

Reserve Name JOB NERR Water Quality Metadata
Months and year the documentation covers: 01/01/2016 to 12/31/2016
Latest Update: 05/25/2018

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons

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2) Entry verification

Deployment data are uploaded from the YSI data logger to a Personal Computer (IBM compatible) by Enid Malavé. Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the CDMO by Enid Malavé and Angel Dieppa where they undergo automated primary QAQC and become part of the CDMO's online provisional database. Excessive pre- and post-deployment data are removed from the file prior to upload with up to 2 hours of pre- and post-deployment data retained to assist in data management. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve where it is opened in Microsoft Excel and processed using the CDMO's NERRQAQC Excel macro by Enid Malavé and Angel Dieppa. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, remove any overlapping deployment data, append files, and export the resulting data file for upload to the CDMO. Upload after secondary QAQC results in ingestion into the database as provisional plus data, recalculation of cDepth or cLevel parameters, and finally tertiary QAQC by the CDMO and assimilation into the CDMO's authoritative online database. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is generally accepted as being the most accurate. The final yearly file and metadata was submitted by Enid Malavé and Angel Dieppa. For more information on QAQC flags and codes, see Sections 11 and 12.

3) Research objectives

The principal objective is to record and track long-term changes and short term variability in water quality parameters that can be associated to changes in estuarine habitats. Through this, we support management decisions based on scientific data. A secondary objective is to promote the access and use of reliable baseline information by federal and local agencies, universities, researchers, educators and local communities to enhance the process by which they make decisions regarding their daily activities. This data is also invaluable in the identification and development of future monitoring and research activities.

A total of four data loggers (YSI 6600 V2, YSI 6600 V4) are deployed in Jobos Bay. Two sondes are deployed in the inner lagoons of the Mar Negro Component and the other two in the Jobos Bay. The instruments are suspended from a pole at a distance at about 0.5 meters from the surface at each

selected site. Data from stations 9, 10, 19 and 20 are being submitted to the Centralized Data Management Office as part of the System-Wide Monitoring Program. Measurements are taken at fifteen-minute intervals for approximately two-week periods. The sites are identified as representative of areas within the reserve and comparable to the sites that may be receiving impact from human activities from surroundings areas or may act as a habitat gradient in the Bay.

Station number nine (9), the impacted site, collects water quality data in a site associated with runoff from littoral and basin mangrove areas. This sampling station is located in the most inland lagoon, closest to the Thermoelectric Power Plant (oil and natural gas). It is subjected to runoff, which may include potential oil spill contamination from this industrial facility. Information compiled from historical environmental documents, indicate that station nine (9) was used as a disposal site for residues of the previously operating sugar mill operation, and therefore might have high organic input into the sediments.

Station number ten (10), located in a mangrove lagoon area towards the southwestern section of Mar Negro is considered the reference or non-impacted site.

Station number (19) is located over a sea grass bed (*Thalassia testudinum*) in the inner western part of the bay just northeast of Cayo Colchones. This station is located near the thermal outfall and operating piers of the Aguirre Power Plant Complex, both activities may have significant effects on sea grass communities. This area is exposed to barge stranding, sediment re-suspension and oil spills. Station number (20) is located on the eastern inner bay section of the Cayos Caribe cays. This station is just south of the mangrove islets associated with the Reserve's coral reefs. Water streams coming through the coral platform may help characterize water conditions of the main marine currents reaching Jobos Bay, as well as possible effects of industrial and chemical activities associated with Phillips Core, AES Coal Energy Plant and Pharmaceuticals located just east to this system.

4) Research methods

The National Estuarine Research Reserve Water Quality Monitoring Program began sampling at Station nine (9) on December 20, 1995 and Station ten (10) on February 1, 1996. Monitoring at station 19 began in April 2004 and at station 20 in June 2004. Long term water quality monitoring is being performed at these stations.

Before each YSI 6600 data logger is deployed, calibration and maintenance is performed following the Standard Operation Procedures of the NEERS. Calibration standards are only required for pH, salinity, and turbidity, all other parameters are done as described in the manual. Buffer solutions for two-point calibration (pH 7 and pH 10) are purchased from a scientific supply company. Salinity is calibrated with a specific conductance standard 50 mS/cm and is purchased from YSI or a scientific supply company.

The two-point turbidity calibration is performed using a 0 NTU (DI water) and 126 NTU standard purchased from a scientific company. YSI sonde 6600 v2 and v4 are equipped with dissolved oxygen optical sensors, both are allowed to sit at least 24 hours after proper calibration. Weather conditions and tide stage are recorded in the field observation log during deployment. Measurements of DO, pH, salinity, specific conductance, turbidity, and temperature are taken at the deployment time to check the accuracy and functionality of the instruments.

Each YSI data logger is tied with steel cable to an iron galvanized pole, which is plunged into the sediments at each sampling area. Data loggers are suspended from a pole at approximately 0.5 meter from the surface of the selected site. Data is recorded every 15 minutes. The following measurements are recorded: date, time, temperature, specific conductance, salinity, dissolved oxygen saturation, dissolved oxygen concentration, depth, pH, and turbidity, all station have an optical chlorophyll-a sensor. Chl-a is an optional parameter non-required for SWMP program. Approximately, every two weeks the data loggers are retrieved, inspected, cleaned, data is downloaded into a personal computer and re-calibrated as noted previously. The data logger is then ready to be deployed again.

The data is processed through a standard quality control/quality assurance established for all 27 reserves within the system. It consists in submitting the raw data to the Centralized Data Management Office (CDMO) server where data undergoes through a macro to flag anomalies predetermine for each station. The data is sent back to the reserve to pass through a secondary QA/QC and finally resubmitted to CDMO for the final approval. Data may be available in different stages of the QA/QC process.

A Sutron Sat-Link2 transmitter was installed at the JOB20 station on 07/20/06 and transmits data to the NOAA GOES satellite, NESDIS ID # 3B0297EC. The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. The “real-time” telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO’s authoritative online database. Provisional and authoritative data are available at <http://cdmo.baruch.sc.edu>.

5) Site location and character

The Jobos Bay National Estuarine Research Reserve (JBNERR) is located on the southern coastal plain of the island of Puerto Rico, a reserve within the West Indies geographical area. JBNERR is composed of two major areas: (1) Mar Negro, located on the western margin of the Bay, and (2) Cayos Caribe (a chain of 17 tear-shaped islets located to the southeast) and Cayos Barca (a chain of 7 tear-shaped islets located to the southwest boundaries) both with a back-reef system. The Mar Negro area comprises the bulk of the Reserve, and consists of mangrove forests and a complex system of lagoons and channels interspersed with salt and mud flats. Coral reefs and sea grass beds, with small beach deposits and upland areas fringe Cayos Caribe and Cayos Barca mangrove islands. Few areas in the watershed drain directly to the bay. Rio Seco to the north-east of the bay is active only during heavy rain events during the wet season. A small creek, Quebrada Coqui, near JBNERR’s pier to the north of the bay, drains into an extensive mangrove fringe forest in a laminar flow. During heavy rain events, Station 09 received runoff water from upland and finally, a diffuse flow of water reaches the bay from the local aquifer.

Station 9 is an impacted site and is located on the northeastern section of the Mar Negro component. This sampling station is associated with mangrove lagoon areas and receives runoff from mudflats, the Thermoelectric Power Plant, and adjacent areas. The tidal range varies from 12 to 14 inches near the monitoring station. The salinity at the vicinity of the monitoring station varies from 26.0 ppt to 41.1 ppt. The average depth at station 09 is 1 meter. The bottom is covered by a thick layer of thin sediments with a high content of organic material. *Microcoleus* sp. (blue-green algae), brown and green algae (*Caulerpa* sp.) are also present at this site, but a better assessment is needed. The station pole was located at 17°56'34.88"N and 66°14'18.64"W until 09/02/2010 12:00PM, then it was relocated to 17° 56' 35.0" N and 66° 14' 18.9" W approximately 65.0 meters from original position. The relocation was due to sedimentation issues and the construction of a new telemetry station. Fresh water input to the station comes only from runoff and rain. This station has been subject of several studies indicating the presence of relatively high level of cooper and pesticides compared to other stations.

Station 10 is located in a mangrove lagoon not impacted directly by any upland or marine activities. It provides a reference for comparison of data obtained in other stations, especially to the station in Mar Negro lagoon. The tidal range varies from 12 to 14 inches. The salinity at the vicinity of the monitoring station varies from 27.0 ppt to 41.7 ppt. The average depth at station 10 is 1 meter. The bottom is covered with a layer of fine sediments with organic material, followed by a layer of calcareous material mainly from shells and oysters. At this site, we can find sea grass (*Thalassia*), calcareous algae (*Halimeda* sp.), green algae (*Caulerpa* sp.) and brown algae (*Dictyota* sp.) among others. The pole is located at 17° 56' 19.00 N, 66° 15' 27.85 W. Fresh water input to the station comes only from runoff and rain. There is not any direct source of fresh water.

Station 19 is located on the western inner section of the bay at a distance of 233 meters from Cayo Colchones Mangroves over sea grass beds (*Thalassia testudinum*). Tidal ranges in this area vary from 12 to 14 inches. The salinity at the vicinity of the monitoring station varies from 30.0 ppt to 36.0 ppt. The average depth at this station is of 2 meters. The YSI sonde is deployed at about 1 foot from the bottom. The bottom is of sandy composition. Sea grass, algae, echinoderms and other related organisms could be found in the area. The pole is located at 17° 56' 34.49"N, 66° 13' 43.77"W. There is no freshwater input to this area.

Station 20 is located in the inner eastern section at about 190 meters of Cayos Caribe Mangrove islets and at about 688 meters from the coral reef barrier. This station is the closest to Mar Caribe. It has a sandy bottom, with calcareous and coral fragments, sea grass (*Thalassia*) communities, echinoderms and other associated organisms. Tidal ranges in this area vary from 12 to 14 inches. The salinity at the vicinity of the monitoring station varies from 30.0 ppt to 36.0 ppt. The average depth of the site is 2 meters. There is no freshwater input to this area. The pole is located at 17° 55' 49.14"N, 66° 12' 41.30"W.

Data from stations 9, 10, 19 and 20 is being submitted to the CDMO. Eight sondes are permanently devoted to taking readings from these two sites, to assure continuous readings while sondes are taken out of the water for data upload and maintenance. This will avoid data gaps for the stations between sonde maintenance procedures. All monitoring is considered long term.

SWMP Station Timeline:

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
job09wq	P	Station 9	17° 56' 34.88 N, 66° 14' 18.64 W	12/01/1995 00:00 - current	NA	NA
job10wq	P	Station 10	17° 56' 19.00 N, 66° 15' 27.85 W	02/01/1996 00:00 - current	NA	NA
job19wq	P	Station 19	17° 56' 34.49 N, 66° 13' 43.77 W	04/01/2002 00:00 - current	NA	NA
Job20wq	P	Station 20	17° 55' 49.14 N, 66° 12' 41.30 W	05/01/2002 00:00 - current	NA	NA
job06wq	P	Station 6	17° 56' 5.95 N, 66° 13' 40.56 W	12/01/1996 00:00 - 12/01/1998 00:00	Did not represent natural conditions	Near to thermal outfall
job11wq	P	Station 11	17° 56' 40.59 N, 66° 15' 43.30 W	03/01/1996 00:00 - 12/01/1998 00:00	Subject to vandalism	
job18wq	P	Station 18	17° 56' 39.96 N, 66° 13' 54.77 W	10/01/1998 00:00 - 11/01/1998 00:00	Moved to station 19	Station 19 represent better general conditions

6) Data collection period

Station nine (9) water quality monitoring began on December 20, 1995.

Station ten (10) water quality monitoring began on February 1, 1996.

Station nineteen (19) water quality monitoring began on April 1, 2004.

Station twenty (20) water quality monitoring began on May 13, 2004.

Deployment and Retrieval Dates 2016:

Station 09			
Date/Time In		Date/Time Out	
01/01/2016	0:00	01/13/2016	11:00
01/13/2016	11:15	01/26/2016	09:45
01/26/2016	10:15	01/27/2016	10:30
01/27/2016	12:00	02/11/2016	12:30
02/11/2016	13:00	02/24/2016	12:30
02/24/2016	12:45	03/08/2016	10:30
03/08/2016	10:45	03/28/2016	10:15
03/28/2016	10:45	04/14/2016	10:15
04/14/2016	10:45	05/04/2016	11:30
05/04/2016	11:45	05/17/2016	11:00
05/17/2016	11:15	06/01/2016	13:15
06/01/2016	13:45	06/14/2016	10:15
06/14/2016	10:30	06/28/2016	10:15
06/28/2016	10:45	07/19/2016	09:30
07/19/2016	09:45	07/26/2016	10:30
08/09/2016	10:00	08/23/2016	10:30
08/23/2016	10:45	09/07//2016	10:00
09/07/2016	10:15	09/26/2016	09:45
09/26/2016	10:00	10/14/2016	10:15
10/14/2016	10:30	11/01/2016	09:45
11/01/2016	10:00	11/16/2016	09:15
11/16/2016	9:30	11/28/2016	10:00
11/28/2016	10:30	12/13/2016	09:00
12/13/2016	09:15	12/31/2017	12:45

Station 19			
Date/Time In		Date/Time Out	
01/01/2016	0:00	01/13/2016	09:30
01/13/2016	09:45	02/04/2016	10:30
02/04/2016	10:45	02/17/2016	10:30
02/17/2016	10:45	03/02/2016	10:30
03/02/2016	10:45	03/15/2016	09:45
03/15/2016	10:00	04/05/2016	09:45
04/05/2016*	10:00	04/20/2016	09:45
04/20/2016	10:00	05/11/2016	09:30
05/11/2016	09:45	05/24/2016	10:45
05/24/2016	11:00	06/07/2016	11:30
06/07/2016	11:45	06/22/2016	09:30
06/22/2016	09:45	07/12/2016	10:15
07/12/2016	10:30	08/03/2016	09:30
08/03/2016	09:45	08/17/2016	09:45
08/17/2016	10:15	08/30/2016	10:30
08/30/2016	10:45	09/13/2016	10:00
09/13/2016	10:15	10/12/2016	10:00
10/12/2016	10:15	10/25/2016	09:45
10/25/2016	10:00	11/09/2016	10:30
11/09/2016	10:45	11/22/2016	10:15
11/22/2015	10:30	12/06/2016	09:15
12/06/2016	09:45	12/20/2016	09:45
12/20/2016	10:00	12/31/2017	12:45

Station 10			
Date/Time In		Date/Time Out	
01/01/2016	0:00	01/13/2016	10:00
01/13/2016	10:15	01/26/2016	10:15
01/26/2016	10:45	02/11/2016	12:00
02/11/2016	12:15	02/24/2016	11:30
02/24/2016	11:45	03/08/2016	10:00
03/08/2016	10:15	03/28/2016	11:15
03/28/2016	11:30	04/13/2016	10:30
04/13/2016*	11:00	05/04/2016	10:45
05/04/2016	11:00	05/17/2016	10:30
05/17/2016	10:45	06/01/2016	11:45
06/01/2016	12:00	06/14/2016	11:45

Station 20			
Date/Time In		Date/Time Out	
01/01/2016	0:00	01/19/2016	09:30
01/19/2016	09:45	02/04/2016	10:00
02/04/2016	10:15	02/17/2016	11:00
02/17/2016	11:15	03/02/2016	10:00
03/02/2016	10:30	03/15/2016	10:30
03/15/2016	10:45	04/05/2016	10:45
04/05/2016	11:00	04/20/2016	11:00
04/20/2016	11:30	05/11/2016	11:00
05/11/2016	11:15	05/24/2016	11:15
05/24/2016	11:30	06/07/2016	12:30
06/07/2016	13:00	06/22/2016	10:15

06/14/2016	12:00	06/28/2016	11:45
06/28/2016	12:00	07/19/2016	12:15
07/19/2016*	12:45	08/09/2016	10:30
08/09/2016	11:00	08/23/2016	11:15
08/23/2016	11:30	09/07/2016	10:45
09/07/2016	11:00	09/26/2016	11:15
09/26/2016	11:30	10/14/2016	11:00
10/14/2016	11:15	10/30/2016	04:15
11/01/2016	11:00	11/16/2016	08:15
11/16/2016	8:45	11/28/2016	11:30
11/28/2016	11:45	12/13/2016	09:30
12/13/2017	09:45	12/31/2017	12:45

06/22/2016	10:30	07/12/2016	09:45
07/12/2016	10:15	08/03/2016	11:15
08/03/2016	11:30	08/17/2016	08:30
08/17/2016	08:45	08/30/2016	10:00
08/30/2016	10:15	09/13/2016	10:00
09/13/2016	10:30	10/12/2016	09:30
10/12/2016	09:45	10/25/2016	09:30
10/25/2016	09:45	11/09/2016	09:45
11/09/2016	10:15	11/22/2016	09:45
11/22/2015	10:00	11/29/2016	23:45
12/01/2016	10:30	12/20/2016	09:15
12/20/2016	09:45	12/31/2017	12:45

***Note: All deployed sondes in Station 10 and 19 are model EXO-2 except the ones with asterisk.**

Station 10:

From 04/13/2016 at 11:00 to 06/01/2016 at 11:45 the sondes deployed were model EXO-2 and from 06/14/2016 at 12:00 to 07/19/2016 at 12:15 sondes deployed were model YSI-6600

From 07/19/2016 at 12:45 to 08/09/2016 10:30, data recovered from an YSI 6600 deployed side by side to the EXO-2. EXO-2 sonde had a power failure.

Station 19:

From 04/05/2016 at 10:00 to 04/20/2016 at 09:45 the sondes deployed were model YSI-6600 and from 04/20/2016 at 10:00 to 07/12/2016 at 10:15 sondes deployed were model EXO-2

7) Distribution

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

Requested citation format:

NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: <http://www.nerrsdata.org/>; accessed 12 October 2012.

Also include the following excerpt in the metadata which will address how and where the data can be obtained.

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

8) Associated researchers and projects

The Jobos Bay NERR maintains four water quality monitoring stations as part of the System Wide Monitoring Program (SWMP) to monitor variability in the estuarine environment. Meteorological station collect continuous information that support water quality data intended to address short-term variability and long-term changes in estuarine water parameters within the bay (i.e., localized impacts of seasonal storms and hurricane events, variability due to tidal circulation, seasonal and interannual differences in rainfall, magnitude and influence of major events such hurricanes, spatial extent of oceanic and tidal forcing).

Our water quality monitoring program is a key component of SWMP. Variables measured include Temperature, Dissolved Oxygen, Turbidity, pH, Salinity and Depth in 4 permanent stations equipped with YSI datasondes. The program supports a nutrient monitoring at the same stations, nitrogen, phosphorus, and chlorophyll are measured in a monthly basis. Also, a diel nutrient sampling is performed in a monthly basis.

SWMP data has been used by:

- Caribbean Regional Association for the Caribbean Regional Coastal Ocean Observing System (CariCOOS) who monitors Real Time data from our SWMP stations.
- Environmental Quality Board for their biennial Puerto Rico 305(b)/303(d) Integrated Report
- Puerto Rico Energy Power Authority (PREPA)
- Department of Natural and Environmental Resources

II. Physical Structure Descriptors

9) Sensor specifications –

YSI 6600EDS data sonde:

Parameter: Temperature
Units: Celsius (C)
Sensor Type: Thermistor
Model#: 6560
Range: -5 to 50 C
Accuracy: +/- 0.15
Resolution: 0.01 C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: 4-electrode cell with autoranging
Model#: 6560
Range: 0 to 100 mS/cm
Accuracy: +/- 0.5% of reading + 0.001 mS/cm
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependant)

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

Parameter: Dissolved Oxygen % saturation

Units: percent air saturation (%)

Sensor Type: Rapid Pulse - Clark type, polarographic

Model#: 6562

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: $\pm 2\%$ of the reading or 2% air saturation, whichever is greater; 200 to 500% air saturation: $\pm 6\%$ of the reading

Resolution: 0.1% air saturation

or

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 6150 ROX

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: $\pm 1\%$ of the reading or 1% air saturation, whichever is greater 200-500% air saturation: $\pm 15\%$ of reading

Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)

Units: milligrams/Liter (mg/L)

Sensor Type: Rapid Pulse - Clark type, polarographic

Model#: 6562

Range: 0 to 50 mg/L

Accuracy: 0-20 mg/L: $\pm 2\%$ of the reading or 0.2 mg/L, whichever is greater
20 to 50 mg/L: $\pm 6\%$ of the reading

Resolution: 0.01 mg/L

or

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 6150 ROX

Range: 0 to 50 mg/L

Accuracy: 0-20 mg/L: ± 0.1 mg/L or 1% of the reading, whichever is greater
20 to 50 mg/L: $\pm 15\%$ of the reading

Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 30 ft (9.1 m)

Accuracy: ± 0.06 ft (0.018 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH – bulb probe or EDS flat glass probe

Units: pH units

Sensor Type: Glass combination electrode

Model#: 6561 or 6561FG

Range: 0 to 14 units

Accuracy: ± 0.2 units

Resolution: 0.01 units

Parameter: Turbidity

Units: nephelometric turbidity units (NTU)

Sensor Type: Optical, 90 degree scatter, with mechanical cleaning

Model#: 6136
Range: 0 to 1000 NTU
Accuracy: +/- 2% of reading or 0.3 NTU (whichever is greater)
Resolution: 0.1 NTU

Parameter: Chlorophyll Fluorescence
Units: micrograms/Liter
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 6025
Range: 0 to 400 ug/Liter
Accuracy: Dependent on methodology
Resolution: 0.1 ug/L chl a, 0.1% FS

YSI EXO Sonde:

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

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

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

OR

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

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: Wiped probe; 4-electrode cell with autoranging
Model#: 599827
Range: 0 to 100 mS/cm

Accuracy: $\pm 1\%$ of the reading or 0.002 mS/cm, whichever is greater
Resolution: 0.0001 to 0.01 mS/cm (range dependent)

Parameter: Salinity

Units: practical salinity units (psu)/parts per thousand (ppt)

Model#: 599827

Sensor Type: Wiped probe; Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: $\pm 2\%$ of the reading or 0.2 ppt, whichever is greater

Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: $\pm 1\%$ of the reading or 1% air saturation, whichever is greater 200-500%
air saturation: $\pm 5\%$ or reading

Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 50 mg/L

Accuracy: 0-20 mg/L: ± 0.1 mg/L or 1% of the reading, whichever is greater

20 to 50 mg/L: $\pm 5\%$ of the reading

Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 33 ft (10 m)

Accuracy: ± 0.013 ft (0.004 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH

Units: pH units

Sensor Type: Glass combination electrode

Model#: 599701(guarded) or 599702(wiped)

Range: 0 to 14 units

Accuracy: ± 0.01 units within $\pm 10^\circ$ of calibration temperature, ± 0.02 units for entire temperature range

Resolution: 0.01 units

Parameter: Turbidity

Units: formazin nephelometric units (FNU)

Sensor Type: Optical, 90 degree scatter

Model#: 599101-01

Range: 0 to 4000 FNU

Accuracy: 0 to 999 FNU: 0.3 FNU or $\pm 2\%$ of reading (whichever is greater); 1000 to 4000 FNU $\pm 5\%$ of reading

Resolution: 0 to 999 FNU: 0.01 FNU, 1000 to 4000 FNU: 0.1 FNU

Parameter: Chlorophyll

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

Dissolved Oxygen Qualifier (Rapid Pulse / Clark type sensor):

The reliability of dissolved oxygen (DO) data collected with the rapid pulse / Clark type sensor after 96 hours post-deployment for non-EDS (Extended Deployment System) data sondes may be problematic due to fouling which forms on the DO probe membrane during some deployments (Wenner et al. 2001). Some Reserves utilize the YSI 6600 EDS data sondes, which increase DO accuracy and longevity by reducing the environmental effects of fouling. Optical DO probes have further improved data reliability. The user is therefore advised to consult the metadata for sensor type information and to exercise caution when utilizing rapid pulse / Clark type sensor DO data beyond the initial 96-hour time period. Potential drift is not always problematic for some uses of the data, i.e. periodicity analysis. It should also be noted that the amount of fouling is very site specific and that not all data are affected. If there are concerns about fouling impacts on DO data beyond any information documented in the metadata and/or QAQC flags/codes, please contact the Research Coordinator at the specific NERR site regarding site and seasonal variation in fouling of the DO sensor.

Depth Qualifier:

The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either depth or water level sensors. Readings for both vented and non-vented sensors are automatically compensated for water density change due to variations in temperature and salinity; but for all non-vented depth measurements, changes in atmospheric pressure between calibrations appear as changes in water depth. The error is equal to approximately 1.03 cm for every 1 millibar change in atmospheric pressure, and is eliminated for vented sensors because they are vented to the atmosphere throughout the deployment time interval.

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

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

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

Salinity Units Qualifier:

In 2013, EXO sondes were approved for SWMP use and began to be utilized by Reserves. While the 6600 series sondes report salinity in parts per thousand (ppt) units, the EXO sondes report practical

salinity units (psu). These units are essentially the same and for SWMP purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the NERR System will assign psu salinity units for all data regardless of sonde type.

Turbidity Qualifier:

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

Chlorophyll Fluorescence Disclaimer:

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

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Station 9	ST09	job09wq
Station 10	ST10	job10wq
Station 19	ST19	job19wq
Station 20	ST20	job20wq

11) QAQC flag definitions

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

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

12) QAQC code definitions

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

General Errors

GIC	No instrument deployed due to ice
GIM	Instrument malfunction
GIT	Instrument recording error; recovered telemetry data
GMC	No instrument deployed due to maintenance/calibration
GNF	Deployment tube clogged / no flow
GOW	Out of water event
GPF	Power failure / low battery
GQR	Data rejected due to QA/QC checks
GSM	See metadata

Corrected Depth/Level Data Codes

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

Sensor Errors

SBO	Blocked optic
SCF	Conductivity sensor failure
SCS	Chlorophyll spike
SDF	Depth port frozen
SDG	Suspect due to sensor diagnostics
SDO	DO suspect
SDP	DO membrane puncture
SIC	Incorrect calibration / contaminated standard
SNV	Negative value
SOW	Sensor out of water
SPC	Post calibration out of range
SQR	Data rejected due to QAQC checks
SSD	Sensor drift
SSM	Sensor malfunction

SSR	Sensor removed / not deployed
STF	Catastrophic temperature sensor failure
STS	Turbidity spike
SWM	Wiper malfunction / loss

Comments

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

13) Post deployment information

STATION 09			Post Deployment Calibration Values			
	Date In	Date Out	SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
	01/01/2016	01/13/2016	48.82	100.2	*	12.4
	01/13/2016	01/26/2016	50.03	96.9	7.00	0.4
	01/26/2016	01/27/2016	49.70	99.3	7.02	0.7
	01/27/2016	02/11/2016	49.83	100.6	7.01	1.9
	02/11/2016	02/24/2016	52.45	98.2	6.97	-2.3
	02/24/2016	03/08/2016	50.07	98.3	7.00	1.0
	03/08/2016	03/28/2016	52.34	97.1	7.00	65
	03/28/2016	04/14/2016	50.80	77.6	7.23	-0.6
	04/14/2016	05/04/2016	50.93	95.8	7.00	-1.2
	05/04/2016	05/17/2016	47.47	96.7	7.00	-2.0
	05/17/2016	06/01/2016	47.72	89	7.17	0.0
	06/01/2016	06/14/2016	53.23	71.9	6.99	-3.7
	06/14/2016	06/28/2016	49.38	86.6	6.89	0.8
	06/28/2015	07/19/2016	50.03	98	7.04	3.2
	07/19/2016	08/09/2016	48.27	99.2	6.91	1.4
	08/09/2016	08/23/2016	49.08	90.1	6.88	2.5
	08/23/2016	09/07/2016	49.89	95.6	6.96	0.7
	09/07/2016	09/26/2016	48.73	93	6.95	0.1
	09/26/2016	10/14/2016	49.12	100	7.07	0.7
	10/14/2016	11/01/2016	50.60	99.5	7.03	0.9
	11/01/2016	11/16/2016	49.14	101.8	7.11	0.3
	11/16/2016	11/28/2016	48.66	93.5	7.02	0.3
	11/28/2016	12/13/2016	52.40	95.1	7.01	0.8
	12/13/2016	01/12/2017	43.17	98.7	6.65	6.9

STATION 10		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
Date In	Date Out				
01/01/2016	01/13/2016	48.60	97.9	7.01	18.2
01/13/2016	01/26/2016	50.48	97.6	6.98	0.6
01/26/2016	01/27/2016	50.27	98.9	7.14	1.0
01/27/2016	02/11/2016	49.85	100.4	6.69	1.0
02/11/2016	02/24/2016	48.83	95.7	6.99	1.1
02/24/2016	03/08/2016	52.76	99.7	7.12	49.8
03/08/2016	03/28/2016	50.22	97.5	7.00	1.4
03/28/2016	04/13/2016	51.30	97.5	7.00	1.4
04/13/2016	05/04/2016	50.33	79.9	7.09	1.4
05/04/2016	05/17/2016	47.65	98.6	7.01	0.55
05/17/2016	06/01/2016	50.33	101.7	7.16	0.09
06/01/2016	06/14/2016	50.54	93.8	6.93	1.30
06/14/2016	06/28/2016	50.07	96.9	7.15	5.03
06/28/2015	07/19/2016	48.47	97.9	6.58	6.9

07/19/2016	08/09/2016	47.88	98.4	6.95	6.0
08/09/2016	08/23/2016	49.70	101.6	7.13	-0.05
08/23/2016	09/07/2016	52.21	98.4	7.05	0.22
09/07/2016	09/26/2016	48.41	97.2	7.09	0.5
09/26/2016	10/14/2016	48.23	99	7.08	0.40
10/14/2016	11/01/2016	48.69	97.3	7.10	0
11/01/2016	11/16/2016	49.10	99.5	7.08	1.64
11/16/2016	11/28/2016	49.81	99.6	7.14	0.54
11/28/2016	12/13/2016	51.86	96.8	7.15	2.59
12/13/2016	01/12/2017	48.24	100.9	6.97	0.39

STATION 19		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
01/01/2016	01/13/2016	50.02	12.2	6.95	43.3
01/13/2016	02/04/2016	48.30	97.4	6.93	0.5
02/04/2016	02/17/2016	49.47	101.1	7.12	2.3
02/17/2016	03/02/2016	46.27	99.7	7.25	0.9
03/02/2016	03/15/2016	51.06	100.6	7.09	-0.6
03/15/2016	04/05/2016	49.36	96.8	7.10	0.0
04/05/2016	04/20/2016	48.24	98.3	7.27	-0.9
04/20/2016	05/11/2016	50.26	83.6	7.20	4.21
05/11/2016	05/24/2016	49.66	107.1	7.10	2.26
05/24/2016	06/07/2016	48.77	100.7	7.10	7.39
06/07/2016	06/22/2016	49.82	107.6	7.07	1.98
06/22/2016	07/12/2016	47.40	43.8	7.01	1.04
07/12/2016	08/03/2016	49.99	100.5	7.11	1.86
08/03/2016	08/17/2016	50.57	90.8	7.05	0.07
08/17/2016	08/30/2016	50.09	97.7	7.20	6.07
08/30/2016	09/13/2016	49.82	100	7.15	0.5
09/13/2016	10/12/2016	51.40	103.8	7.09	1.48
10/12/2016	10/25/2016	49.70	92.4	7.13	1.09
10/25/2016	11/09/2016	47.25	99.7	7.10	-0.04
11/09/2016	11/22/2016	49.02	101	7.11	1.83
11/22/2016	12/06/2016	49.46	88.6	6.94	7.10
12/06/2016	12/20/2016	49.48	100.4	7.27	0.13
12/20/2016	01/17/2017	49.74	29.4	6.97	7.12

STATION 20		Post Deployment Calibration Values			
		SpCond (50mS/cm)	DO%	pH (7)	Turb (0 NTU)
01/01/2016	01/19/2016	50.37	95.5	6.91	2.8
01/19/2016	02/04/2016	51.80	100.8	7.01	4.8
02/04/2016	02/17/2016	49.00	101.7	7.04	3.4
02/17/2016	03/02/2016	46.73	97.1	7.28	0.4

03/02/2016	03/15/2016	51.14	102.2	7.19	0.0
03/15/2016	04/05/2016	49.90	96.5	6.98	10.2
04/05/2016	04/20/2016	48.00	100.5	7.18	2.7
04/20/2016	05/11/2016	50.22	104.4	7.08	2.0
05/11/2016	05/24/2016	48.78	99.5	6.98	0.1
05/24/2016	06/07/2016	49.50	96.8	7.12	2.0
06/07/2016	06/22/2016	50.29	101.1	6.86	0.0
06/22/2016	07/12/2016	48.29	96.6	6.86	6.3
07/12/2016	08/03/2016	49.98	102.7	7.03	1.0
08/03/2016	08/17/2016	49.79	99.1	7.00	1.4
08/17/2016	08/30/2016	50.09	96.2	7.15	4.8
08/30/2016	09/13/2016	49.64	100.1	7.21	0.7
09/13/2016	10/12/2016	49	102.9	7.08	1.0
10/12/2016	10/25/2016	49.67	96	7.08	1.3
10/25/2016	11/09/2016	49.31	96.8	7.15	0.7
11/09/2016	11/22/2016	48.73	99.5	7.04	0.9
11/22/2016	11/29/2016	*	*	7.05	0.7
12/01/2016	12/20/2016	48.25	102.1	6.98	1.2
12/20/2016	01/17/2017	50.30	98.6	6.73	29

*Bad sensor

14) Other remarks/notes

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

Conductivity/Salinity comments:

JOB09WQ: From 03/08/2016 10:45 to 03/28/2016 10:15. Rejected data due to incorrect calibration (SIC).

JOB10WQ: 02/04/2016 at 11:45 data rejected <-3> (CVT) possible tampering.

JOB10WQ: 03/08/2016 at 10:15 to 03/28/16 10:15. Suspect data due to unknown cause (CCU).

JOB10WQ: 03/28/2016 at 11:30 to 04/13/16 10:30. Suspect data due to unknown cause (CCU).

JOB20WQ: 11/26/2016 at 00:00 to 11/29/2016 at 23:45 data rejected <-3> (SCF) conductivity sensor failure.

DO Data comments:

JOB19WQ: Low post calibration value and biofouling affected data from 01/01/2016 to 01/13/2016.

JOB20WQ: DO Rejected data 11/26/2016 at 00:00 to 11/29/2016 at 23:45 data rejected <-3> (SCF) conductivity sensor failure.

pH Data comments:

JOB09WQ: From 04/29/2016 new pH sensor installed.

JOB09WQ: From 07/15/2016 new pH sensor installed on 02A0155AD.

Turbidity Data comments:

JOB09WQ: From 01/01/2016 to 01/13/16 (SSM), sensor malfunction

JOB09WQ: From 02/11/2016 to 02/16/16 (CAF), negative values

JOB09WQ: From 03/22/2016 17:45 to 03/28/2016 10:15. Rejected data due to biofouling (CBF).

JOB09WQ: From 03/28/2016 to 04/14/2016. Some data rejected due to biofouling (CAF).

JOB09WQ: From 03/27/2016 to 03/28/2016, <1> STS, CBF little crab between sensors (barnacles, sediment).

JOB09WQ: New turbidity sensor installed.

JOB10WQ: From 3/17/2016 21:30 to 3/28/2016 11:15, Rejected data due to biofouling (CBF) (algae, barnacles, sediment).

JOB10WQ: From 8/04/2016 18:00 to 8/09/2016 10:30, <1> (CBF).

JOB19WQ: From 02/17/2016 data rejected due to wrong depth (CWD).

JOB19WQ: New turbidity sensor installed on 14K101408 on 08/01/2016

JOB20WQ: From 03/02/2016 at 10:15 to 03/15/16 at 16:00 data rejected due to wrong depth (CWD).

JOB20WQ: New turbidity sensor installed on 04/19/2016.

Depth Data Comments:

Notes:

JOB09WQ: From 01/11/2016 at 20:15 to 01/13/2016 at 11:00 data affected (GPF) anomalous battery power failure.

JOB09WQ: From 07/26/2016 at 21:45 to 08/09/2016 at 09:45 battery power failure.

JOB09WQ: From 10/18/2016 at 10:30 to 10/23/2016 11:45, CRE data affected by significant rain event.

JOB09WQ: From 11/29/2016 at 19:45 to 11/30/2016 06:45 and 12/02/2016 to 12/03/2016 at 6:00 CRE data affected by significant rain event.

JOB10WQ: From 02/20/2016 at 05:30 to 07:00, CRE all data affected by significant rain event.

JOB10WQ: From 04/13/2016 at 11:00 to 06/01/2016 at 11:45 the sondes deployed were model EXO-2 and from 06/14/2016 at 12:00 to 07/19/2016 at 12:15 sondes deployed were model YSI-6600. We had two sondes deployed but EXO-2 failed. For this reason, we recovered data from the YSI-6600. The two sondes are deployed in separate tubes but are at the same depth situated next to one another.

JOB10WQ: From 07/19/2016 at 12:45 to 08/09/2016 10:30, data recovered from an YSI 6600 deployed side by side to the EXO-2. EXO-2 sonde had a power failure. The two sondes are deployed in separate tubes but are at the same depth situated next to one another.

JOB10WQ: From 10/18/2016 at 17:15 to 10/28/2016 at 16:45, CRE data affected by significant rain event.

JOB10WQ: From 10/30/2016 at 04:30 to 11/01/2016 at 10:45 battery power failure (GPF).

JOB10WQ: From 11/28/2016 at 11:49 to 11/29/2016 07:00 and 11/29/2016 at 17:15 to 12/03/2016 at 22:15 CRE data affected by significant rain even

JOB10WQ: From 12/03/2016 at 22:30 to 12/13/2016 at 09:30 battery power failure (GPF).

JOB19WQ: From 01/01/2016 at 00:00 to 04/20/2016 at 09:30 depth appears odd compared to the rest of 2016. Differences in instruments used to collect data may be the cause of this. Depth data is marked 1 GSM CWD and all other parameters 0 GSM CWD.

JOB19WQ: From 04/05/2016 at 10:00 to 04/20/2016 at 09:45 the sondes deployed were model YSI-6600 and from 04/20/2016 at 10:00 to 07/12/2016 at 10:15 sondes deployed were model EXO-2. We had two sondes deployed but EXO-2 failed. For this reason, we recovered data from the YSI-6600. The two sondes are deployed in separate tubes but are at the same depth situated next to one another.

JOB19WQ: From 10/19/2016 at 11:00 to 15:45, CRE data affected by significant rain event.

JOB19WQ: From 10/19/2016 at 20:00 to 10/22/2016 05:00, CRE data affected by significant rain event.

JOB20WQ: From 10/18/2016 at 15:00 to 16:45, CRE data affected by significant rain event.

Other:

Significant rain events*:

Date	Precipitation (mm)	Event associated with
02/19/2016	29.47	
03/29/2016	32.50	
04/29/2016-04/30/2016	42.00	
05/30/2016	12.40	
05/31/2016	54.4	
06/02/2016	20.80	
07/25/2016	15.74	
07/31/2016	26.9	
08/26/2016	13.20	
09/11/2016	9.90	
10/03/2016	40.13	Hurricane Mathew passed south of PR*
10/08/2016	20.82	
10/18/2016	64.5	
10/19/2016	19.8	
11/04/2016	9.10	
11/07/2016	10.9	
11/18/2016	16.3	
11/20/2016	16.0	
11/28/2016	29.2	
12/02/2016	20.3	

*Significant rain events are considered to affect water quality parameters during a period of time.

**Hurricane Mathew may have affected data at all stations from 09/28/16 to 10/08/16.