them to track environmental conditions at any given moment, and more readily respond to episodic events as they happen which, in turn, can facilitate more accurate planning and decision making.

6.2 Background:

Monmouth University, with support from the Barnegat Bay Partnership (BBP) and others, operated a suite of four continuous water quality monitoring stations in the Barnegat Bay during the early 2000's (Bonnet Island, Barnegat Inlet, Seaside Park, Mantoloking/Point Pleasant Canal). The data generated from these stations was available through the Monmouth University website and was used by a variety of stakeholders. Monmouth University was no longer able to maintain and operate the previously deployed water quality stations. Therefore, the BBP took over the maintenance and operation of three water quality monitoring stations in 2017.

7.0 PROJECT DESCRIPTION:

The objective of this project is to provide stakeholders (New Jersey residents, water quality managers and researchers) with timely access to measurements of coastal water quality. This

was done through the refurbishment of two existing long-term water quality monitoring stations (Seaside Park and Mantoloking) and the installation of a new station at Beach Haven (Table 1).

Information to be provided at all stations includes: pH, turbidity, temperature, dissolved oxygen, salinity and water depth. Additionally, the Beach Haven station measures pCO_2 to aid in understanding the impacts of coastal acidification. This information is expected to be useful to a wide range of users including fishermen, students, educators, researchers, and the general public. Persons interested in knowing the current conditions in "their bay" or estuary will find this valuable and should gain a better understanding of the dynamics of water quality in the waters near their home.

Table 1: Site information for each BBP continuous water quality monitoring location.

Site Name	**Beach Haven**	**Seaside**	**Mantoloking**
Location	Queen City Marina	Seaside Park Yacht Club	Mantoloking Yacht Club
Waterbody	Little Egg Harbor	Barnegat Bay	Barnegat Bay
Type of deployment	Fixed/piling	Fixed/dock	Fixed/piling
Latitude	39.567079 N	39.921813 N	40.0374 N
Longitude	74.245045 W	74.0828445 W	74.05405 W
Mean Depth (meters)*	2.06 m	1.53 m	1.17 m
Deployment Depth (from Bottom)	0.457 m	0.457 m	0.457 m
Parameters			
Turbidity	X	X	X
Dissolved Oxygen	X	X	X
Specific Conductance/salinity	X	X	X
Water Temperature	X	X	X
pH	X	X	X
Water Depth	X	X	X
pCO2	X		

** Data from 2017-2021 used in mean depth calculations.*

The YSI Exo2 multiparameter data logger system (YSI Inc, Yellow Springs, Ohio) is being used in this project. The YSI Exo2 multiparameter data logger system is designed for long term *in situ* monitoring and profiling. The Exo2 series data sonde uses a fully integrated sensor setup that accurately and reliably measures the parameters chosen: water temperature, conductivity, salinity, dissolved oxygen, pH, turbidity, and water depth.

To accurately measure changes in water chemistry associated with coastal acidification, the Beach Haven station is also equipped with a Pro-Oceanus CO_2-Pro CV CO_2 sensor (Pro-Oceanus, Bridgewater, NS). In combination with the data from the YSI Exo2 sensors, we will be able to measure changes in pCO_2 concentration at the appropriate scale.

Each of the monitoring stations consists of one deployment platform that is affixed to a bulkhead, piling or other dock structure. Each station is assigned two YSI data sondes; one data sonde is deployed in the water while the second remains ready for a maintenance and calibration swap every 2–4 weeks. Prior to initial deployment, each of the YSI Exo2 data logger systems are programmed to record temperature, salinity, dissolved oxygen, pH, turbidity, and water depth every 15 minutes. The Pro-Oceanus sensor also records data concurrent with the YSI. Each data sonde removed or swapped from the field is subsequently brought back to the laboratory for cleaning and calibration for redeployment. The Pro-Oceanus sensor is designed for long-term deployment, and is only brought back from the field on an as-needed basis for cleaning and calibration (see Section 13.2 for additional details). The monitoring stations remain operational as long as possible: one goal is year-round collection at most locations, and the minimum goal is from early spring until late fall at each location.

The data are transmitted via a cellular modem once per hour to the BBP, and to the New Jersey Department of Environmental Protection Bureau of Marine Water Monitoring, where it is downloaded and sent to their website for data retrieval by other organizations. As stated above, it is anticipated that data will be continuously collected year-round, but at a minimum, between March and November annually.

8.0 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA:

Data quality objectives (DQOs) for the water quality parameters being measured can be expressed in terms of accuracy, precision, and completeness goals. These DQOs were established by obtaining estimates of the most likely data quality that is achievable by the instruments based on the instrument manufacturer's specifications.

The DQOs are used as quality control criteria for field measurements to set the bounds of acceptable measurement error. Generally speaking, DQO's are usually established for the following aspects of data quality: precision and accuracy, representativeness, comparability, and completeness.

8.1 Precision and Accuracy

The term accuracy is defined as the difference between a measured value and the true or expected value, and represents an estimate of systematic error or net bias. Precision is defined as the degree of mutual agreement among individual measurements, and represents an estimate of random error. Collectively, accuracy and precision can provide an estimate of the total error or uncertainty associated with an individual measured value.

Accuracy and precision will be managed by using calibrated YSI Exo2-series datasondes to collect water quality data at each of the sites. According to the manufacturer's recommendation, individual datasondes can remain deployed for a period of 3 -4 weeks and accurately provide reliable data. The deployment period chosen for this project is slightly more conservative at 2-4 weeks. At the end of this time period, the datasondes in the field are swapped out for newly calibrated units.

During deployment, transmitted data are reviewed and tracked and any anomalies are noted and investigated to confirm that the instrument was fully operational and providing credible data. If data being collected are suspect, the data sonde will be inspected and, if necessary, a newly calibrated unit will be deployed as soon as possible. Suspect readings include consistent reporting of dissolved oxygen levels less than 3.0 or greater than 13 milligrams per liter (mg/L), salinities less than 5 or above 32 parts per thousand (ppt), pH levels below 7.0 or above 9.0, DO saturation less than 50 or above 300 percent (%), specific conductivity less than 10,000 or above 52,000 Micro Siemens per centimeter (µS /cm), and temperatures less than 0 or above 32 degrees Centigrade (°C).

The data quality objectives for the water quality parameters being measured with the YSI Exo2 data logger system in the field are expressed separately as maximum allowable accuracy, precision and

completeness goals in Table 2. Pre- and post-calibration checks on known standards or alongside a newly calibrated handheld unit must be within the accuracy goal for each parameter for each device, and multiple readings at calibration must fall within the precision goals (Table2). If either the accuracy or precision goals are not met during pre-deployment calibration, the instrument will be re-calibrated, assessed and if not resolved, the unit will not be deployed. If the accuracy goals are not met during post-calibration checks, the data for that parameter will be flagged and removed from the final dataset.

Table 2: Data Quality Objectives for surface water quality measurement using the YSI Exo2 multi-parameter datasonde system				
Parameter	**Pre-Deployment Accuracy Goals**	**Post-Deployment Accuracy Goals**	**Precision Goal (Pre-deployment)**	**Completeness Goal**
Dissolved oxygen	±0.3 mg/L	±0.3 mg/L	10%	100%
Specific Conductance µS/cm	±1% of the standard value	±10% of the standard value	10%	100%
pH	±0.1 units	±0.3 units	10%	100%
Temperature	n/a	±0.5 °C	10%	100%
Turbidity	±2.0% of the standard value	±5.0% of the standard value	10%	100%

The data quality objectives for the water quality parameter being measured with the Pro Oceanus Pro-CV CO_2 sensor cannot be met until such time that a verification process can be identified. The lab which previously verified these data has discontinued performing the analyses for CO_2 verification. Until a verification process can be implemented, data collected by the Pro Oceanus Pro-CV CO2 will be used for educational purposes only.

8.2 Bias

In order to eliminate bias, which could cause errors in data obtained during the project, all equipment will be inspected and properly calibrated as described in Section 13 of this QAPP before being deployed. Calibration of the datasondes will always be performed by the same trained personnel following detailed procedures. This reduces the likelihood of human (operator) induced error.

8.3 Representativeness

The concept of representativeness refers to the ability of the project to accurately and precisely characterize the existing conditions of a water body through the measurement of selected environmental parameters. In terms of the project sampling design, the sites of deployment have been selected to be as representative as possible of conditions in the water bodies at large where they are located, taking into account location, accessibility and security. Additionally, this monitoring program is part of a larger effort to deploy continuous water quality datasondes in the bay, and thus should be looked at as part of a larger program. These sites were selected

based on local knowledge and in consultation with other water quality monitoring organizations (Jacques Cousteau National Estuarine Research River [JCNERR] and N.J. Department of Environmental Protection [NJDEP] Bureau of Marine Water Monitoring) to represent different salinity regimes (*e.g.*, polyhaline, mesohaline) within the bay.

8.4 Comparability

Comparability is defined as the confidence with which one data set can be compared to another. To ensure data comparability in this project, we utilize the same model YSI data logger systems being deployed by other organizations in the state including NJDEP, USGS, and Rutgers University. All of these data will be shared among the agencies and organizations via the internet and these data sets will undergo periodic review, comparison, and analysis by the group.

Each of the three stations is using the same hardware, and is set up, operated and maintained in the same way. The only exception is the pCO2 sensor at Beach Haven.

8.5 Completeness

Completeness is defined as a measure of the amount of data collected during each field sampling event compared to the amount that was expected to be obtained under the conditions of measurement. We have established a completeness goal of 100% for the various parameters being measured. However, a loss of data collection capabilities (power supply issues) or data outside of the normal parameter range (potential biofouling or sensor drift) may or may not prevent the remaining data from being used, depending on the goals of the user.

8.6 Sensitivity

Sensitivity is essentially the lowest detection limit of the method or instrument for each of the parameters being measured. The sensitivity of the YSI Exo2 datasonde for the parameters being measured is summarized in Table 3, and the Pro-Oceanus Sensor in Table 4.

Table 3: YSI Exo2 multi-parameter datasonde system sensitivities.			
Parameter	**Range**	**Accuracy**	**Resolution**
Dissolved oxygen	0 to 50 mg/L	@ 0 – 20 mg/L; greater of 1% of reading or +/- 0.1 mg/L @ 20 – 50 mg/L; 5% of reading	0.01 mg/L
Salinity	0 to 70 ppt	±1.0% of reading or 0.1 ppt	0.01 ppt
pH	0 to 14 units	+/- 0.2 units	0.01 units
Temperature	-5 to 35°C 35 to 50°C	+/- 0.01°C +/- 0.05°C	0.001°C
Turbidity	0 to 4,000 Formazin Nephelometric Unit (FNU), Nephelometric Turbidity Unit (NTU)	0-999 FNU +/- 2% of reading or 0.3 FNU 1000-4000 FNU +/-5% of reading	0.01 FNU, NTU 0.1 FNU, NTU
Depth (non-vented)	0 to 33 feet (ft), 0 to 10 meters (m)	±0.013 ft, ±0.004 m	0.001 ft, 0.001 m

Table 4: Pro-Oceanus CO_2-Pro CV sensitivities			
Parameter	**Range**	**Accuracy**	**Resolution**
CO_2	0-3000 parts per million (ppm)	+/- 0.5%	0.01ppm

9.0 NON-DIRECT MEASUREMENTS (SECONDARY DATA):

Independent, paired field data readings using a calibrated YSI handheld meter are collected alongside the deployed sonde for its last reading and the newly deployed sonde for its first reading. The measurements are entered on the BBP Water Quality Calibration Log and Field Log (Appendix 3) and used in the QA process outlined in the BBP Standard Operating Procedure for QA/QC and Data Management of Continuous Water Quality Data (Appendix 2). A deployment will be flagged for more in depth review if the paired measurements fall outside of specified ranges.

10.0 FIELD MONITORING REQUIREMENTS:

10.1 Monitoring Process Design

This project involves three long term water quality monitoring stations (Table 1). These stations are part of a broader network of automated stations independently maintained and operated by the NJDEP, US Geological Survey, and JCNERR to assess changes in water quality within the Barnegat Bay-Little Egg Harbor watershed. The Seaside and Mantoloking station locations were determined through cooperative discussion amongst all interested parties in an effort to provide continuous water quality data at reasonable spatial scales given budgetary constraints. The Beach Haven location, which includes the capabilities to measure changes in coastal acidification, was set by consensus among the interested parties considering the current monitoring coverage, the desire to place it near to sensitive biotic receptors (particularly shellfish), and limited suitable shore-side deployment locations.

Each of the stations contains a YSI Exo2 multiparameter datasonde that measures temperature, salinity, pH, dissolved oxygen, turbidity, and depth every 15 minutes. The Beach Haven station also contains a Pro-Oceanus CO_2-Pro CV that measures pCO_2. All data are stored on a datalogger and also transmitted hourly via cellular modem to the BBP for QA/QC and to an NJDEP website for public consumption. It is our intention to deploy the sensors, at a minimum, from March to November of each year, with possible removal in the winter for annual regularly scheduled maintenance and to lessen the possibility of ice damage. We will attempt to extend the deployment of the devices through the winter, weather dependent.

10.2 Monitoring Methods:

Each station includes a YSI Exo2 multiparameter datasonde designed for long-term, *in-situ* monitoring. The YSI Exo2 is equipped with sensors that measure and record the following surface water quality parameters: water temperature, salinity, dissolved oxygen, pH, turbidity, and depth. Each monitoring station is assigned two YSI Exo2 datasondes: one datasonde is deployed in the water and a second remains ready for a maintenance and calibration swap every 2 - 4 weeks, depending on the degree of fouling. Each time a datasonde is replaced with a newly calibrated unit, the datasonde retrieved from the field is brought back to the BBP laboratory for post-deployment checks, cleaning, and maintenance. These retrieved units will subsequently be recalibrated prior to redeployment.

The Beach Haven station will also be equipped with a Pro-Oceanus CO_2-Pro CV. This instrument is designed for long-term, *in situ* monitoring, and requires annual calibration. However, during the YSI swap the housing will be examined for biofouling and cleaned as needed.

The EXO2 datasondes are located at each station in a manner that allows for constant monitoring of water conditions at a depth of approximately 0.457 m off bottom. This is achieved by hanging the datasondes inside PVC pipes affixed to the deployment platforms that have holes drilled in the lower portion of the deployment pipes along their length to allow for water exchange

(see https://www.ysi.com/File%20Library/Documents/Guides/Long-Term-Deployment-Tube-Guide.pdf for an example and template). The Pro Oceanus Pro CV sensor is affixed to a treated PVC frame which allows for the device to be slid up and down for maintenance and deployment. The deployment platforms are constructed as fixed shore side locations on bulkheads/pilings at each site. Mean water depths for each site are located in Table 1.

The YSI KOR software is used to conduct the EXO2 sonde calibrations and setup according to the BBP Standard Operating Procedure for the Calibration and Maintenance of YSI EXO-2 Multi-Parameter Data Sondes (Appendix 1). Once deployed, the Campbell CR1000 and CR6 data loggers and Data Management System manages sensor sampling, data buffering and cellular telemetry to a base station. This system is deployed shore-side adjacent to the data sonde platforms. The data sondes, water pump (Pro-Oceanus sonde only), and data loggers are powered via an onsite 12v battery that is recharged through a solar charging system.

The Campbell CR1000 and CR6 data logger systems (Campbell Scientific, Logan, Utah) are programmed to record data every 15 minutes. The data telemetry system provides data to the BBP, and to the NJDEP web site in near real-time. The telemetry system is comprised of a field component located at each sampling site and an office component located at the NJDEP Bureau of Marine Water Monitoring. The field component consists of a housing, a data logger that stores the data collected by the sensors on the corresponding data sonde, a battery and solar panel to supply power, and a modem. Once an hour, the NJDEP computer server connects with the data loggers located at each sampling site and uploads and updates the data on the website.

Deployment and retrieval for the EXO2 datasondes will be conducted in accordance with the best management practices developed as part of the National Estuarine Research Reserve System (NERRS) System-Wide Monitoring Program (SWMP) YSI/Xylem EXO Multi-Parameter Water Quality Monitoring Standard Operating Procedure V.2.2 (Mensinger *et al*. 2022; Appendix 4) and BBP's Standard Operating Procedure for the Calibration and Maintenance of YSI EXO-2 Multi- Parameter Data Sondes (Appendix 1). Post-deployment data processing are conducted according to BBP's Standard Operating Procedure for QA/QC and Data Management of Continuous Water Quality Data (Appendix 2) and the CDMO NERR SWMP Data Management Manual V.6.7 (Appendix 5).

10.3 Field Quality Control (QC):

Field quality control measures associated with deployment of continuous monitoring sondes are divided into two categories; the physical environment of the sondes and the stability of the sensors.

Inspection and maintenance of the deployment platforms, data telemetry system, and associated power supply are conducted with each site visit. Biofouling, which occurs when aquatic organisms such as algae begin to grow on the data sondes, can prevent the sensors from

obtaining accurate readings. The EXO2 system is designed to operate in severe fouling environments and kept free of fouling by a universal anti-fouling sensor wiper assembly centrally installed on the sonde. In addition, sensors are wrapped in copper tape and the sonde guard is copper alloy with copper screening to keep the sensors free of debris. The intake pump for the CO2-CV is wrapped with copper tape and a copper cage is constructed around the pump intake to prevent the intake from being clogged. The PVC tubes holding the sondes and the CO2-CV deployment system are treated with antifouling paint. If biofouling is suspected of being an issue during deployments, a cleaning brush and scraper are used to remove fouling from the deployment tubes. When fouling is extreme, the EXO deployment tubes are designed to allow them to be rotated out of the water for servicing.

The sensors on the Exo2 units are calibrated prior to deployment (section 13) and checked against known standards upon retrieval (Appendix 1, Section 5.0). Independent, paired field data readings using a calibrated YSI handheld meter are collected alongside the deployed sonde for its last reading and the newly deployed sonde for its first reading. The measurements are entered on the BBP Water Quality Calibration Log and Field Log (Appendix 3) and used in the QA process outlined in the BBP Standard Operating Procedure for QA/QC and Data Management of Continuous Water Quality Data (Appendix 2). A deployment will be flagged for more in depth review if the paired measurements fall outside of specified ranges.

The pCO2 sensor is returned to the manufacturer for maintenance and calibration yearly. Prior to each deployment and upon its return, the sensor is run in a bucket of tap water to ensure proper operation and provide pre and post deployment readings for comparison. When deployed, the instrument and pump are inspected every 2-4 weeks for fouling. The instrument is removed when fouling is heavy and cleaned per the manufacturer's directions in Pro-Oceanus CO2-Pro CV User's Manual V.4.2.0 (Appendix 6) in the lab. Verification samples to assess accuracy of the Pro Oceanus Pro-CV pCO_2 instrument will be collected once a laboratory is identified that can process these samples.

11.0 ANALYTICAL REQUIREMENTS:

The analytical requirements are addressed throughout the QAPP and summarized in Tables 2 through 7. The specific methodology for each of the YSI sensors can be found in the Exo User's Manual (https://www.ysi.com/File%20Library/Documents/Manuals/EXO-User-Manual-Web.pdf).

12.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS:

All calibration records and field notes are initialed, time- and date-notated, and kept as part of the permanent project record in the BBP Lab.

13.0 TESTING, INSPECTION, MAINTENANCE, AND CALIBRATION REQUIREMENTS:

The collection of pCO_2 data requires the collection of additional parameters in order to validate the data. The laboratory and personnel that originally performed this validation are no longer performing this service. The BBP is attempting to obtain assistance from another lab to perform these data collections and analyses and will update the Quality Assurance Project Plan accordingly.

The YSI sensors require routine calibration checks to verify that their performance is within acceptable quality standards. The following sections will discuss the procedures and frequency for the various instrument calibrations that are key components in the collection of accurate environmental data.

13.1 Instrument/Equipment Testing, Inspection and Maintenance:

The Pro-Oceanus CO_2-Pro CV requires annual maintenance and calibration verification to be performed by the manufacturers' representatives or service consultants. These procedures are documented by date and the signature of the person performing the inspection, and the documentation will be maintained as part of the QA file located in a binder in the BBP offices.

For the YSI Exo2 sondes, a maintenance log is kept for each datasonde and updated prior to, and after each deployment. Each EXO2 sonde and associated sensors are serviced by the manufacturer every other year and documentation is maintained as part of the QA file located in a binder in the BBP offices.

13.2 Instrument/Equipment Calibration and Frequency:

An SOP has been developed and is followed closely while maintaining, calibrating and operating the YSI EXO2 datasondes and associated equipment (Appendix 1). The methods utilized to calibrate the probes on the EXO2 datasondes are found in Appendix 1, Section 3.0 and are used prior to each deployment, while the post-deployment procedure in Section 5.0 will occur following all deployments.

The Pro-Oceanus CO_2-Pro CV is factory calibrated based on conditions found at our deployment site, and is returned to the factory each winter for inspection, repair, and recalibration.

13.3 Inspection/Acceptance of Supplies and Consumables:

The Principal Investigator will be responsible for procurement of all supplies and equipment associated with the project covered by this QAPP. It will be their responsibility to inspect and accept all supplies and consumables received to ensure their quality and acceptability. All replacement probes for YSI datasondes must be received directly from the appropriate company. Probes are only accepted if they are not noted as damaged after a visual inspection,

and pass initial calibration tests (YSI). Materials that do not meet these criteria will be returned to the manufacturer and replaced.

14.0 DATA MANAGEMENT:

As previously described, data collected at each of the monitoring sites is transmitted via cellular modem to the NJDEP and BBP. Once an hour, the NJDEP computer server connects with the data loggers located at each sampling site and uploads and updates the data to the Bureau of Marine Monitoring website. On an hourly schedule, the BBP system also downloads the data, which are stored for QA/QC checks to make a final archive for public use. This archived data undergo a data review and validation process (see Section 16) prior to being made available to the public as a fully quality controlled product.

Battery life, depth, and humidity issues at each station are reviewed regularly each week by the BBP via remote access to look for any anomalies, which, if present, are noted and investigated to confirm that the instrument is fully operational and providing credible data. If data being collected are suspect, the datasonde is inspected and, if necessary, a newly calibrated unit is deployed as soon as possible. Data falling outside expected ranges (Dissolved oxygen levels less than 3.0 or greater than 13 mg/L, salinities less than 5 or above 32 parts per thousand, pH levels below 7.0 or above 9.0, DO saturation less than 50 or above 300%, specific conductivity less than 10 or above 52 mS/cm, and temperatures less than 0 or above 32 degrees Centigrade) will trigger an alarm on the viewing website, allowing staff to assess, in person or remotely, if the sensors are operating correctly.

YSI sensor calibrations are conducted using KOR (YSI INC, Yellow Springs, Ohio). Station programming is accomplished through the Campbell datalogger software (Campbell Scientific, Logan, Utah). Data QA/QC is done using Excel (Microsoft Corp., Redmond, Washington) and R (R Foundation, Vienna, Austria).

The hard copies of the datasonde calibration sheets and deployment logs are held at the BBP office to enable QA/QC of the downloaded data, after which they are stored by the BBP indefinitely.

15.0 ASSESSMENTS AND OVERSIGHT:

The BBP's QA Officer ensures that all data from the project are generated in accordance with procedures outlined in this Quality Assurance Project Plan. Other project participants immediately report any problems or QA/QC issues to the BBP QA Officer. The BBP QA Officer recommends appropriate corrective action and determines the acceptability of affected data. The BBP QA Officer conducts an audit of the calibration procedures, field deployment, data retrieval, and data verification within the first three months of the start of each sampling season. NJDEP Office of Quality Assurance may request information regarding sampling schedules and data access to assess compliance with QAPP procedures at any time.

The BBP QA Officer is present during the initial calibration and datasonde deployments each year to ensure consistency with previous years' efforts. They are also tasked with ensuring that no unacceptable data (i.e., data that has previously been deemed suspect) are released or included in evaluations and analysis of results.

The BBP QA Officer keeps a written record of any deviations from the approved QAPP. Results of all corrective actions are documented for the record in accompanying data reports generated annually.

16.0 DATA REVIEW, VERIFICATION, VALIDATION AND USABILITY:

16.1 Date Review, Verification, and Validation

Data collected from the Pro Oceanus Pro CV sensor is downloaded from the instrument every time the instrument is removed from service for cleaning or calibration. Without verification samples, the data are reviewed and notes made in the raw file for the following conditions: sensor failure; in field maintenance or cleaning; low voltage; and outside of sensor range. Raw data with notes are stored at the BBP office and available upon request

QA/QC procedure for the EXO2 sensors can be found in BBP's Standard Operating Procedure for QA/QC and Data Management of Continuous Water Quality Data (Appendix 2) and are briefly outlined below. Transmitted data are initially and continuously reviewed in accordance with Section 14.0 (above) using real time alarms.

Raw data are currently directly disseminated via the web in the form of the most recent measurement taken, and a summary table of values collected in the past day, past three days, past week, past two weeks, past three weeks, and past month. No flagging of suspect data are currently being provided in real time. The following disclaimers are posted on the web site:

> **"NOTE: Provisional Data Subject to Revision" (on the station dashboard), or**
>
> **"This Data has not been QA'd" (on the graphs).**

The following procedural steps represent the EXO2 QAQC process for finalizing collected data.

1. During sonde retrieval, a handheld YSI measurement is taken for each parameter collected by the sonde and recorded on the datasheet.
2. Upon return to the lab, the retrieved sonde and probes are assessed for accuracy by performing post deployment checks in accordance with the procedures in Appendix 1 section 5.0, Appendix 2 and accuracy goals in Table 2 and Table 5. **Data from probes which do not fall within the desired accuracy goals in Table 2 are not continued forward in the QA process and do not appear in the final dataset.** Data from probes

which do not fall within the desired accuracy goals in Table 5 are examined for validity using the goals from Table 2 and the remaining QA process.

3. The measurements taken by the handheld YSI during retrieval are also compared to the last measurement taken by the sonde while in the field and must be within 10% of each other. If data are more than 10% different, the data are flagged and examined in subsequent QA procedures for validity.
4. The remaining data that have not been removed from step 2 are transferred to the CDMO macro provided by the National Estuarine Research Reserve, where data falling outside sensor ranges (Table 3) are flagged, and all data are plotted.
5. Data are then processed in R to assess ranges which are considered unusual for the area (Table 6). Data falling outside these expected ranges are flagged. This process follows the BBP Standard Operating Procedure for QA/QC and Data Management of Continuous Water Quality Data (Appendix 2) and CDMO NERR SWMP Data Management Manual V.6.7 (Appendix 5).
6. Data are then assessed in R for spiking (Table 7) which examines unlikely jumps or declines in data compared to the previous measurement. Data jumping or declining more than expected are flagged. This process follows the BBP Standard Operating Procedure for QA/QC and Data Management of Continuous Water Quality Data (Appendix 2) and CDMO NERR SWMP Data Management Manual V.6.7 (Appendix 5).
7. All records with flags are then examined individually. This is done by comparing various ecological variables to determine whether natural events (excessive rainfall, droughts, etc.) have led to these flagged results, and by comparing flagged data to nearby continuous sensors operating in the same system by the Jacques Cousteau National Estuarine Research Reserve and other BBP/NJDEP continuous stations. **If it is determined that the data are valid, the flagged comment is removed and data are considered valid, otherwise, data are removed permanently from the final corrected file.** The flag codes and procedures are located in the CDMO NERR SWMP Data Management Manual V.6.7 (Appendix 5).
8. Temperature data remaining in the data file are then corrected, and the data are formatted and sent to NJDEP as the final QAQC data record.

Original data, before validation and at each stage of the QAQC process, are stored on the server at BBP which is maintained and backed up offsite at Ocean County College.

Table 5. Pre and Post Deployment Sensor Diagnostic Operating Range	
Parameter	**Range**
Dissolved Oxygen Sensor (gain)	0.87-1.25
pH sensor Buffer 7 (mv)	0 +/- 50
pH sensor Buffer 4 (mv)	+180 +/- 50
pH sensor Buffer 10 (mv)	-180 +/- 50
Conductivity (cell constant)	0.469 +/- 0.05
Millivolt span between pH 4 and pH 7 Buffers	165 to 180
Millivolt span between pH 7 and pH 10 Buffers	165 to 180

Table 6. Range Test Validation Ranges	
Parameter	**Validation Range**
Dissolved Oxygen (mg/l)	3 to 13
Dissolved Oxygen % saturation	50 to 300
pH	7 to 9
Salinity (ppt)	5 to 35
Specific Conductance (mS/cm)	10 to 52
Temperature (˚C)	0.0 to 32
Turbidity (NTU)	0.1 to 250

Table 7. Spiking Test Intervals	
Parameter	**Unlikely Interval Difference (15-minute interval)**
Dissolved Oxygen (mg/l)	2
Dissolved Oxygen % saturation	15
pH	0.25
Salinity (ppt)	2
Specific Conductance (mS/cm)	5
Temperature (˚C)	2
Turbidity (NTU)	15

16.2 Reconciliation with user requirements:

Users of the data collected include collaborating agencies and organizations including the Barnegat Bay Partnership, NJDEP Bureau of Marine Water Monitoring, Stevens Institute, Monmouth County Board of Health, etc. In addition, the data are available to other interested scientists, agencies, and the public via the NJDEP Bureau of Marine Water Monitoring web site. However, it should be noted that in any use, the end user must evaluate the data using quality criteria appropriate for their intended use or decision-making process.

17.0 REPORTING, DOCUMENTS AND RECORDS

All QAPP related data and all associated raw data records (including records of calibrations and calibration checks, deployment log books and other pertinent project related documents) are maintained at the Barnegat Bay Partnership's offices at Ocean County College and shall reside indefinitely from date of collection. If Barnegat Bay Partnership can no longer provide the required storage, the data shall be transferred for archival storage to the NJDEP. A statement on the annual audit of the QA procedures by the BBP Quality Assurance Officer is produced and stored at the BBP offices. Biannually, a results report detailing the previous two years of monitoring is created by the Principal Investigator and reviewed by the BBP Quality Assurance Officer. This report details the period of record monitored, the mean, range, and standard deviations for each parameter both annually and seasonally, and the frequency of violation with established state water quality standards at each site. Lastly, this report also details the percent of deployments which attained the post-accuracy QA standards (Table 2), includes the annual QA audit results, and notes any issues or deviations from the QAPP. This report is shared with members of Section 4.0 by the BBP Quality Assurance Officer.

18.0 CORRECTIVE ACTIONS:

During deployment of the data sondes, transmitted data are reviewed and tracked and any anomalies are noted and investigated to confirm that the instrument is fully operational and providing credible data. If data being collected are suspect, the data sonde is inspected and, if necessary, a newly calibrated unit is deployed as soon as possible.

The pre-deployment probe diagnostic values (Table 5) are evaluated to ensure the sensors are within the acceptable range and functioning properly; any probe not meeting these standards after calibration will not be deployed.

Any data collected by a probe which fails the post deployment accuracy check are removed from the final data set for that entire deployment. All data found to be collected with a malfunctioning probe are flagged as suspect and evaluated based on the post deployment accuracy checks and the subsequent QAQC procedures. This process is documented in BBP's Standard Operating Procedure for QA/QC and Data Management of Continuous Water Quality Data (Appendix 2).

If a data record fails either the automated Range or Spiking tests (Tables 6 and 7), that record receives a flag for review and potential removal from the final corrected dataset based on

ecological or climatic variables concurrent with measurements.

The file containing all the data after the automated scan, including the flagged records marked for one of the above reasons, is carefully evaluated on whether the result is actually valid. This is done by comparing various ecological variables to determine whether natural events (excessive rainfall, droughts, etc.) have led to these flagged results. If it is determined that the data are valid, the flagged comment is removed and data are considered valid, otherwise, data are removed permanently from the final corrected file.

This QAPP will be reviewed every year by the Principal Investigator and the BBP Quality Assurance Officer for updates or changes. If updates or changes are necessary, all signatories will be requested to review and approve.

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APPENDICES:

Appendix 1. Standard Operating Procedure for the Calibration and Maintenance of YSI EXO-2 Multi- Parameter Data Sondes

Barnegat Bay Partnership

Continuous Water Quality Monitoring Program

Standard Operating Procedure for the

Calibration and Maintenance of

YSI EXO-2 Multi-Parameter Data Sondes

Prepared By
Nicole Petersen
Barnegat Bay Partnership
V.3.1 February 2024

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BACKGROUND:

Barnegat Bay Partnership's continuous water quality monitoring program consists of 3 monitoring stations in Barnegat Bay (Table 1).

Table 1: Barnegat Bay Partnership's continuous water quality monitoring locations in Barnegat Bay.

Site Name	Location	Waterbody	Latitude	Longitude
Mantoloking	Mantoloking Yacht Club	Barnegat Bay	40.0374 N	74.05405 W
Seaside Park	Seaside Park Yacht Club	Barnegat Bay	39.921813 N	74.0828445 W
Beach Haven	Morrison's Marina	Little Egg Harbor	39.567079 N	74.245045 W

Each of the monitoring stations consists of one deployment platform affixed to a bulkhead, piling or other dock structure and is assigned two YSI data sondes; one data sonde is deployed in the water and a second remains ready for a maintenance and calibration swap every 2 - 4 weeks. Each of the YSI EXO2 data logger systems is programmed to record temperature, salinity, dissolved oxygen, pH, turbidity, and water level every 15 minutes. The raw data is transmitted via a cellular modem once per hour to the New Jersey Department of Environmental Protection Bureau of Marine Water Monitoring, where it is downloaded, processed and sent to their website for near real-time data retrieval by other organizations.

This SOP will provide step by step instructions on how to connect to, calibrate, maintain and store the YSI EXO2 multi-parameter datasondes for the Continuous Water Quality Monitoring Program. The consistent and accurate calibration and care of these sondes is crucial to reliable and useful data.

1.0 EXO COMMUNICATION & KORS SOFTWARE – CONNECTING THE EXO TO A PC OR LAPTOP

A copy of KORS software, (as of 3/08/2017, Version 1.0.12) is currently downloaded on the BBP's Lab toughbook. This software is used for EXO communication, calibration, post-deployment readings, data file download, sonde/probe firmware updates, and any other necessary interaction with the sonde via a PC. The YSI.com website should be checked for software updates routinely. This section briefly covers how to connect the EXO2 sonde using KORS.

1.1 Sonde Connectivity:

EXO sondes are accessed via one of two potential options:

1. USB/SOA (Signal Output Adapter) Cabled Connection
    a. Open KORS Software
    b. Connect the USB cable to the PC and the blue SOA adapter to the sonde connector located on the top of the sonde.
    c. Click the "Circular Blue/Green Arrows" icon (7th icon from the left in KORS)
    d. Click Rescan
    e. Click the COMM port that has the EXO USB adapter and EXO sonde ID shown
    f. Click "Connect"
    g. If the USB adapter or sonde do not show up at first, unplug the USB cable from the computer, plug it in again, and repeat steps c through f. If this fails to show the sonde, unplug the adapter from the sonde, re-connect the adapter, and repeat steps c through f.
2. Wireless Bluetooth Connection
    a. Open KORS Software
    b. Place the magnetized section of the black probe removal tool over the magnet icon located on the sonde (about halfway down the sonde within the black stickered area that says EXO2) to activate the sonde.
    c. Click the "Circular Blue/Green Arrows" icon (7th icon from the left in KORS)
    d. Click Rescan
    e. Click the EXO sonde ID shown
    f. Click "Connect"

NOTE: make sure to connect to the appropriate EXO sonde as the Bluetooth may pick up any other active EXO sondes nearby.

2.0 RECORD KEEPING

A "BBP Continuous Water Quality Monitoring Calibration and Field Log" (BBP CWQM log) must be completed for each instrument's calibration, deployment, retrieval, and post-calibration procedures. These logs will be stored at the BBP in the binder labeled," BBP Water Monitoring Network – Site Specific Data Sheets". Blank logs are stored on the shared drive under "BBP Water Monitoring Network\Calibrations\Calibration logs". In addition, any field maintenance that is performed during an instrument's deployment will be recorded in the yellow WQ Field Notebook and on the datasheet for that deployment.

Prior to calibration, record the Station Name, Buoy ID, Time Zone, and Sonde Code, as well as the serial number for the sonde and each probe. To find the serial numbers, perform the following while the sonde is connected to KORS:

1. Click the Gear Icon
2. Click Smart QC and record each serial number on the datasheet.

Check the Sonde time by doing the following (This can also be completed during programming after calibration):

1. Click the Gear Icon
2. Click "Sonde"
3. Click "Update Time"
    a. Make sure "Relative to PC" is checked and applied. All Water Quality data is collected in Easter Standard Time (EST). Please make sure that the time is EST not Local time/Daylight Savings Time (EDT) when we are in Daylight Savings Time (March through November)

Finally, fill in the first section of the Pre-Deployment Calibration/Programming portion of the CWQM Logsheet. You can find the replacement dates in the file: …BBP Water Monitoring Network/ EXO2 serial numbers & replacement log.

3.0 CALIBRATION AND MAINTENANCE PROCEDURES

3.0.1 Calibration frequency:

November through April - every 3-4 weeks
May through October - every two weeks
These are general guidelines. Probe drift, malfunction or increased/decreased biofouling may necessitate more or less frequent cleaning and calibrations.

3.0.2 Anti-fouling measures:

Biofouling presents challenges to the collection of accurate and reliable data. The following anti-fouling measures will be taken for ALL BBP sensors, probes and equipment prior to calibration and deployment.

1. Antifouling paint will be applied to all PVC that house sensors. YSI recommendations for tube construction are available on YSI
2. Copper Sensor Guard – a copper alloy sensor guard offers biofouling properties and replaces the normal black plastic sensor guard. These are available through YSI.
3. Duct tape – will be applied to the sonde body to both reduce biofouling and aid in its removal.
4. Copper Tape - will be applied to the bodies of all sensor probes. This adhesive-backed tape, sold by YSI and other vendors, reduces biofouling when applied to the body of each probe. Sensor faces/caps should not be covered with copper tape.
5. Packing tape – will be applied beneath the duct tape and copper tape for cleaner removal of each.
6. C-Spray - while it does not prevent fouling, this spray material can be applied to the sonde connector region, sensors, and internal sensor guard faces to make biofouling removal easier (available through YSI, SKU616290).

3.0.3 How to install probes on the EXO2:

1. Please refer to the EXO User Manual located on the shared drive or at www.EXOwater.com and the instructions that come with each new probe for complete probe installation instructions.
2. Make sure the ports and plugs are clean and dry. Each terminal should be lightly greased with KRYTOX. If discoloration occurs to the copper terminals you may clean GENTLY with diluted distilled white vinegar and a q-tip or Kimwipe. Make sure the connectors are thoroughly dry using a compressed air source. Before connecting a probe or dummy plug, grease the tips and black neoprene wet-mate material. If the wet-mate material dries out, it will allow water into the port damaging the unit.
3. Order of installation: -
   Port 1 - Turbidity
   Port 2 – Optical DO
   Port 3 – Empty – make sure to use a port plug
   Port 4 – Wiped Conductivity/Temperature
   Port 5 – pH

Port 6 – Empty – make sure to use a port plug
Port 7 –Central Wiper

3.0.4 General Calibration Considerations:

The following guidelines should be followed to insure proper laboratory practices, quality control and safety.

1. Please refer to MSDS sheets when handling any standard and follow recommended safety practices.
2. Lot numbers on all standards are to be recorded in the KORS software. Expired standards are to be discarded appropriately. Record the date a standard is opened on all standard bottles. Discard opened standards after 6 months. Turbidity standards are the exception; they should be discarded after 12 months of opening.
3. Make sure all equipment and work spaces are clean and dry before calibration.
4. All equipment and analyzers should be visually inspected for any abnormalities, such as a broken probe or damaged bulkhead.
5. Calibrations are best performed using a beaker, guard and calibration cup that are dedicated to calibration only and never taken in the field. This insures there is no contamination during the calibration process.
6. During the calibration **NEVER** accept any calibrations that display an error message. Troubleshoot the cause of the problem, correct it, and recalibrate or replace the probe before deploying the instrument.
7. Recommended probe calibration order:
    a. Temperature (not a true calibration, but a check against another source)
    b. Specific Conductivity
    c. pH
    d. Turbidity
    e. Wiper
    f. Depth
    g. Dissolved Oxygen
8. Remove the Wiper Brush from the sonde before calibrations. The brush can trap residual standard and affect the calibration accuracy.
9. All diagnostic parameters (pH millivolts, pH slope, DO gain, and conductivity cell constant) for EXO sondes are presented after calibration of the respective parameter on the KORS generated calibration log sheet and should be recorded on the BBP CWQM Log once each calibration is complete.

3.0.5 Calibration Supplies:

250ml plastic graduated beakers
Compressed air
Kimwipes
Turbidity standard (see how to prepare a dilution if preparing this standard)
pH buffers (4,7,10)

Conductivity standard
Rinse Standards
YSI ProPlus handheld
Dedicated calibration cup and guard
CLEAN 5-gallon bucket
Air pump and air stone
Deionized water and rinse water bottle
Laptop with KORS software
EXO2 Datasonde
SOA/USB for sonde to laptop connection

The following sections provide step-by-step methods for the calibration of each probe type. All data is recorded on the BBP CWQM Log under Pre-Deployment Calibration. (Note: make sure to complete sections 1.1 and 2.0 prior to the calibrations.)

Before starting any calibration procedures: fill a bucket with tap water and start aerating so that the bucket has been aerated for **60** mins prior to calibrating DO.

3.1 Temperature Sensor Check:

While it is not possible to calibrate the temperature probe, a temperature test is performed to verify that the temperature probe is working properly. Using a calibrated YSI handheld, perform the procedure below. BBP's handheld meters are calibrated and maintained by BBP staff. The temperature is checked quarterly against a NIST certified thermometer. The correction factor of this meter is recorded on the unit with masking tape and may be verified by the calibration logs for each meter.

1. Allow the sonde and YSI handheld to simultaneously sit in an aerated 5-gallon bucket of room temperature tap water for at least 5 minutes to reach temperature equilibrium.
2. Connect to the sonde via KORS software (section 1.1).
3. Click the Green Running Man icon to place sonde into discrete sampling mode.
4. Verify temperature readings have stabilized and record the **corrected** temperature reading from the YSI handheld in the data sheet's Pre-Deployment section noting which YSI handheld was used.
5. Enter the Barometric Pressure from the YSI handheld where indicated.
6. Record the sonde's temperature value, rounding to 1 decimal place, in the Pre-Deployment section of the data sheet next to "EXO-2".
7. Record the correction factor for the EXO sonde. Make sure to record 0.0 if there is NO correction factor.
8. Remove and replace EXO sonde from the water bucket and record a "duplicate" reading. This will be entered on the data sheet under EXO-2 duplicate. The duplicate should be +/- 10% of the corrected reading. If it is not, please notify lab manager.
9. Remove the sonde from the water bucket

3.2 Specific Conductance Functional Test

The Specific Conductivity check will verify that cleaned and dry electrodes read < 2 µs/cm with the probe dry and in air.

1. Rinse the Specific Conductance probe with Distilled or Deionized Water after the temperature verification test.
2. Using a compressed air source and kimwipes, carefully dry the sensor completely.
3. The Specific Conductance reading in air must be < 2 µs/cm, if greater that 2 µs/cm contact Xylem/YSI for assistance. Ideally, this reading should be 0.0. **Any reading >0.0 needs to be addressed, please notify lab manager before continuing with calibration.**
4. This reading is taken in discreet mode under the running man icon.
5. Record the Specific Conductance test value in the Sensor Diagnostics section under Pre-Deployment Calibration/Programming.

3.3 Conductivity Probe (Specific Conductivity & Salinity)

1 Point Calibration

1. CAREFULLY Attach sonde to ring stand without guard and tighten both clamps. Adjust the height so that the end of the wiper hangs about 1 cm above the stir plate when it is placed underneath.
2. Fill a clean 250 mL plastic beaker with ~150 mL calibration standard. For Conductivity calibrations, do NOT use the stir plate – make sure it is off as it *can* interfere with the sensor calibration.
3. Place the EXO sonde into the beaker.
4. Dunk the sensor a few times in the standard to ensure no air bubbles are trapped on the inside face of sensor.
5. Click the calibration icon (Bullseye) in KORS.
6. Click "Conductivity"
7. Click "SpCond" (Specific Conductivity)
8. Choose 1-point calibration and make sure the calibration standard value shows up properly (this may be entered manually each time or can be set to show up automatically by clicking the Gears icon, Calibration submenu icon, Cond icon, SpCond icon, and then entering the standard value for Cal Point 1, followed by clicking apply).
9. Enter the appropriate conductivity standard values in KOR from the manufacturer. The Standard value will change depending on temperature. This information can be obtained from the bottle, or the certificate of analysis located in the BBP Lab LOGS binder.
10. Type in the standard type, manufacturer, and lot # of the standard (standard type and manufacturer can be entered manually each time or auto-set using the procedure

described in the previous step). Record the standard value in the "standards" column on the calibration logsheet.

11. Click "Start Cal"
12. Once the temperature value has stabilized and "unstable data" in red font changes to "stable data" in green font, click "apply". Note- make sure the PreValue is stable. You may receive a stable data signal and the value is still changing. Once there has been no change in value for 30 seconds, you may "apply".
13. Click "Complete" to finish the calibration.
14. The calibration worksheet for the probe will pop up and the user should record the following four (4) values:
    a. Standard Value: record this value in the data sheet's "Standard" column.
    b. Pre-Calibration Value: record this value in the data sheet's "Before Cal" column.
    c. Post-Calibration Value: record this value in the data sheet's "Calibrated" column.
    d. Cell Constant: record this value in the data sheet's "Sensor Diagnostics" cell constant field. Review the cell constant value to make sure it is within the proper range of 0.419-0.519 for the Wiped CT sensor (From YSI: For wiped conductivity (599827), the ideal cell constant = 0.469/cm ± 0.05).
15. Exit the calibration worksheet.
16. Click the green running man icon and record the specific conductivity in the "check" column. The check reading should be +/- 1.0% of the standard value. If it is not, the sensor will need to be recalibrated.
17. While still in discrete mode, remove and re submerge sensor in the check standard and record a duplicate check reading. Record this value on the data sheet. The duplicate should be +/- 10% of the check reading. If it is not, please notify the lab manager.
18. Pour the used standard into a container labeled "rinse" as this standard can be used as a rinse in a future calibration.

YSI Tips:
Never calibrate with a standard less than 1.0 µS/cm as they are easily contaminated by residual Distilled water and electrical noise. Typical calibration errors are attributed to incorrect standard value input, inadequate calibration standard volume, or air bubbles in the conductivity cell. **Sensor accuracy is ±1% of the temperature compensated standard value**.

3.4 pH Probe:

3 Point Calibration (pH 4, pH 7, pH 10)
Note: All pH sensors require periodic reconditioning and cleaning, the pH reconditioning procedure should be performed quarterly and at the beginning of a new season. Please see

YSI pH handbook from YSI for proper pH sensor cleaning and reconditioning and long-term storage procedures.
Please be careful not to crack or damage the pH bulb. It is an unguarded glass electrode tip and is easily broken.

3.4.1 pH 4

1. Attach sonde to ring stand without guard and tighten both clamps. Adjust the height so that the end of the wiper hangs about 1 cm above the stir plate when it is placed underneath.
2. Rinse sensors with Deionized water into a 500 ml plastic beaker.
3. Rinse sensors with pH 4 rinse standard. To minimize standard use, use the wash bottle labeled "pH 4 Rinse" to rinse the sensors into a 500 ml plastic beaker.
4. Fill a clean 500 mL plastic beaker with ~250 mL pH 4 calibration standard and a clean stir bar. Place the sensors in the beaker, place the stir plate under the beaker, and turn the stir plate on low.
5. Click the calibration icon.
6. Click "pH".
7. Choose 3-point calibration and wait for the temperature reading on the top right to stabilize. Enter the Corrected Temperature on the Calibration Logsheet under "Buffer Temp".
8. Enter the appropriate pH 4, pH 7 and pH10 standard values in KOR based on the chart below according to the temperature:

Temp °C	pH		Temp °C	pH		Temp °C	pH
13	7.05		13	4.00		13	10.14
14	7.04		14	4.00		14	10.13
15	7.04		15	4.00		15	10.12
16	7.04		16	4.00		16	10.11
17	7.03		17	4.00		17	10.10
18	7.03		18	4.00		18	10.08
19	7.02		19	4.00		19	10.07
20	7.02		20	4.00		20	10.06
21	7.02		21	4.00		21	10.05
22	7.01		22	4.00		22	10.04
23	7.01		23	4.00		23	10.03
24	7.01		24	4.00		24	10.02
25	7.00		25	4.00		25	10.01
26	7.00		26	4.00		26	10.00
27	7.00		27	4.00		27	9.99
28	7.00		28	4.01		28	9.98

9. There is also a pH compensation worksheet on the shared drive that will give you values at specific temperatures (Shared\BBP Water Quality Laboratory\SOPs and Manuals\pH temperature compensation calculator). It is critical to note that unlike all other parameters; the exact pH value used for calibration may change slightly based on the temperature at which you are calibrating, and this compensation can vary based on the manufacturer's formula. If the standard values shown in the calibration page have been auto-set and do not match the values you want, simply input the correct values and proceed to the next step.
10. Enter the standard type, manufacturer, and lot # for each calibration point.
11. Click "Start Cal"
12. Watch the **mV** value, once the mV value has stabilized and "unstable data" in red font changes to "stable data" in green font, click "apply". Note- make sure the mV value is stable. You may receive a stable data signal and the mV value is still changing. Wait for this value to stop moving for at least 30 seconds before hitting apply.
13. Verify the "Pending (Post) value is correct and click "Proceed".

3.4.2 pH 7

1. Rinse the EXO probes with Deionized water to remove pH 4 standard used in the last step.
2. To minimize standard use, use the wash bottle labeled "pH 7 Rinse" to rinse the sensors into a 500 ml plastic beaker.
3. Fill a clean 500 mL plastic beaker with ~250 mL pH 7 calibration standard and a clean stir bar.
4. Click "OK" when the small window pops up saying "Proceed to Standard (7.0x pH).
5. Place the sensors in the beaker, place the stir plate under the beaker, and turn the stir plate on low.
6. Once the mV value has stabilized and "unstable data" in red font changes to "stable data" in green font, click "apply". Note- make sure the mV value is stable. You may receive a stable data signal and the mV value is still changing. Wait for this value to stop moving for at least 30 seconds before hitting apply.
7. Verify the "Pending (Post) value is correct and click "Proceed".

3.4.3 pH 10

1. Rinse the EXO probes with Deionized water to remove pH7 standard used in the last step.
2. To minimize standard use, use the wash bottle labeled "pH 10 Rinse" to rinse the sensors into a 500 ml plastic beaker.
3. Fill a clean 500 mL plastic beaker with ~250 mL pH 10 calibration standard and a clean stir bar.
4. Click "OK" when the small window pops up saying "Proceed to Standard (10.0x pH).

5. Place the sensors in the beaker, place the stir plate under the beaker, and turn the stir plate on low.
6. Once the mV value has stabilized and "unstable data" in red font changes to "stable data" in green font, click "apply". Note- make sure the mV value is stable. You may receive a stable data signal and the mV value is still changing. Wait for this value to stop moving for at least 20 seconds before hitting apply.
7. Verify the "Pending" (Post) value is correct and click "Complete".

3.4.4 QC/Record Keeping

1. The calibration worksheet for the probe will pop up and the user should record the following values:
    a. Standard Value: record this value in the data sheet's "Standard" column.
    b. Pre-Calibration Value for Cal Point 1: record this value in the data sheet's "Before Cal" column.
    c. Post-Calibration Value for Cal Point 1: record this value in the data sheet's "Calibrated" column.
    d. Raw Value pH mV: record in the data sheet's "Sensor Diagnostics" pHx millivolts field. These values should fall withing the ranges specified below. If they are outside these ranges, notify the lab manager and do not deploy the sonde:
        i. pH sensor Buffer 7 mV = 0 ± 50
        ii. pH sensor Buffer 4 mV = +180 ± 50
    e. Record the values (Standard Value, Pre-Calibration Value, Post-Calibration Value, and Raw Value) on the data sheet for the 2nd and 3rd calibration points following the same process as outlined in a-d above.
    f. Also record the pH probe slope in the data sheet's "Sensor Diagnostics" next to the text "mV span 7-4 and 7-10". Ranges should fall within the following limits. If the slope is out of range, notify lab manager and do not deploy the sonde.
        i. mV span between pH4 and pH 7 buffers = 160 –180
        i. mV span between pH7 and pH 10 buffers = 160 –180
        ii. pH data collected with a probe slope of less than 155 requires mandatory coding as suspect data. Do not deploy a sonde displaying a pH slope at or below 160. A new pH probe will display a slope at or near 180. A probe displaying a slope of 160-165 indicates the probe tip is nearing the end of its lifespan and will require replacement in the near future- notify lab manager.
2. Exit the calibration worksheet.
3. Remove the beaker from the sensors.
4. Rinse the EXO probes with Deionized water to remove pH 10 standard from the previous step.

5. To minimize standard use, use the wash bottle labeled "pH 7 Rinse" to rinse the sensors into a 500 ml plastic beaker.
8. Place the pH 7 calibration standard and a clean stir bar on the stir plate. Place the sensors in the beaker, place the stir plate under the beaker, and turn the stir plate on low.
6. Click the green running man icon and record the pH in the "check" column for pH 7 once the value stabilizes. **This value should be +/- 0.10 pH s.u. from the standard value. *(Accuracy: ±0.1 pH units within ±10˚C of calibration temp; ±0.2 pH units for entire temp range).*** If the check falls outside of this range, recalibrate and notify lab manager.
7. While still in discrete mode, remove and re submerge sensor in the check standard and record a duplicate check reading. Record this value on the data sheet. The duplicate should be +/- 10% of the check reading. If it is not, please notify lab manager.
8. Pour all of the calibration standards into the bottles labeled "rinse" for each standard so it may be used as a rinse in another calibration.
9. Dispose of the used rinse standards per the msds and college policies.

3.4.5 Cleaning

1. Dampen a Kimwipe with DI and gently wipe the glass bulb to clean it. The bulb is VERY delicate, DO NOT USE EXCESSIVE PRESSURE!
2. If there is a slow pH response, recondition the sensor by soaking it overnight in pH4 buffer or diluted household vinegar. Continue to step 3 if there is no improvement.
3. Soak 1-3 hours in Vinegar. Rinse thoroughly with tap water and check response. If no improvement, move to step 4.
4. Bleach:
    a. Soak the sensor in 1:1 Bleach solution for 1 hour.
    b. Rinse the sensor and soak in clean water for at least one hour while stirring occasionally.
    c. Rinse with DI and check for performance improvement.
    d. Continue to step 5 if there is no improvement.
5. 1M HCl:
    a. Soak the sensor for 30-60 minutes in 1M HCl.
    b. Rinse sensor in clean water (not DI) and wipe with a moistened cotton swab.
    c. Soak the sensor in clean water for an hour to ensure all traces of acid are removed.
    d. If there is no improvement, the sensor may need to be replaced. Contact YSI support.

YSI Tips: pH probe tips typically last 1 – 1.5 years on average. The entire probe does not need to be replaced when its lifespan has ended; only the probe tip (Part #577603-02).

3.5 Turbidity probe:

3.5.1 Turbidity calibration considerations:

1. NTU (nephelometric turbidity units) and FNU (formazin nephelometric units) are considered synonymous for the purposes of this document.
2. Do not calibrate turbidity in the field as clean surfaces and solutions are essential for a good turbidity calibration.
3. Use the dedicated EXO calibration cup for turbidity calibration; do not use any other calibration vessel.
4. Bubbles over the optics will interfere with calibration therefore it is recommended to carefully pour standards into the calibration cup with the cup held at an angle to avoid aeration and to visually confirm all air bubbles are clear from the probe face before calibration.
5. A 2-point calibration can be performed when sensor drift is evident. In such a case a dilution of stock formazin standard may be used as a second point. Using distilled water as a 0 NTU calibration point is not recommended as any contamination from the calibration cup, guard or sensors may introduce error. For more on turbidity visit YSI's website.

3.5.2 1-point Turbidity calibration:

For the best consistency, EXO users should use the YSI-labeled turbidity standards throughout the lifetime of their sensors, and use the FNU values on the labels of these standards during calibration

Note Turbidity standard= 100NTU, however, you will enter 124 NTU from bottle label as the standard value in KOR.

1. Rinse the EXO calibration cup, guard, and probes with DISTILLED water to remove standard from the previous calibration.
2. Fill the clean and dry Exo calibration cup that is labeled "Calibrations" with turbidity rinse standard.
3. Put a clean and dry guard onto the sonde and place in the Calibration cup. Gently shake and swirl to rinse the sensors.
4. Empty the Calibration cup and fill the Exo calibration cup that is labeled "Calibrations" up to the second line with 124 NTU YSI turbidity calibration standard by holding the calibration cup at an angle and slowly pouring the standard into the calibration cup to avoid introducing air bubbles.
5. Place the Exo sonde with the rinsed guard still installed into the Exo calibration cup and tighten the cup around the guard.
6. Gently tap the EXO sonde and calibration cup on the work bench at a 45-degree angle to insure air bubbles are not present on the sensor face. Visually inspect to make sure the probe face is air bubble-free before proceeding.
7. Click the calibration icon.

8. Click "Turbidity"
9. Click "Turbidity NTU"
10. Choose 1-point calibration and make sure the calibration standard shows up properly (this can be set by clicking the Gears icon, Calibration submenu icon, Turb icon, and then entering 124.00 for Cal Point 1 followed by clicking apply).
11. Enter the standard type, manufacturer, and lot #.
12. Click "Start Cal"
13. Once the turbidity value has stabilized and "unstable data" in red font changes to "stable data" in green font, click "apply".
14. Verify the "Pending" (Post) value is correct and click "Complete".
15. The calibration worksheet for the probe will pop up and the user should record the following values:
    a. Standard Value: record this value in the data sheet's "Standard" column.
    b. Pre-Calibration Value: record this value in the data sheet's "Before Cal" column.
    c. Post-Calibration Value: record this value in the data sheet's "Calibrated" column.
16. Exit the calibration worksheet.
17. Click the green running man icon and record the turbidity in the "check" column. This Value should read +/- 2.0% of the standard value. If not, recalibrate.
18. While still in discrete mode, remove and re submerge sensor in the check standard and record a duplicate check reading. Record this value on the data sheet. The duplicate should be +/- 10% of the check reading. If it is not, please notify lab manager.
19. Pour the used standard into a container labeled "rinse" as this standard can be used as a rinse later.
20. Dispose of the used rinse standards per the msds and college policies.

YSI Tips:
Take care not to touch, bang or scratch the turbidity probe as this can damage the optics and produce inaccurate readings. If necessary, the face can be gently wiped with a lint free Kimwipe to remove dirt or smudges. **Sensor accuracy is ±2% at 124 NTU, so the check should read between 121.52 and 126.48 NTU.**

3.6 Wiper

1. Attach a clean wiper brush to the end of the central wiper and use the hex key to tighten as much as possible. While turning the Allen key, wiggle the wiper. This aids in proper alignment and reduces wiper loss during deployment.
2. Click the green running man icon and click "Wipe Sensors"
3. Click the calibration icon
4. Click "Wiper"
5. Click "Wiper PosV"

6. Click "Start Cal"
7. Hold the sonde in a position where you can see the brush location in relation to the garage, or attach to ring stand.
8. Click to "jog left" or "jog right" to center the brush in the garage.
9. Click "apply"
10. Click "complete"
11. The calibration worksheet for the probe will pop up and the user should record the wiper factory home and cal value on the datasheet.
12. Close the Calibration worksheet.
13. Park Range should be **±.05 the Cal value.** Enter the range on datasheet.
14. Exit the Calibration Worksheet.

If using a zip tie: Zip tie the sensors together using a zip tie from the central wiper maintenance kit from YSI.

If using the sensor alignment ring from YSI: Attach the sensor alignment ring and o-ring to keep sensors in position. Placement should be just below the tops of sensors and 2 o-rings should be used to keep ring in place.

3.7 Depth/Water Level:

1 Point Calibration

1. Fill EXO calibration cup with a small amount of water (the volume should not reach anywhere near the probes) to create a water-saturated air environment.
2. Screw the guard onto the sonde and place it into the calibration cup (do not tighten cup – it should not be air tight).
3. Allow the sonde to remain in a vertical position.
4. Click the calibration icon.
5. Click "Depth"
6. Click "Depth m"
7. Click "Start Cal"
8. Once the depth value has stabilized and "unstable data" in red font changes to "stable data" in green font, click "apply".
9. Click "Complete"
10. The calibration worksheet for the probe will pop up and the user should record the following values:
    a. Pre-Calibration Value: record this value in the data sheet's "Before Cal" column for depth.
    b. Post-Calibration Value: record this value in the data sheet's "Calibrated" column for depth.
11. Exit the calibration worksheet.
12. Click the green running man icon and record the depth in the "check" column.

13. While still in discrete mode, remove and replace sensor in the cal cup and record a duplicate check reading. Record this value on the data sheet. The duplicate should be +/- 10% of the check reading. If it is not, please notify lab manager.

YSI Tip: Make sure the correct latitude for the deployment site has been entered into the EXO sonde. **Sensor accuracy is ±0.004, so the check should read between -0.004 and 0.004**.

3.8 Dissolved Oxygen Probe:

3.8.1 1-point calibration

1. Aerate a 5-gallon bucket filled ¾ full with tap water for at least an hour prior to calibrating a dissolved oxygen probe. This creates an air-saturated environment referred to as a 100% air-saturated water bath.
2. Once the bucket has been aerated for a minimum of 60 mins, remove the air stone and place the sonde and calibrated handheld in the aerated bucket of water. Make sure there are no air bubbles on either DO sensor surface.
3. Click the calibration icon.
4. Click "ODO"
5. Click "ODO % sat"
6. Review the temperature value on the screen and make sure it is stable.
7. Enter the Barometric Pressure in mmHg recorded on datasheet from section 3.1.
8. Choose 1-point calibration and make sure the calibration standard shows up properly as air saturated (this can be set by clicking the Gears icon, Calibration submenu icon, ODO icon, ODO % sat icon, and then selecting "air saturated" followed by clicking apply).
9. Click "Start Cal"
10. Once the temperature value has stabilized and "unstable data" in red font changes to "stable data" in green font, click "apply".
11. Verify the "Pending (Post) value is correct and click "Complete".
12. The calibration worksheet for the probe will pop up and the user should record the following three values:
    a. Pre-Calibration Value: record this value in the data sheet's "Before Cal" column.
    b. Post-Calibration Value: record this value in the data sheet's "Calibrated" column.
    c. DO Gain: record in the data sheet's "Sensor Diagnostics" optical DO gain field.
13. Review the DO Gain to make sure it is within the recommended 0.87 – 1.25 range
14. Exit the calibration worksheet.
15. Click the green running man icon and record the DO in the "check" column.

3.8.2 QC

1. Place both the EXO sonde and calibrated handheld in the aerated bucket. Make sure the handheld has been calibrated in air saturated water (in the bucket).
2. Record the handheld DO% and mg/L and the EXO mg/L on the calibration log sheet. EXO mg/L values should be within ± 0.3 mg/L of the calibrated handheld.
3. While still in discrete mode, remove and re submerge sensor in the water bucket and record a duplicate mg/L reading. Record this value on the data sheet.

YSI Tips:
DO probe sensor caps should last 1–2 years (possibly longer), but do require replacement once its lifespan has ended. For optimum performance, Optical DO sensor membranes must be kept fully hydrated in water. If your DO probe has been dry-stored, it will need to hydrate in saturated tap water over night. If the probe was stored in saturated air the sensor should be placed in saturated water for a few hours to ensure full hydration. Always make sure that the DO membrane is clean and free of any slime or mold. **Sensor accuracy is ±1%, so the check should read between 99% and 101%**.

4.0 DEPLOYMENT and RETRIEVAL

4.1 Programming:

4.1.1 Update time

1. While connected to the EXO2, Click Gear icon
2. Click "Sonde"
3. Click "Update Time"
    a. All Deployments will be in Eastern Standard Time. Make sure your PC is set to standard time. If necessary, click box next to "Relative to PC" so that sonde time is in Eastern Standard Time. This step may not be necessary if it is not during Daylight Savings Time.
4. Click "Apply"
5. Circle the Y for YES under "Set Clock Status" in the Programming section of the datasheet.

4.1.2 Prepare for deployment

1. Click Large Green Arrow icon.
2. Click "Read Current Sonde Settings" submenu icon (Note– this should not change with each deployment).
    a. Make sure the template matches the sonde code/station name. When sondes return from service at YSI, they have a ysi template loaded. You **MUST** upload the appropriate station template (Seaside, Mantoloking or Beach Haven).
3. Click Screwdriver & Wrench icon.
4. Enter a template file name (each station has a template) and choose deployment Time Zone.
5. The user will also see three clickable tabs:
    a. Basic
        i. Logging Interval (Hour:Minute:Second): enter as 0:15:0
        ii. Username: enter as user wishes.
        iii. Site Name: choose from drop-down menu list of station names entered into KORS using the Map icon (See KORS software section).
        iv. File name prefix: characters entered here will be the first ones used in filenames.
    b. SDI-12: used in telemetry applications. Order of parameters should be:
        i. Temp_C
        ii. SpCond_mS
        iii. Sal

iv. Depth_m
v. PH
vi. PH_mV
vii. Turbidity_NTU
viii. ODO_Percent
ix. ODO_mg/L
x. Batt_V

c. Advanced: used to enable sample and hold for sondes placed at telemetry sites along with other advanced logging options.

6. Once the information has been set in the above three tabs, click the small green arrow icon (says Save, Deploy, Start Logging when moused over).
7. Click "Continue" on the pop-up that warns about depth and elevation.
8. Choose a start time and date (either setting a time when the instrument will be deployed or if on site, using "Next Interval"). *When entering a custom time, do not use the "tab" button as it will auto populate with a 1900 date and the file will not save. Make sure to click through and check the date prior to continuing.
9. Click "Apply".
10. The "Current Deployment Summary" screen will show up containing a number of values needed for filling out the "Programming" section of the data sheet. Record the following from this summary page on the data sheet:
    a. Start Date
    b. Start Time (standard time)
    c. Free Memory Status (%): labeled as Log Space Available in % in KOR
    d. Battery Voltage
    e. Sonde Filename: name of the .BIN file

4.1.3 The sonde is now ready for deployment!

1. Disconnect Sonde from laptop by clicking the Circular Blue/Green Arrows icon.
2. Click Rescan
3. Click on the Comm port that has the currently connected EXO.
4. Click Disconnect
5. Close KOR software
6. Disconnect SOA from sonde and laptop
7. Replace Comm port plug.

4.2 EXO Retrieval/Deployment

The sonde is now ready to be deployed at the appropriate station.

4.2.1 Prior to leaving

1. Make sure each sonde has a label taped to the sonde body indicating the Sonde Code and Station ID.

2. When transporting the sondes, a tap-water-soaked towel can be wrapped around the probes. The sonde may also be transported in a field calibration cup filled with tap water. This is to be done during both deployment and upon retrieval to reduce shock and vibration damage and ensure a saturated environment for the oxygen probe during transport. This task is *MANDATORY* to improve the oxygen data we are collecting.
3. Sondes should be transported in a cooler of sufficient size to allow them to lie horizontal across the bottom. Suggested size is 28" x 15" x 14" for up to 4 sondes.
4. A copper guard with copper mesh shall accompany each EXO. It is to be installed over sensors in place of the plastic guard to help lessen fouling and prevent anything from entering the guard and interfering with the sensors.
5. A handheld WQ monitor (YSI) will also be needed for side by side comparison readings.

4.2.2 Retrieval

1. Place calibrated YSI handheld in the water adjacent to the EXO deployment tube at approximately the same depth as the deployed EXO (do not come in contact with the sediment). Independent, paired field data readings are required at all sonde retrievals/deployments. Use a YSI hand-held meter or other properly calibrated instrument to collect data alongside the deployed sonde for its last reading and the newly deployed sonde for its first reading. At a minimum, you must take an independent paired reading with the freshly calibrated sonde against the deployed sonde before replacing
2. Once on site, record field data with a calibrated YSI hand-held meter or other properly calibrated instrument for the following mandatory parameters on the data sheets: corrected water temperature, specific conductivity, salinity, pH, pH millivolts, barometric pressure, DO percent saturation, DO concentration, turbidity if applicable and instrument used to take measurements. Additional optional parameters may be recorded in the "Comments" field of the data sheet.
3. Pull EXO2 up from deployment tube. Be sure to pull by the safety rope and not the communication cable.
4. Retrieve the sonde from the water and visually examine it and the probes for fouling and/or damage. Note any fouling type and amount in the "Fouling Presence" section of the Water Quality Field Log, however DO NOT remove fouling, so that true post-deployment readings may be obtained. Obtain photos of the sonde body and probes/bulkhead to be stored on the shared drive. Note the photo ID's on the Retrieval section of the Log sheet.
5. Disconnect the power cable and safety cable from the retrieved instrument and remove fouling with fresh or bay water careful not to get water directly into and onto the male and female connections.

6. Wrap the EXO sonde in a tap-water saturated white towel or place in a tap water filled calibration cup and place in a cooler in order to prevent severe vibrations to the EXO sonde during transportation.

4.2.3 Deployment

1. Prepare the new sonde for deployment by attaching the copper guard (careful not to hit the unguarded pH sensor bulb) and plugging the data cable into the appropriate port.
2. Make sure that there is a safety rope/cable attached to the bail of the sonde and the cap of the deployment tube. Use this rope to lower the EXO. Ensure that the sonde is completely deployed – lift and lower and make sure it is hitting the stop bolt in the deployment tube.
3. Once the sonde is fully deployed, record the YSI handheld data (the handheld should have remained in place) on the Deployment section of the newly deployed sonde's data sheet.
4. All sondes are to be deployed so that the probes stay submerged at low tides and are at a fixed distance off the bottom to allow for tidal and flow amplitude measurements. Suggested methods include a perforated PVC (or other plastic) tube attached to a pile of bridge abutment or a steel cage resting on the bottom (be sure probes are 0.25 to 0.5 meter off bottom). If you use a perforated tube, this tube must be periodically inspected for fouling and cleaned.
5. The length of time the instrument is deployed is dependent on the rate of fouling at your site. This will range from less than a week to up to a maximum of four weeks.
6. PVC deployment tubes:
    a. Service the tubes annually
    b. To check on the integrity of the installation tube, deploy a second sonde outside the tube and at the same depth. Compare the data from the two sondes. If the tube is fouled, the sonde inside will only be recording the microcosm of the pipe, not the water itself.

5.0 EXO DATA DOWNLOAD & POST-DEPLOYMENT READINGS

NOTE – Post deployment readings and checks note any changes or drift of the probe during deployment combined with effects of biofouling. This process is critical not only for data QAQC, but also for data users to know if the data were affected by biofouling, wear and tear, or other issues. Ideally these checks will take place within 24 hours of EXO sonde retrieval. If not, it is critical to make a visual inspection of the conductivity cells and note, either photographically or via notes, any visible fouling to document related drift. Bubbles and saturated water bath currents may dislodge material and significantly impact drift.

5.1 Data Download

1. Place the EXO sonde into a bucket of clean water that has been aerated for at least 60 minutes to create a 100% air saturated water bath. Allow the sonde ample time to reach temperature equilibration prior to beginning the download and post-deployment readings procedures.
2. Connect to the EXO sonde via the USB/SOA adapter or wirelessly via Bluetooth (see section 1.1).
3. Click Large Green Arrow icon
4. Click "Stop Deployment", "Apply", "OK"
5. Click Data Folder icon
6. Click "Transfer"
7. Click to highlight the file of interest. The deployment file name is noted on the Calibration Log sheet under Programming.
8. Click "Selected"
9. Click "View/Export"
10. If a PC folder window comes up, click the file of interest in that window and click "okay". If it does not pop up, click the small blue folder icon that says "select file" when you mouse over it (NOT the Main Data folder icon), select the file and click "okay".
11. Click the icon next to the small blue folder icon (two white pages stacked on each other) that says "export data" when moused over.
12. Two files should now be visible in the "Data Files" folder within the KORS folder on the PC hard drive; a .BIN file and an Excel file, the latter of which often opens automatically.
13. Circle YES on the datasheet for "data download".
14. Do NOT remove the sonde from the aerated water bath yet.

5.2 Post-Deployment Readings/Checks

These readings are taken in discrete mode via the Green Running Man icon and exhibit many procedural similarities to the calibration procedure. While not specifically listed step by step, the same set up and rinsing procedures between readings for each probe as detailed in the Calibration Section should be followed. Values recorded during Post-Deployment checks are written in the "Post-Deployment Checks" section of the WQ Data Sheet.

1. Remove the guard and using an Allen wrench, remove the wiper brush from the central wiper assembly. Clean all debris from the brush immediately. Soak the brush in water with mild detergent. Remove brush, rinse well and use a small o-ring to keep bristles from drying with gaps. Place the freshly cleaned wiper to the side to dry as it is no longer needed for this section. The wiper may also be soaked in Boiling water with the o-ring in place to help re-form the bristles.
2. Place a calibrated YSI handheld into the aerated bucket with the sonde. Reconnect to the sonde if necessary (Section 1.1).
3. Click the Green Running Man icon.
4. Record date, time, analyst, ysi used and the date the handheld was last calibrated.
5. Record the temperature readings given by the EXO sonde and YSI handheld, remembering to record the corrected temperature for both instruments.
6. Record the DO % saturation and mg/L readings taken in the air saturated water bath for both instruments in the post-deployment checks section of the data sheet.
7. While in discreet mode, click the "Wipe Sensors" button. Note the finished wiper voltage value on the datasheet under "wiper position".
8. Remove the EXO from the saturated water bath. Remove air stone from bucket.
9. Place guard back on sonde and place in a water-saturated air environment (loosely fitted calibration cup with a tiny amount of water in it). While in discreet mode, record the water depth/level value given by the EXO sonde and the barometric pressure reading from the handheld.
10. Record the Battery voltage given in discreet mode in the appropriate box on the datasheet.
11. Record post-deployment specific conductivity reading on the datasheet by running the EXO in discreet mode in the same standard value used to calibrate with. Rinse the sensors with deionized water before moving on to the next step.
12. Record post-deployment pH readings, corrected temperature and diagnostic millivolt readings on the data sheet by running the EXO sonde in discrete mode in each of the 3 pH standards. Careful to rinse with Deionized water and the appropriate rinse standard in between each calibration check.
    a. Also record the pH probe slope on the data sheet next to the text "mV span 7-4 and 7-10".
    b. Verify that the pH slope is within the ideal range of 160 – 180. pH data collected with a probe slope of less than 155 requires mandatory coding as suspect data. It is not recommended to deploy a sonde displaying a pH slope at or below 155.

A new pH probe will display a slope at or near 180. A probe displaying a slope of 160-165 indicates the probe tip is nearing the end of its lifespan and will require replacement in the near future.

15. Place handheld and sonde in bucket without aeration and record turbidity readings on log sheet.
16. Disconnect the sonde from KORS (remove the adapter for cabled communication or put the EXO sonde to sleep with the magnet tool for blue tooth connection).
17. Clean the EXO sonde thoroughly.
    a. Remove batteries and clean battery compartment cover and grease the o-rings.
    b. Clean and re-tape each sensor very carefully. Inspect and re-grease all o-rings.
    c. Port plugs can also be cleaned with Q-tips and re-greased. All pins can be greased as well.
    d. Dry all female connectors with compressed air.
    e. If removing the sensors, be sure to keep the DO tip wet and the pH tip in pH 4 buffer.
18. Connect the clean, taped sensors to the sonde. Place the EXO in a calibration cup with about an inch of water to ensure a water saturated environment.
19. The EXO may now be prepared for storage until its next deployment.

6.0 PROBE CARE & STORAGE

Most of the probes, except Conductivity, have a limited shelf life so do not purchase replacements too far in advance. The procedure for storage of probes is different for short-term (1 month or less) and long-term (greater than 1 month). Please refer to the EXO user manual for more detailed instructions and recommendations regarding storage and care.

6.1 Short-term Storage

For short term storage, it is important to keep the probes moist but not immersed in water. Keep probes attached to the EXO sonde and place approx. 0.5 inches of tap water (not distilled) in the sealed EXO calibration cup.

6.2 Long-term Storage

1. Probes/sensors: All probes should be cleaned and dried thoroughly and then stored in their original box with caps on where appropriate. Each probe was shipped with a cap to cover the connector; these should also be place on the probes for long term storage.
    a. Clean conductivity sensors and store them dry.
    b. The pH probe should be stored in the pH storage cup (the one it was shipped in) containing 1 molar KCL or pH 4 buffer.
    c. No special precautions are necessary for the Depth sensor.
    d. Store the turbidity probe dry in air and cover the optical surface with a cap to prevent scratching
    e. Dissolved Oxygen probes should be stored in the cap it was shipped in. This cap has a small sponge that should be kept moist to maintain a water-saturated air environment to avoid the need for a 12-hour membrane rehydration at a later date. This sponge should be checked periodically to make sure it remains moist. The probe can be stored dry, but if done so it must be re-hydrated in water for a 12-hour period.
    f. Remove the brush from the wiper probe and store dry (make sure it is clean and dries in original shape – no gaps or forks in the bristles). The wiper itself can be stored in its original box with cap over connector.
    g. Remover copper tape applied directly to the sensors prior to long-term storage to prevent the glue from hardening and becoming difficult to remove. Copper tape can remain in place if a protective barrier is applied underneath like packing tape or YSI clear anti-fouling sleeves.

2. For EXO sondes:
    a. Remove batteries prior to storage greater than 30 days.
    b. The battery compartment and compartment cap should be cleaned thoroughly and re-greased prior to storage.
    c. Clean and re-grease the two sonde connectors (located at the top of the sonde) and place connector caps on both.
    d. Put plug ports in place of any missing sensors.

EXO Parameter Measured	Sensor**	Range	Accurracy	Response	Resolution
Conductivity[1]	Conductivity / Temperature Sensor	0 to 200 mS/cm	**0 to 100:** ±0.5% of reading or 0.001 mS/cm, w.i.g.;	T63<2 sec	0.0001 to 0.01 mS/cm (range dependent)
	SKU: 599870		**100 to 200:** ±1% of reading		
Depth - 10 m	Integral, Non-vented Depth Sensor[3]	0 to 10 m	±0.04% FS (±0.004 m or ±0.013 ft)	T63<2 sec	0.001 m (0.001 ft)
		(0 to 33 ft)			(auto-ranging)
Dissolved Oxygen, % air saturation	Optical Dissolved Oxygen Sensor	0 to 500%	**0 to 200%:** ±1% of reading or 1% saturation, w.i.g.;	T63<5 sec[5]	0.1% air saturation
	SKU: 599100-01	air saturation	**200 to 500%:** ±5% of reading [4]		
Dissolved Oxygen, mg/L	Optical Dissolved Oxygen Sensor	0 to 50 mg/L	**0 to 20 mg/L:** ±0.1 mg/L or 1% of reading, w.i.g.;	T63<5 sec[5]	0.01 mg/L
	SKU: 599100-01		**20 to 50 mg/L:** ±5% of reading [4]		
Level, Vented - 10 m	Integral Vented Level Sensor	0 to 10 m (0 to 33 ft)	±0.03% FS (±0.003 m or ±0.010 ft)	T63<2 sec	0.001 m (0.001 ft)
pH	pH Sensor	0 to 14 units	±0.1 pH units within ±10˚C of calibration temp;	T63<3 sec[8]	0.01 units
	SKU:599701 guarded, 599702 unguarded		±0.2 pH units for entire temp range[7]		
	pH/ORP Sensor				
	SKU:599705 guarded, 599706 unguarded				
Temperature	Conductivity / Temperature Sensor	-5 to 35°C	±0.01°C[2]	T63<1 sec	0.001 °C
	SKU: 599870	35 to 50°C	±0.05°C[2]		
Turbidity[9]	Turbidity Sensor	0 to 4000 FNU	**0 to 999 FNU:** 0.3 FNU or ±2% of reading, w.i.g.;	T63<2 sec	0 to 999 FNU = 0.01 FNU;
	SKU: 599101-01		**1000 to 4000 FNU:** ±5% of reading[10]		1000 to 4000 FNU = 0.1 FNU
Salinity	Calculated from Conductivity and Temperature[11]	0 to 70 ppt	±1.0% of reading or 0.1 ppt, w.i.g.	T63<2 sec	0.01 ppt
Specific Conductance	Calculated from Conductivity and Temperature[11]	0 to 200 mS/cm	±0.5% of reading or .001 mS/cm, w.i.g.	-	0.001, 0.01, 0.1 mS/cm
					(auto-scaling)
Total Dissolved Solids (TDS)	Calculated from Conductivity and Temperature[11]	0 to 100,000 mg/L	Not Specified	-	Variable
		Cal constant range			
		0.30 to 1.00			
		(0.64 default)			
Total Suspended Solids (TSS)	Calculated from Turbidity and user reference samples	0 to 1500 mg/L	Not specified	T63<2 sec	Variable

**Specifications indicate typical performance and are subject to change. All sensors have a depth rating to 250 m (820 ft), except shallow and medium depth sensors, ammonium,
chloride, and nitrate. Accuracy specification is attained immediately following calibration under controlled and stable environmental conditions. Performance in the natural
environment may vary from quoted specification.
w.i.g. = whichever is greater
EXO sensors are not compatible with YSI 6-Series sondes, sensors, or handheld.
[1]Outputs of specific conductance (conductivity corrected to 25˚C) and total dissolved solids are also provided. See Calculated Parameters and footnote 11.

[2] Temperature accuracy traceable to NIST standards

[3]Accuracy specifications apply to conductivity levels of 0 to 100,000 µS/cm.

[4] Relative to calibration gases

[5] When transferred from air-saturated water to stirred deaerated water

[6] When transferred from water-saturated air to Zobell solution

[7]Within the environmental pH range of pH 4 to pH 10.

[8]On transfer from water-saturated air to rapidly stirred air-saturated water at a specific conductance of 800 µS/cm at 20˚C; T63<5 seconds on transfer from water-saturated air to
slowly-stirred air-saturated water.

[9] Calibration: 1-, 2-, or 3-point, user-selectable

[10] Performance based on 3-point calibration done with YSI AMCO-AEPA standards of 0, 124, and 1010 FNU. The same type of standard must be used for all calibration points.

[11] Values are automatically calculated from conductivity according to algorithms found in *Standard Methods for the Examination of Water and Wastewater* (Ed. 1989).

(From: ysi.com)

Appendix 2. BBP Standard Operating Procedure for QA/QC and Data Management of Continuous Water Quality Data

Barnegat Bay Partnership

Continuous Water Quality Monitoring Program

Standard Operating Procedure for

QA/QC and Data management of Continuous

Water Quality Data

Prepared By
Nicole Petersen
Barnegat Bay Partnership
V.2 September 2023

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BACKGROUND:

Barnegat Bay Partnership's continuous water quality monitoring program consists of 3 monitoring stations in Barnegat Bay (Table 1).

Table 1: Barnegat Bay Partnership's continuous water quality monitoring locations in Barnegat Bay.

Site Name	Location	Waterbody	Latitude	Longitude
Mantoloking	Mantoloking Yacht Club	Barnegat Bay	40.0374 N	74.05405 W
Seaside Park	Seaside Park Yacht Club	Barnegat Bay	39.921813 N	74.0828445 W
Beach Haven	Morrison's Marina	Little Egg Harbor	39.567079 N	74.245045 W

Each of the monitoring stations consists of one deployment platform affixed to a bulkhead, piling or other dock structure and is assigned two YSI data sondes; one data sonde is deployed in the water and a second remains ready for a maintenance and calibration swap every 2 - 4 weeks. Each of the YSI EXO2 data logger systems is programmed to record temperature, salinity, dissolved oxygen, pH, turbidity, and water level every 15 minutes. The raw data is transmitted via a cellular modem once per hour to the New Jersey Department of Environmental Protection Bureau of Marine Water Monitoring, where it is downloaded and sent to their website for near real-time data retrieval by other organizations.

This SOP was developed utilizing the Centralized Data Management Office (CDMO) Data Management Manual (Appendix 1, V.6.7) and will provide step by step instructions on how to manage, process and check the data collected from the continuous monitoring program. The consistent processing of data is crucial to reliable and useful data.

DATA MANAGEMENT AND QA/QC

The data should be downloaded from the EXO2 sondes as described in the Barnegat Bay Partnership's (BBP) "Standard Operating Procedure for the calibration and Maintenance of YSI EXO-2 Multi-Parameter Data Sondes" section 5.1. All original data files will remain on the sondes as back up in case there are problems with data files or storage. Additionally, data will be backed up at least monthly to the following shared folder on the one drive: WATER QUALITY DATA BACKUP.

WHERE ARE THE DATA LOCATED?

Once the data are downloaded from the sonde, they are automatically saved on the lab computer connected to the EXO in the following location:

C:\Program Files (x86)\KOR-EXO\Data Files

1. Transfer files to: *Shared\ BBP Water Monitoring Network\Data\QC 1-RAW Data Files* – this is where all unprocessed RAW data will be saved.
2. Each deployment will have 2 files, an excel file and a .bin file that can only be read in KOR. Both are "copied". *Do not cut or delete original files. *
3. Each file will have the same format:
    a. EXO_SD_<serial number>_<deployment date>_<6 numbers that are not important>
    b. Example: EXO_SD_16F101826_111517_143000
4. Data will be stored on and processed from the Ocean County College server: Bbay(\\neptune)--> *Shared\BBP Monitoring Network\Data*
    a. There are 4 folders that will be used:
        i. QC 1-Raw Data Files = unprocessed raw files
        ii. QC 2-In Progress = files in the process of being QC'd
        iii. QC 3-Completed = files completely processed
        iv. R – Files = code to QC and analyze data

HOW TO PREP THE ORIGINAL FILE

In this step the original file will need to be saved as a .CSV file that can be used in the rest of the QA/QC procedures.

1. Find the deployment Log sheet of the file you want to QAQC. This should be located in the Lab either on the WQ Clipboard or in the 1st cubby where the blank data sheets are.
2. Navigate to the file you would like to QAQC where it was saved in 1.1.
3. The file name can be located on the data sheet under Pre-Deployment Calibration/Programming->Programming →Sonde file name
4. Cut both the excel file and the .bin file and paste them into *Z:\Shared\BBP Water Monitoring Network\Data\QC 2-In Process* and the appropriate station

folder (BH, SS or MT - location can be found on the data sheet for the deployment).

5. Open the excel file
6. Save the excel file as a CSV (comma delimited).
    a. File
    b. Save as
    c. Select .csv (comma delimited)
    d. Name it as the file name with "**_cdmo"** at the end. (ex:EXO_SD_16F101826_111517_143000**_cdmo**.csv)
    e. Click OK to pop up and YES to format question
7. Organize files as follows:
    a. Create a folder for the specific deployment:
        i. Z:\Shared\BBP Water Monitoring Network\Data\QC 2-In Progess\BH or SS or MT\EXO_SD_16F101826_111517_143000
    b. Cut all 3 files for that deployment and paste them into the specific deployment folder you just created. This is the folder you will continue to work out of until the process is complete.

PREPPING THE CSV FOR CDMO

The BBP utilizes, with permission, the non-SWMP online tool for processing data files (SWMP= System Wide Monitoring Program for the National Estuarine Research Reserve System-NERRS). The procedure is outlined here but for additional information about the NERR process, please refer to the Centralized Data Management Office (CDMO) Data Management Manual V.6.7 2022.

1. Open the newly created .csv file
2. Double check the serial numbers of the sonde and sensors on the data sheet.
3. Delete entire rows - the top sonde information up to the column headings (usually Rows 1-23). Do not delete the column headings.
4. Now you are going to delete all of the data before the sonde was deployed in the bay and after it was pulled. Note: as of 2018, Sonde time was left in EASTERN Standard Time.
    a. Look at the "Deployment Date and Time" on the deployment sheet and find it in your file (make note if the data sheet time was in LOCAL or EST).
    b. Now look at the "Cable Power V" column (this column indicates the amount of power coming to the sonde from the cable attached to the box).
    c. This will read 0 when the power to the sonde is coming only from its batteries. Once you hook the cable up to the sonde, this will have a voltage reading and it's the best indicator of when the sonde was put into the water.
    d. Once you identify when you have power, look at the first couple lines of data and make sure that the data is consistent with other readings. Salinity and Specific Conductance is another good indicator as is Depth.

This is to ensure that the cable was hooked up to the sonde and the sonde wasn't sitting on the dock taking measurements. Once you can confirm that the sonde was in the water, you can go ahead and delete the data rows above that point from when the sonde wasn't in the water (do not delete column headings).

e. Do the same thing from the retrieval date and time to delete the data after the sonde was pulled from the water.
f. Note – there are times where a sonde will be deployed without topside power. In these instances, the cable power indicator cannot be used. You will need to look at all parameters along with the deployment/retrieval times to determine what is to be deleted.
g. Save (save automatically as same file type - _cdmo.**csv**)

DATA SHEET QA/QC

CHECK (QC) deployment and retrieval data. This step is crucial and should not be forgotten. Once you have deleted header data along with pre and post deployment data you must review all pre and post deployment calibration/check data. Refer to the following file to calculate % errors: *Z:\Shared\BBP Water Monitoring Network\Data\Post check_pH_%error_QCworksheet.* If any of the below values are outside limits, a note is made on the logsheet.

1. Calibration checks<- look at the values recorded during calibration. Make notes on data sheet if any are out of spec. All of the following values should be checked during calibration. If anything is out of the noted values, steps should be taken at that calibration step so a questionable sensor is not deployed. This step double checks that process. Note any discrepancies in the "Pre-Deployment" comments section of the datasheet.
    a. The following parameters are compared against a calibrated handheld YSI instrument during calibration:
        i. Temperature = a correction factor is determined in the calibration step
        ii. DO mg/L = ± 0.3 mg/L
    b. The following parameters are checked against the calibration standard value:
        i. DO% = ± 1%
        ii. Depth = ± 0.004m
        iii. Sp Conductivity = ± 1%
        iv. Turbidity = ± 2%
        v. pH 7 = ± 0.1 pH units from true value (temperature compensated value) of buffer
2. Calibration **Precision** goal check <- look at the check standard and duplicate reading for each parameter. The precision goals for each reading should be +/- 10% of each other. Make a note if they fall outside of the precision goal.
3. Review that all of the calibration sensor diagnostics check out. Make notes on data sheet if any are out of spec. All of the following values should be checked

during calibration. If anything is out of the noted values, steps should be taken at the calibration step so a questionable sensor is not deployed. This step double checks that process. Note any discrepancies in the "Pre-Deployment" comment section of the datasheet.

i. Dissolved Oxygen Gain = 0.87-1.25
ii. pH sensor Buffer 7 mV = 0 ± 50
iii. pH sensor Buffer 4 mV = +180 ± 50
iv. pH sensor Buffer 10 mV = -180 ± 50
v. Conductivity cell constant = 0.469 ± 0.05
vi. mV span between pH4 and pH 7 buffers = 160 –180
vii. mV span between pH7 and pH 10 buffers = 160 –180

4. Post deployment checks (**Accuracy**)<- look at the post deployment check section of the data sheet. Open the following file *Z:\Shared\BBP Water Monitoring Network\Data\ POST check_pH_%error_Qcworksheet* and enter data in the "POST QAQC goals" tab. NOTE ANY failures in the "Post-Deployment Comments" section of the datasheet. **Any parameter that fails a post deployment check results in that parameter being removed from the final data set (the entire deployment).**
    a. The following parameters are checked against known standards:
        i. Sp Conductivity = ± 10% of known standard
        ii. pH = ± 0.3 pH units from true value (temperature compensated value) of buffer
        iii. Turbidity = ± 5.0% of known standard
    b. The following parameters are checked against a calibrated handheld YSI instrument in a bucket of water that has been aerated for at least 60 minutes:
        i. DO mg/L = ± 0.3 mg/L;
        ii. Temperature = ± 0.5°C
5. Compare the **DEPLOYMENT** YSI readings to the 1st reading on the spreadsheet. All of the values should be within +/-10% of each other except pH which should be within ±0.1 of each other. Note on log sheet the % error and comments under "Deployment Comments".
6. Compare the **RETRIEVAL** YSI readings to the last reading on the spreadsheet. All of the values should be within +/-10% of each other except pH which should be within ±0.2 of each other. Note on log sheet the % error and comments under "Retrieval Comments.
7. If any of the checks are questionable, the data set may be in question. Discuss with Lab supervisor.
8. Save your file (file name will remain the same *_cdmo.csv)

***When comparing YSI readings to the EXO readings, remember that depending on which method was used to calibrate the YSI's, the DO% and mg/L numbers may not be comparable. Therefore, the same calibration methods must be used for comparability. You may have a larger than expected difference in the YSI reading if it

was calibrated in water saturated air as opposed to air saturated water and this will result in removing data that may be valid. ***

GETTING A FILE FROM CDMO

1. Go to cdmo.baruch.sc.edu/nonswmp this is the online form to submit your CSV that will flag your data..
2. Login:
    a. Username: BBP_wqdata
    b. Password: bluecrab82
3. Put the Station name in for the sonde that you're looking into. Enter the full site name, not code.
    a. BBP_01 is **Beach Haven**
    b. BBP_02 is **Seaside**
    c. BBP_03 is **Mantoloking**
4. Data type = WQ
5. Enter your email address- this is where they are going to send your file once they run it through CDMO – "Continue".
6. Select the sonde type: EXO
7. Select OK when a message box appears reminding you to remove pre and post deployment data.
8. Browse for the QC file that you want to submit. This will be the file that you called "_cdmo.csv".
9. Click "Upload"
10. Don't touch any of the pull-down menus on this screen and just scroll to the bottom and click "Process Data"

LOADING YOUR NEW FILE FROM CDMO INTO THE NERRS MACRO

1. Go to your email
2. Download the file sent to you from cdmosupport@belle.baruch.sc.edu
3. From the download folder on your PC, find and cut the file you just downloaded. This file will have the same filename with _QC added on the end.
        i. Paste the file to the correct location under the location and deployment folder that you are working with (ex: Z:\Shared\BBP Water Monitoring Network\Data\QC 2-In Progess\BH \EXO_SD_16F101826_111517_143000\EXO_SD_16101826_143000_cdmo_QC.csv)
4. You should now have 4 files for the deployment
    a. Original BIN file (.bin)
    b. Original Excel file (.xls)
    c. File sent TO cdmo: _cdmo.csv
    d. New file FROM cdmo: _cdmo_QC.csv
        i. Please note, previous SOP had this file renamed to _Qccdmo and the original cdmo file deleted. Either name is acceptable as long as

there is a QC with cdmo in the name. No files should be deleted going forward from this version.

5. Open the NERRS Macro: Z:\Shared\BBP Water Monitoring Network\Data\nerrqaqc.xls
    a. If you get a security pop up box, click enable macros.
6. From the top menu bar, select:
    a. ADD-INS
    b. NERR QAQC Main Menu
7. From the menu, select:
    a. Step 1 = Open data file
    b. Select the cdmo_QC file you just received from CDMO and renamed.

DATA FILE CREATION AND FORMATTING FOR QA/QC

1. Once you have selected your file in step 7 above, move to Step 2 = Enter Station Code
    a. Select OK
    b. Enter the station (full) name
        i. Beach Haven
        ii. Seaside
        iii. Mantoloking
    c. Select Continue with worksheet setup
    d. Step 2 Complete! Box will pop up stating Flagged data have been color coded for easier review.
2. Proceed to Step 3: Create Charts – click OK
    a. Select Create Charts for All Parameters
    b. Once this step is complete the Create Charts box re-appears. Click FINISHED. The file now contains MANY worksheets for each parameter, faults and more.
3. Add a worksheet tab labeled "metadata" to the front of the workbook by clicking the "+" sign and moving the tab to the front of the workbook.
    a. Use the file "metadata template" (*Z:\Shared\BBP Water Monitoring Network\Data\Metadata_Template)* to populate the tab.
    b. Save the workbook.
        i. IMPORTANT: Do not use the save icon to save the file. It will only save the first sheet as a CSV and you will lose all your progress.
        ii. Open the NERR QAQC menu in "add ins".
        iii. Select Step 6: Save as Excel File.
            1. Name this file "EXO_SD_xxxxxxx_xxxxxx_xxxxxx_Fulldata.xls
            2. Now there are 5 files in the deployment folder:
                a. Original BIN file (.bin)
                b. Original Excel file (.xls)
                c. File sent TO cdmo: _cdmo.csv

d. File FROM cdmo: _cdmo_QC.csv
e. Excel workbook with all the tabs: _Fulldata.xls

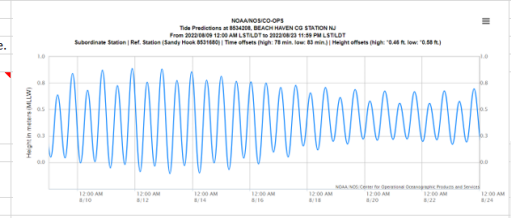
FILE/DATA QAQC PROCESS

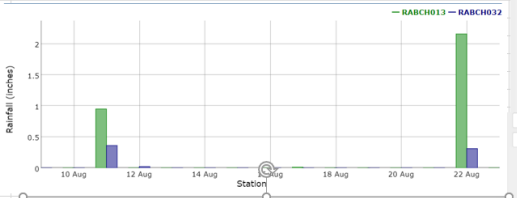
1. With the Fulldata file still open, fill out the Metadata tab to include:
    a. Date and name of analyst
    b. Deployment is in Eastern Standard Time (EST)
        i. Note here if the deployment time zone differed from EST or appears to be missing times
    c. Data QC'd per CDMO and BBP QAPP QC standards and procedures
    d. Interval check comments below.
    e. Wiper malfunction –
        i. Note any issues with the wiper during deployment here
            1. Examples: Wiper fell off during deployment, macroalgae on wiper bristles, wiper parked over turbidity sensor, etc.
    f. Wiper home and Park Range
        i. Copy these forms the calibration logsheet
    g. Flag Notes
        i. Any and all reasons for flags will be explained in this section.
    h. Comments (Copy from the datasheet)-
        i. Deployment – anything written on the datasheet
        ii. Retreival
        iii. Post-deployment
    i. Data Quality Objectives (DQO), Range and Spike checks – copy output from R code.
        i. Open R Studio
        ii. Open the R script "Interval Check" *(Z:\Shared\BBP Water Monitoring Network\Data\R - Files\R scripts\Interval_check)*
        iii. Change the file path for datain on line 17 (use the _cdmo_QC.csv file) and change the WiperPosV < and WiperPosV> to match the range on the data sheet (line 82).
        iv. Run the code up through the wiper check.
        v. Copy and paste any test results in the console into the appropriate section of the metadata tab. Any positive results will have to be investigated.
    j. Snips (using windows snipping tool) of the following:
        i. Tides from correct NOAA station: https://www.tidesandcurrents.noaa.gov/noaatidepredictions.html?id=8534208&units=metric&bdate=20220211&edate=20220304&timezone=LST/LDT&clock=12hour&datum=MLLW&interval=hilo&action=dailychart
        ii. Stream discharge from correct station (USGS): https://dashboard.waterdata.usgs.gov/app/nwd/en/?aoi=default

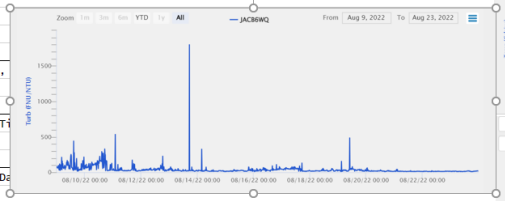
iii. Rainfall totals from 1-2 stations – select Ocean County https://njdep.rutgers.edu/rainfall/graph_basic.php
    1. Beach Haven = North Beach Haven and Parkertown
    2. Seaside = Seaside Heights and Beachwood beach
    3. Mantoloking = Normandy Beach and Windward
iv. CDMO data https://cdmo.baruch.sc.edu//dges/
    1. JCNERR – Nacote Creek Weather station data – max wind and wind
        a. Select MET station(Nacote Creek)
        b. Graph data – use english units for these
    2. JCNERR – Buoy 126 WQ data – Temp, Sal, DO mg/L, depth, pH and turbidity – use metric units for these

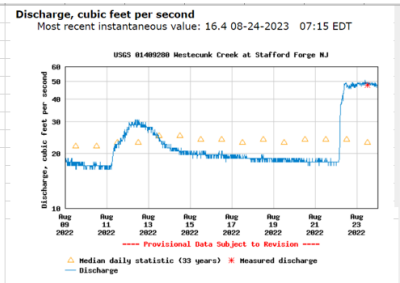
Here is an example of a completed Metadata sheet. There is a lot going on here. Everything is noted, explained when possible and all web snips are pasted.

NP 8/23/2023	*original .bin file was 4 hours off. the "fix.hours" file was compiled using datalogger data and adjusting the*
Deployment is in Eastern Standard Time (EST)	*deployment time by adding 4 hours*
Data QC'd per CDMO and BBP QAPP QC standards and procedures	*UPDATE:*
Interval check comments below.	*CDMO would not create the graphs and run macro with the fixed file. It kept*
Wiper malfunction -	*giving errors that the dates and times were not sequential.*
Wiper home= 1.20 Park range = 1.15-1.25	*I reverted back to the original bin file and left the 2 hours of missing data out.*
Flag Notes	
***File is off by 4 hours - will fix in the data polishing code.	
>2" rainfall at parkertown on the 22nd - sharp increase in discharge.	
Barnegat in August had 6.57"rainfall-yet top 10 dryest on record	
There was some discharge around the 12-13 - not certain for the reason for turbidity spike around the 14th, but JCNERR saw similar spike, and other parameterse seemed to change at that time as well. water temp became more stable.	
salinity drop around the 22nd - precip	
respiration - late night early morning pH drops. pH pattern and values similar to JCNERR	
COMMENTS: (COPY THESE FROM DATASHEET)	
PRE-DEPLOYMENT:	
DEPLOYMENT:	
co2 pulled at 0852-0859	
RETRIEVAL:	
POST-DEPLOYMENT:	
R-Interval test	
> subset(datain, pH.diff > 0.25, select = c(ExcelRowID, Date,	
[1] ExcelRowID Date Time pH.diff	
<0 rows> (or 0-length row.names)	
> subset(datain, Sal.diff > 2, select = c(ExcelRowID, Date, Ti	
[1] ExcelRowID Date Time Sal.diff	
<0 rows> (or 0-length row.names)	
> subset(datain, SpCond.diff > 5000, select = c(ExcelRowID, Da	
[1] ExcelRowID Date Time SpCond.diff	
<0 rows> (or 0-length row.names)	
> subset(datain, Temp.diff > 1, select = c(ExcelRowID, Date, Time, Temp.diff))	
ExcelRowID Date Time Temp.diff	
29 30 08/09/2022 14:00 1.031	incoming high
30 31 08/09/2022 14:15 1.165	incoming high
38 39 08/09/2022 16:15 2.791	high tide









2. Go through worksheet and inspect each of the charts, following the general considerations described below. **Nothing is deleted in this file**. Just flag with the appropriate codes (refer to CDMO manual for instructions on using the macro).
    a. Check the POST check excel file for any data sets that need to be rejected. These are any parameters that failed the POST deployment check ranges. Flag as rejected the entire deployment for affected parameters.
    b. Check all data that fail the DQO, Range and spike/interval tests from the R output.
        ii. Look at each line of the output and investigate each. Be careful to flag the appropriate record. The output from R will give you the records that bracket a failed spiking test. Only flag those data that are out of range.
            2. If the data seem to fit the general pattern of rising or falling at the time and/or you can find a reasonable explanation for failing these tests after checking tides/weather/other buoys, just flag as <0> (CDF) to note that you looked at the data, they passed final QC, and they appear to fit the conditions at the time. You can use a more specific comment if you find one.
            3. Generally, if a data point fails the interval test AND does not keep with the pattern of data change at the time, it will be rejected. Flag as <-3>.
            4. In either of these cases, you must make a note in that R output in the metadata tab for that record as to why you did or did not reject data.
    c. Check all the plots to look for unusual data.
        ii. Look for outliers (even those under the threshold of the spiking test), drift, unusual highs or lows, and periods of unusually stable or variable data. Then check resources to see if there are any explanations for the unusual data. Also check other parameters for coinciding anomalies that will give information on whether the data are showing an interference/error or a real event.
            2. If no explanation can be found, then data should be flagged and rejected. Flag as <-3>.
            3. If an explanation can be found flag as <0> and use the most appropriate comment code.
        iii. In either of these cases, you must make a note in that R output in the metadata tab for that record as to why you did or did not reject data.
    d. To chart more than one parameter on one chart for comparison, click Design on the menu bar. Then Select data. Data range – highlight Date column with heading, control parameter 1 with heading, control

parameter 2 with heading. Change line and marker settings in the chart options.

e. Wiper loss: If the wiper falls off during the deployment, you will need to reject all parameters (except depth) after you determine when biofouling began on the sensor faces. Reject data after the time when you can determine that biofouling is happening. When you flag for wiper loss AND biofouling, make the comment for "biofouling". When sensor faces are fouled, DO tends to get very low/hypoxic and turbidity drifts higher. pH generally tends to trend lower with fouling.
f. Depth
    ii. Usually a smooth curve in all sites. Tidal variation is obvious.
    iii. There is no spike test interval for depth, so pay close attention for outliers or periods of higher variation (check weather history to see if these are caused by storms). If you find a depth anomaly, check the other sites for something similar around the same time. MT and SS usually follow a similar pattern, and BH might follow a similar pattern but much more loosely.
g. Wiper PosV:
    ii. Usually grouped around the park/post-cal value. Wiper check code in R should have alerted you to any issues.
    iii. If wiper is out of range, reject (<-3>) all data except depth. Code for Wiper malfunction.
h. pH: Exhibits daily cycles, loosely following tides.
    ii. Make sure to check for pH drift at the end of a deployment. If there is drift, pH will show a gradual but consistent increase toward the upper limits. This data should be cross checked with all resources and other stations before deciding that it is drift. Once there is evidence that it was sensor drift, data is to be flagged and rejected from the point where pH clearly rises above the deployment mean to the end of the deployment.
    iii. It is also recommended to compare to the ysi grab samples and the previous deployment's last readings to make sure these values are not skewed too much.
i. Salinity and Specific Conductance:
    ii. These measurements are taken from the CT sensor (Conductivity/Temperature). Many other readings are calculated from the reading taken from this sensor. **Any failure of the conductivity sensor, you must reject: salinity, specific conductivity, DO mg/L, and depth.**
    iii. Data exhibit daily cycles, usually following tides. Weather (wind, precip and temperature) will also affect Salinity and Specific Conductance. Check all weather station data and other WQ stations for patterns.

iv. BH will see higher salinities than MT and SS. BH is more influenced by ocean water and the other 2 stations are more influenced by river systems resulting in lower salinities than BH.
v. Any flag that is applied to Sal should also be applied to SpCond, and vice versa.
vi. Special note – MT is within 200 meters of a municipal storm water pump station. When this is on, it may influence salinity, conductivity, turbidity and maybe other parameters. If you see a lower than normal salinity reading with no recent rainfall this may need to be investigated.

j. Temperature:
ii. Data exhibit daily cycles, usually following tides. Sometimes there are temperature lows around low tide where data fail the spike test, especially at BH. (edit- 2022 had low temps > interval check at the incoming high tide). **If the temperature sensor fails, all data except turbidity and depth will need to be rejected.**

k. DO (mg/L) and DO (percent):
ii. Data exhibit daily cycles, following tides and phytoplankton activity. DO will increase during daylight hours while photosynthesis is taking place and then steadily decrease overnight as respiration continues and photosynthesis does not.
iii. Any rejection or flag applied to DO_mgl should also be applied to DO_pct, and vice versa.
iv. Keep an eye out for DO "fangs" that may indicate poor exchange of water within the pipe and sonde guard.
v. DO mg/L will inversely follow water temperature. As the water temperature increases, the DO mg/L will decrease, as the water temperature decreases, the DO mg/l will increase.

l. Turbidity:
ii. Data do not necessarily exhibit daily cycles like the other parameters.
iii. Turbidity is useful for judging when biofouling on the sensor faces started. Look for values drifting higher.
iv. Turbidity can be an affected by many things. Turbidities will increase with wind, precip, algae growth, mixing and sediment load from runoff and streams (and many other things).

3. After you have made determinations about flagging and/or rejecting data, go through and apply the appropriate codes:
   a. Use Step 4 of the Macro to select data and apply the appropriate flag codes, error codes, and comments
   b. You can apply one code from each of the three categories. If you cannot describe your reasoning with a code use the comment "See metadata". Be sure to describe the flag in the metadata.

c. Once all flagging and coding is completed, proceed to Step 5 of the Macro and "Synch data". This will copy all flagged data to the correct tabs.
d. On the macro menu, select "Run Stats"
e. Save the file as an excel file (EXO…_Fulldata.xls)
   ii. Do not use the save icon
   iii. Use "Save as" or Step 6 of the Macro to save.
   iv. Step 6 again to save as *_Fulldata.xls

4. Make a .csv file that is ready for R (EXO…_QCR)
   a. **Copy** the Data tab to a new book
   b. Unprotect the sheet and delete all charts ("review" tab up top, unprotect sheet
   c. **Delete all the <u>data</u> that are flagged for rejection (<-3> leave the flag code on sheet). NEVER delete data from the FULLdata workbook.**
   d. Highlight data columns (Turb to end of columns – do not format date/time as number!) and format cells as "Number" with 2 decimal places.
   e. Save as (EXO…_**QCR**.csv)

PREP DATA TO SEND TO DEP

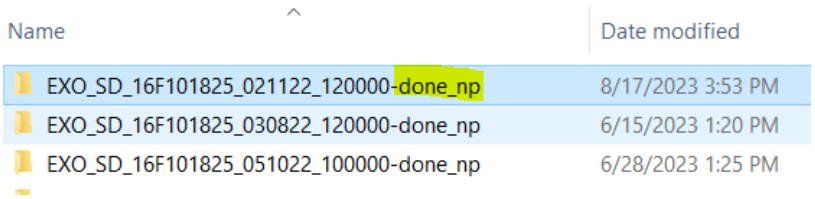
1. Open R studio. Then open file Z:\Shared\BBP Water Monitoring Network\Data\R - Files\R scripts\Data polishing(current).R
2. Customize R code to the deployment file:
   a. Change datain file name (path) to bring in the EXO…_QCR file that you just completed.
   b. Line 29: look on deployment data sheet and enter the temperature correction determined at calibration.
   c. Line 41 is only used when the original file Time is incorrect and needs to be adjusted. This sometimes happens if the sonde template was not configured to the correct timezone at deployment. This line will be commented out (#). You will need to remove the # to run the line of code if necessary.
   d. Line 45-51: There are two different scripts depending on whether the data was collected in EST or EDT. All deployments should be in EST, but this needs to be checked.
3. Line 60: enter the correct year for BBP Real-time 20**
4. Line 62: enter the station name for this data set
5. Line 84: Change the dataout path to the same location that datain came from with file name "EXO…**DEPfinal**.csv This will save a "**DEPFinal** file to the deployment folder.
6. Line 86: Change the dataout path location to Z:/BBP Water Monitoring Network/ Data/QC 3-Completed/SENT TO DEP/**SITENAME**/EXO_**filename**_**DEPfinal**.csv

a. where site name and file name need to be customized.

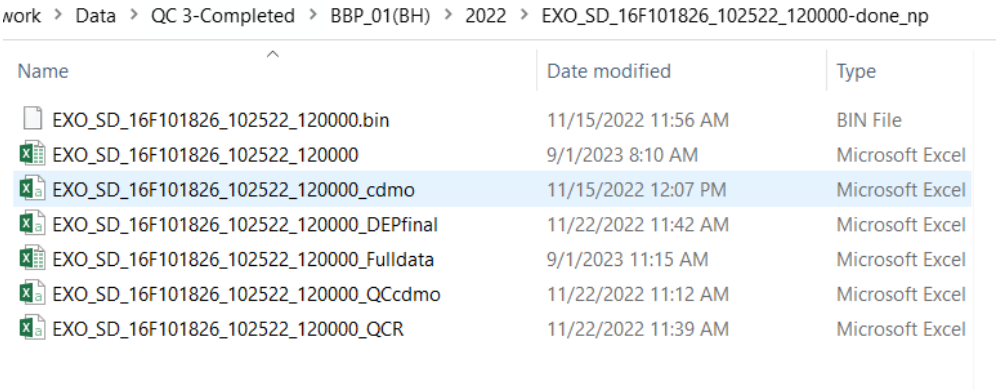
7. Run the full script line by line.

FINISH THE QA/QC

1. Check and make sure the DEPFinal file has been saved to the deployment folder and the SENT TO DEP folder.
2. **Once you save the _DEPfinal.csv, <u>DO NOT open</u> in excel as it will change the date format.**
3. Indicate that the file is done with QA/QC by noting "-done_initials" next to the file folder name.



4. You should now have 7 total files in the deployment folder:



5. Write the "EXO_SD_****_****_****_DEPfinal.csv" file name at the top of the data sheet and write the QC date and your initials.
6. File the data sheet in the Binder labeled "Site Specific Data Sheets".

SEND FILE TO DEP

Quarterly, files need to be sent to DEP for upload onto the DEP website: https://njdep.rutgers.edu/continuous/

1. Open R studio and open the R script "Append files for DEP.R"
2. Load/read files in. Each year and station will have it's own section, this will have to be completed for each new file. No code is deleted, just added to so anyone can go back and run a full year.
3. Then run the "rbind" code to join all of the files just entered into the dataframe. Be sure to create a new line of code to "rbind" so that each t=year has it's own line of code.

4. Run the section labaled "Run on all locations, making sure to change the Mikesdata$Station to the station you are running (Beach Haven, Mantoloking OR Seaside).
5. Then add a new write.csv line to save the file as the correct station and year (2022BH_data, 2022SS_data etc.).
6. Email Briana at DEP the final appended file you just created @ Briana.Morgan@dep.nj.gov and copy Mike @ mike.kusmiesz@dep.nj.gov (Mike:609-292-5602) and Nicole @ mailto:npetersen@ocean.edu

Appendix A: Water Quality Data QC Web Links

CDMO – To start QC process: http://cdmo.baruch.sc.edu/nonswmp/

Tides

Beach Haven – https://www.usharbors.com/harbor/new-jersey/beach-haven-nj/#monthly-tide-chart This will take you to the current month's chart.

https://www.usharbors.com/harbor/new-jersey/beach-haven-nj/tides?tide=2019-09 You change the month and year on the end of this to take you to the right chart.

https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=8534208

Seaside – https://www.usharbors.com/harbor/new-jersey/barnegat-pier-nj/tides/#monthly-tide-chart This will take you to the current month's chart

https://www.usharbors.com/harbor/new-jersey/barnegat-pier-nj/tides/%20-%20monthly-tide-chart?tide=2019-07 You change the month and year on the end of this to take you to the right chart.

https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=8533135

Mantoloking – https://www.usharbors.com/harbor/new-jersey/mantoloking-nj/tides/#monthly-tide-chart This will take you to the current month's chart.

https://www.usharbors.com/harbor/new-jersey/mantoloking-nj/tides/%20-%20monthly-tide-chart?tide=2019-09 You change the month and year on the end of this to take you to the right chart.

https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=8532786 - Mantoloking - closest

Weather

https://www.timeanddate.com/weather/@4501554/historic?month=1&year=2020

NJ Monthly Climate data, precipitation - http://climate.rutgers.edu/stateclim_v1/nclimdiv/index.php?stn=NJ029&elem=pcpn

All stations - https://www.wunderground.com/history/

Use this link and put in the location and date you need. The closest weather station with historical data is Atlantic City Airport or Newark, NJ.

Stream and River Gauges

Beach Haven – https://nwis.waterdata.usgs.gov/nj/nwis/uv?site_no=01409280 . Westecunk Creek discharge and temperature data at Stafford Forge.

Seaside – https://nwis.waterdata.usgs.gov/nwis/uv?site_no=01408500 . Toms River WQ and discharge data.

Mantoloking – https://nwis.waterdata.usgs.gov/nj/nwis/uv?site_no=01408120 . North Branch Metedeconk River discharge data at Lakewood.

Other WQ gauges

Beach Haven – Buoy at Ship bottom, **Station Name**: MB_01, **Buoy ID**: NJBuoy759, https://njdep.rutgers.edu/continuous/ (offline as of Nov 2019). Buoy at

https://waterdata.usgs.gov/monitoring-location/01409280/#parameterCode=00060&startDT=2022-01-19&endDT=2022-02-11

LEH inlet, **Station Name**: BB14, **Buoy ID**: NJBuoy758, http://njdep.rutgers.edu/continuous/graph_basic.php?id=1

Seaside and Mantoloking – Buoy at Barnegat Inlet/Oyster Creek (not very close to either Seaside or Mantoloking). **Station Name**: BB07a, **Buoy ID**: NJBuoy767, http://njdep.rutgers.edu/continuous/#

http://cdmo.baruch.sc.edu/dges/

https://w2.weather.gov/climate/index.php?wfo=phi

Mantoloking weather- USGS: https://nwis.waterdata.usgs.gov/nj/nwis/uv/?cb_00021=on&cb_00025=on&cb_00035=on&cb_00036=on&cb_00045=on&cb_00052=on&cb_61728=on&format=gif_default&site_no=400226074031601&period=&begin_date=2019-09-09&end_date=2020-09-16

Manto tides- USGS:

https://waterdata.usgs.gov/nwis/uv?agency_code=USGS&site_no=01408168

https://nwis.waterdata.usgs.gov/usa/nwis/uv/?cb_72279=on&format=gif_default&site_no=01408168&legacy=1&period=&begin_date=2021-08-31&end_date=2021-09-15

All NJ water watch – tides – weather, etc! USGS

https://maps.waterdata.usgs.gov/mapper/wateralert/

rainfall-can select daily totals by month at many stations

http://njdep.rutgers.edu/rainfall/graph_basic.php?station_id=27

NJ climate data:

https://climate.rutgers.edu/stateclim/?section=menu&target=climate_summaries

Appendix B: META DATA TAB TEMPLATE

(DATE, INITIALS)

Deployment is in Eastern Standard Time (EST)

Data QC'd per CDMO and BBP QAPP QC standards and procedures

Interval check comments below.

Wiper malfunction -

Wiper home= Park range =

Flag Notes

(ADD NOTES ABOUT FLAGGED AND REJECTED DATA HERE, ALSO GENERAL NOTES ABOUT DEPLOYMENT DATA)

COMMENTS: (COPY THESE FROM DATASHEET)

PRE-DEPLOYMENT:

DEPLOYMENT:

RETRIEVAL:

POST-DEPLOYMENT:

R-Interval test

Appendix 3. BBP Water Quality Calibration Log and Field Log

Calibration/Deployment/Retrieval Log
BBP Continuous Water Quality Monitoring Program

Station Name: _____ **BBP__** _____ **Time Zone:** _____

Datasonde: Sonde Code _____ (EXO-2 NonVented 10M) Serial Number _____

Probes:	Port	Parameter	S/N	Port	Parameter	S/N
	1	Turbidity		5	pH	
	2	Optical DO		6	*empty*	
	3	*empty*		7	Wiper	
	4	Wiped CT		D	Depth	

PRE-DEPLOYMENT CALIBRATION/PROGRAMMING

Date of Calibration: _____ mm/dd/yyyy pH cap replaced: _____ Technician(s): _____

Batteries Installed: _____ mm/dd/yyyy ODO membrane replaced: _____

Pre-Deployment

Temp °c _____ Handheld ID _____ Baro. Press. mm Hg (depth) _____

Temp °c _____ EXO-2 _____ **Correction Factor:** _____

_____ EXO-2 duplicate

	Standard	Before Cal	Calibrated	Check/DUP
SpCond µS/cm				
buffer temp:			SpCond Duplicate	
pH 4				
pH7				/
pH10				
Turbidity NTU				/
Depth m	**0.0m Offset**			/
Optical Dissolved Oxygen % (100% air saturated water)				

Handheld DO% and mg/L: _____ EXO mg/L: _____ EXO mg/L Duplicate: _____

Wiper: Factory Home: _____ Cal: _____ Park range: _____

Sensor Diagnostics

Pre-Deployment

Specific Conductance Functional Test: (must be <0.2 µS/cm) _____

Cell constant (0.419-0.519) _____

pH 4 (+180 +/- 50mV) _____

pH 7 (0 +/- 50mV) _____

pH 10 (-180 +/- 50mV) _____

mV span 7 - 4 (160-180) _____

mV span 7 - 10 (160-180) _____

Optical DO Gain (0.87-1.25) _____

Programming

Set Clock Status (EST): Y N

Sample Interval: 15 min

Start Date: _____ mm/dd/yyyy

Start time: _____ 24 hh:mm

Free Memory (status): _____ %

Battery Voltage: _____ v

Sonde File Name: EXO_SD_

Calibration checks:
Sp Conductivity check = +/- 1.0%
pH 7.0 check = +/- 0.10 units
Turbidity check= +/- 2.0%
Depth check = +/- 0.004 m
ODO % check = +/- 1.0%
ODO mg/L check = +/-0.3 mg/L from handheld

Duplicate reading (precision):
check and dup should be +/- 10% from one another.

Comments-Pre: _____

DEPLOYMENT INFORMATION FIELD LOG

Date Deployed: _____ Time: _____ TZ: EST / LOCAL Technicians: _____

Corrected Water Temp: _____ °C DO Conc. _____ mg/L pH: _____

Barometric Pressure: _____ mmHg Sp. Cond _____ µS/cm pH mV: _____ Turbidity: _____ NTU

DO %: _____ % Salinity _____ ppt HandleId: _____ Last Calibrated: _____

Comments: _____

Calibration/Deployment/Retrieval Log

BBP Continuous Water Quality Monitoring Program

Station Name: _____ **BBP__** **Time Zone:** _____

RETRIEVAL INFORMATION FIELD LOG

Date Retrieved: _____ Time: _____ TZ: EST / LOCAL Technicians: _____

Field Data:

Corrected Water Temp: _____ °C DO Conc. _____ mg/L pH: _____ Turbidity: _____ NTU

Barometric Pressure: _____ mmHg Sp. Cond _____ µS/cm pH mV: _____

DO %: _____ % Salinity _____ ppt Handleld: _____ Last Calibrated: _____

Fouling Presence:

Type: A=algae, B=barnacles, C=crabs, E=eggs, F=fish, H=hydroids, MD=mud, S=sponges, SI=silt, SL=shell, SP=shrimp, T=tunicates, W=worms, O=other, N=none

Amount: H=heavy, M=moderate, L=light (e.g. A/H, B/L)

Sonde/Guard: _____ Dissolved Oxygen: _____

Temp/Cond: _____ Turbidity: _____

pH: _____ Wiper/Brush: _____

Comments-Retrieval: _____

Pictures taken? Y N

saved to one drive? Y N

ID#'s

POST-DEPLOYMENT CHECKS

Date/Time: _____ Analyst: _____ YSI used: _____ Last Calibrated: _____

	YSI	SONDE	STANDARD	Corrected Temp	Sonde	
Temp (corrected)	°C	°C	SpCond (µS/cm)			pH Millivolts
Optical DO % (100% Air saturated water)	%	%	pH 4			
DO Concentration mg/L	mg/L	mg/L	pH 7			
Barometric Pressure	mm Hg		pH 10			
Depth m	**0.0 m offset**	m	mV span	4…7	7…10	
Data Download **Y**	Battery voltage:	V	Turbidity (NTU)/ _____			NTU
Data Download **N**	Wiper Position:	V	Turbidity (NTU)/ _____			NTU

Comments-Post: _____

Data Files saved to: Z:\Shared\BBP Water Monitoring Network\Data\QC 1-RAW Data Files Y N

Appendix 4. National Estuarine Research Reserve System (NERRS) System-Wide Monitoring Program (SWMP) YSI/Xylem EXO Multi-Parameter Water Quality Monitoring Standard Operating Procedure V.2.2

See Attached

Appendix 5. CDMO NERR SWMP Data Management Manual V.6.7

See Attached

Appendix 6. Pro-Oceanus CO2-Pro CV User's Manual V.4.2.0

See Attached