St. Martins Marsh and Big Bend Seagrasses Aquatic Preserves (SMMAP & BBSAP)

**Water Quality Metadata Report**

July - December 2018

Latest Update: April 9, 2019

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact the Aquatic Preserve office [Timothy.W.Jones@dep.state.fl.us](mailto:Timothy.W.Jones@dep.state.fl.us) with any additional questions.

**I. Data Set and Research Descriptors**

**1) Principal investigator & contact persons:**

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**2) Entry verification:**

Data from each deployment are uploaded from the YSI data sonde to a PC, and graphs are produced using EcoWatch software Version 3.10. These graphs are examined for suspect data that might derive from probe failure. Notes are made of any abnormal data, and sensors are reconditioned as necessary. The files are subsequently exported from EcoWatch in a comma-delimited format (.csv) and opened in Microsoft Excel for processing. Two copies of this file are saved in the .csv format; one file is used to archive the raw data, while the second file is edited to adjust records to Eastern Standard Time (EST) as needed to read exactly at the top or bottom of the hour (e.g., 00:00:00), to format column headers, and to delete data at the beginning and end of each deployment when the sondes were out of the water during transport. These latter data are referred to as “tails” and are identified by field notes that document the times the data sondes are in and out of the water. Tails are also noticeable by a series of salinity and conductivity values near zero.

Using the edited .csv files, monthly graphs are compiled and processed by various macros created by Aquatic Preserve staff and the National Estuarine Research Reserve’s Central Data Management Office (CDMO). These macros are designed to: 1) check data files for missing data points, 2) fill all cells that do not contain data with periods (.), 3) convert the data columns to appropriate formats for time, date and numeric variables, 4) find all data that are out of acceptable range for the sensors, 5) save the files as Excel worksheets (\*.xls), and 6) generate single parameter monthly graphs.

Anomalous data are evaluated to determine if the suspect data should be deleted. Data are flagged if the values are: 1) outside the range expected for the site, or 2) outside the range of measurements established for the sensors (see Section 9). Data outside the "normal" range of water quality parameters for a particular site were investigated for validity based on field observations, QC checks, PC6000 printouts, and instrument diagnostics. Data are deleted if the anomalies are attributed to sensor malfunction. In addition to observations of any physical damage (e.g., a torn DO probe membrane), sensor malfunctions are detected if the voltage reading of the probe is outside the range established for the sensor or the sensor will not calibrate.

**3) Research objectives:**

The objective of this effort is to establish baseline data by quantifying the spatial/temporal variability and trends, both seasonally and as a function of tidal force, of selected abiotic parameters within the Aquatic Preserves; to record changes in water quality due to major storm events such as hurricanes; and to use this water quality data to complement the annual seagrass monitoring conducted by the Aquatic Preserves.

**4) Research methods:**

Historically, YSI 600 OMS data sondes had been continuously operated (data collection interval: 30 minutes) at the Crystal River site since January 2004, at the Bennett Creek, Kings Bay, and Homosassa River monitoring stations since February 2004, and at the Withlacoochee monitoring station since March 2004. YSI 6600 EDS data sondes were operated at Cat Island and Lone Cabbage Key beginning in March 2004, and at Seahorse Key and Gomez Rocks beginning in April 2004. These models incorporate a specially designed wiper apparatus attached to the turbidity probe that reduces the oxygen and pH sensor fouling and thereby improves the quality of data collected. At each site, the sonde is contained within a 10 cm (inside diameter) housing pipe mounted vertically on a piling. To facilitate water flow across the sensors, several 2 cm diameter holes were drilled into the submerged portion of the pipe. Hole density is greatest near the base where the sonde sensors are located. In early 2005, the Cat Island and Lone Cabbage Key sites were removed. During most of 2005 and early 2006, data was sporadically collected at all sites due to lack of staff.

As of March 2006, all YSI 600 OMS sites were operational. In July 2006, the Gomez Rocks site was removed, and in August 2006, the Seahorse Key station became operational. In October 2006, the YSI 600 OMS was replaced with an YSI 6600 EDS sonde at the Kings Bay station. In March 2007, a 6600 EDS station was established in Dekle Beach. In early 2009, the data collection interval was changed to 15 minutes at all locations. In March 2009, an additional 6600 EDS station was installed at the mouth of the Suwannee River. In March 2010, the Kings Bay station was relocated due to the replacement of the piling the sonde was previously located at. In February 2012, all four YSI 6600 EDS sondes were upgraded from rapid pulse dissolved oxygen probes to ROX optical dissolved oxygen probes. In May 2015, the Crystal River site was broken down due to piling replacement, and the Seahorse Key site was deconstructed. The Homosassa site was upgraded from a YSI 600 OMS to a YSI 6600 EDS in August of 2015. The Kings Bay location was downgraded from a YSI 6600 EDS to a YSI 600 OMS outfitted with a turbidity probe. Due to insufficient staffing, data from 2015 to 2017 are intermittent, and all sites were decommissioned in 2017.

In July 2018, a new station was installed in Chassahowitzka and is the only site operating at this time (see Table 1). A 6600 EDS is being used with a 15-minute data collection interval. Parameters being recorded include time, date, temperature (°C), specific conductivity (mS/cm), salinity (ppt), dissolved oxygen (% and mg/L), depth (m), pH, and turbidity (NTU). The data sonde tube is attached to a piling with hose clamps, and water flow through the tube is facilitated with a series of drilled out 2-in and 1-in holes in the submerged portion of the tube.

Sonde exchanges at the 6600 EDS sites are made at approximately two-week intervals. At the end of a sampling period, sondes are returned to the laboratory where post-deployment readings and, if necessary, reconditioning take place in accordance with the methods outlined in the YSI Operating and Service Manual. The EDS turbidity wiper brush is removed and replaced with a clean wiper to avoid contamination of standards during post-deployment procedures. After a superficial rinse of the sonde in tap water, post deployment readings are recorded for pH (RICCA 7.00 buffer solution) and specific conductivity (RICCA 50.00 mS/cm standard). A post-deployment turbidity reading in 0.0 NTU standard (DI water) is recorded after a more thorough rinse of the turbidity sensor. The results of these post-deployment readings are used to evaluate the validity of data (See Table 2).

**5) Site locations and character:**

The St. Martins Marsh Aquatic Preserve was established on October 21, 1969. The St. Martins Marsh Aquatic Preserve covers open water areas from the Crystal River to the Homosassa River in coastal Citrus County. It is composed of approximately 28,400 acres of open water, several inlet bays, tidal rivers and creeks, salt marsh, and adjoins upland hammock islands. Nutrient exchange between the marshes and the Gulf of Mexico make the salt marsh a significant area of primary production and a nursery ground for commercial and recreational fish species. St. Martins Marsh Aquatic Preserve’s freshwater tributaries includes two, first-magnitude, spring-fed rivers: the Homosassa River to the south and the Crystal River to the north. Spring discharge does not fluctuate dramatically from season to season allowing a constant flow of freshwater into St. Martins Marsh’s productive and well-balanced estuary. The area’s vast coastal salt marshes, mud flats, oyster bars, mangrove islands, and seagrass beds are the southern terminus for migratory waterfowl of the Atlantic and Mississippi flyways. St. Martins Marsh provides stop-over and wintering areas for many migratory species. The Springs Coast is characterized by unique limestone outcroppings and exposed karstic features. Habitats associated with these areas are seagrass meadows and hardbottom. Hardbottom habitat is defined as an area of hard substrate, natural or artificial, where macroalgae, sponges, and corals can grow and attach using specialized holdfasts. See Table 1 for a description of stations both past and present.

The Big Bend Seagrasses Aquatic Preserve was established in 1985. Its boundaries extend from the Withlacoochee River north to the St. Marks River and out nine nautical miles. The Preserve boundary encompasses all tidal lands, islands, seagrass beds, shallow banks, and submerged bottoms from the mean high water line. Landward, it includes all-natural waterways tidally connected to the preserve to the extent of state jurisdiction. Spanning over 945,000 acres, the Big Bend Seagrasses Aquatic Preserve is the largest aquatic preserve and one of the most pristine places in Florida. The Big Bend Seagrasses Aquatic Preserve consists mainly of a large, remote, and undeveloped expanse of submerged seagrasses and nearshore marshlands located along approximately 180 miles of the northeast coast of the Gulf of Mexico where the Florida peninsula joins the panhandle. Numerous estuaries, which nurture a diverse flora and fauna, are formed at the confluence of the many rivers and streams that flow into the Preserve. Open waters and submerged bay bottoms of these estuaries provide habitat to a wide variety of sea and shore birds. This region supports a very important commercial shellfish industry including Cedar Key clams, scallops, oysters, pink shrimp, and blue crab. This area of Florida is also a popular destination for the recreational scallop season. The Suwannee River region supports Essential Fish Habitat (EFH) and the most viable population of the threatened Gulf sturgeon. Big Bend’s vast seagrass beds with mud and sand substrates are important marine habitats to this species.

**Table 1: Station Descriptions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Station Code** | **Station Name** | **Location** | **Active Dates** | **Reason Decommissioned** | **Notes** |
| BBSBC | Bennett Creek | N29 01.078  W82 43.621 | 02/2004- 07/2016 | Compilation of insufficient staff and equipment failure | Sand/rock bottom, near residential development |
| BBSCR | Crystal River | N28 55.502 W82 41.227 | 01/2004- 08/2016 | Compilation of insufficient staff and equipment failure | Sand/mud bottom, adjacent to oyster bars, near mouth of river |
| BBSDB | Dekle Beach | N29 48.836  W83 37.735 | 03/2007- 12/2015 | Compilation of insufficient staff and equipment failure | Sand/rock bottom located on Channel Marker #1 |
| BBSHS | Homosassa River | N28 46.224 W82 41.783 | 02/2004- 07/2016 | Compilation of insufficient staff and equipment failure | Sand/mud/rock bottom, near mouth of river |
| BBSKB | Kings Bay | N28 53.0  W82 35.986 | 02/2004- 07/2016 | Compilation of insufficient staff and equipment failure | Sand/rock bottom, near residential developments, high tourism activity |
| BBSSK | Seahorse Key | N29 06.109 W83 04.588 | 04/2004- 05/2015 | Compilation of insufficient staff and equipment failure | Sand/seagrass bottom, NE corner of Seahorse Key |
| BBSSW | Suwannee River | N29 17.269  W83 09.965 | 03/2009- 07/2016 | Compilation of insufficient staff and equipment failure | Mud bottom, at the mouth of the West Pass of the Suwannee River |
| BBSWT | Withlacoochee River | N29 00.063 W82 45.422 | 03/2004- 06/2016 | Compilation of insufficient staff and equipment failure | Sand/rock bottom, near mouth of river |
| BBSCH | Chassahowitzka | N 28.77514  W 82.71631 | 07/2018- Present | N/A | Sand/mud bottom, near mouth of Homosassa River |

**6) Data collection period:**

Individual sonde deployment and retrieval dates and times for 2018 data are as follows:

Deployment Retrieval

Date/Time Date/Time

Chassahowitzka

07/06/18, 09:30:00 07/18/18, 08:15:00 [CH site installed]

07/18/18, 08:30:00\* 08/02/18, 08:00:00\*

08/02/18, 08:30:00 08/16/18, 09:45:00

08/16/18, 10:00:00 08/30/18, 09:15:00

08/30/18, 09:30:00 09/13/18, 09:15:00

09/13/18, 09:45:00\* 09/27/18, 08:45:00

09/27/18, 09:00:00 10/09/18, 07:30:00

10/09/18, 07:45:00 10/24/18, 08:00:00

10/24/18, 08:15:00 11/07/18, 08:30:00

11/07/18, 08:45:00 11/21/18, 08:45:00

11/21/18, 09:00:00 12/05/18, 09:45:00

12/05/18, 10:00:00 12/26/18, 13:30:00

12/26/18, 13:45:00 01/14/19, 08:45:00

\* indicates short term loss of data due to battery failure, out of water for maintenance, weather related causes, and/or other internal problems that occurred during deployment.

\*\* indicates long term loss of data due to sonde removal from field for long term repairs.

**7) Distribution:**

The Principle Investigator (PI) retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and Aquatic Preserve (AP) site where the data were collected will 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.

Aquatic Preserve water quality data and metadata can be obtained from the Manager at the individual Aquatic Preserve site (please see Principal Investigators and Contact Persons) and online at the Aquatic Preserves data portal home page [www.floridaapdata.org](http://www.floridaapdata.org). Data are available in comma delimited format.

**8) Associated researchers and projects:**

The SMMAP and BBSAP have formed partnerships with other agencies and organizations actively involved in resource protection in the Preserves’ watershed. Cooperating managers of lands within the AP’s include the: 1) National Park Service (NPS), 2) Suwannee River Water Management District (SRWMD), 3) Southwest Florida Water Management District (SWFWMD), 4) Department of Environmental Protection (DEP) Division of Recreation and Parks/Florida Park Service (FPS), 5) United States Fish and Wildlife Service (USFWS), 6) DEP Aquatic Preserve Program, 7) Florida Fish and Wildlife Conservation Commission (FWC), 8) Florida Forest Service (FFS), and 9) Citrus, Taylor, Jefferson, Dixie, Levy, and Wakulla Counties.

Other water quality research and monitoring initiatives within the Aquatic Preserves include: 1) Nutrient sampling in the Big Bend region in conjunction with DEP’s Division of Environmental Assessment and Restoration (DEAR) and 2) Project COAST in conjunction with the laboratory of Dr. Thomas Frazer at the University of Florida (This work includes water quality, light penetration (PAR), and nutrient analyses.).

**II. Physical Structure Descriptors**

**9) Sensor specifications:**

SMMAP deployed 6600 EDS data sondes in 2018 at the Chassahowitzka site.

YSI 6600 EDS 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

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 6150 ROX

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 15% or reading

Resolution: 0.1% air saturation

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

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 50 mg/L

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

20 to 50 mg/L: +/- 5% of the reading

Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 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

**Depth Qualifier:**

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

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 Aquatic Preserve calibration sheet or digital calibration log.  This offset procedure standardizes each depth calibration. If accurate atmospheric pressure data are available, non-vented sensor depth measurements can be corrected. The Principal Investigator should be contacted in order to obtain information regarding atmospheric pressure data availability.

**Salinity Units Qualifier:**

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 Aquatic Preserve purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the Aquatic Preserve program will assign psu salinity units for all data regardless of sonde type.

**Turbidity Qualifier:**

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 Aquatic Preserve purposes they will be considered equivalent. Moving forward, the Aquatic Preserve program 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.

**10) Coded variable definitions:**

Sampling station: Sampling site code: Station code:

Chassahowitzka CH BBSCH

**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 data sonde, 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:**

End of deployment post-calibration readings in standard solutions are taken prior to probe cleaning.

**Table 2. Post-deployment readings of 6600 EDS sondes deployed at the Chassahowitzka site during 2018.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **pH** | **SC (mS/cm)** | **DO %** | **Turbidity (NTU)** | **Depth (m)** |
| **Date/Std.** | **7.00** | **50.00** | **100.0** | **0.0** | **n/a** |
| 07/08/18 | 6.70 | 49.71 | 104.7, 106.3 | 2.9 | 0.030 |
| 07/18/18 | 7.09 | 50.15 | 105.3, 108.3 | 0.1 | 0.069 |
| 08/02/18 | 7.02 | 50.46 | 100.3, 102.1 | 0.7 | 0.082 |
| 08/16/18 | 7.06 | 49.78 | 101.2, 87.5 | -0.1 | 0.047 |
| 08/30/18 | 7.07 | 50.04 | 98.8, 99.0 | -1.4 | 0.008 |
| 09/13/18 | 7.01 | 49.97 | 99.0, 99.8 | -0.2 | 0.059 |
| 09/27/18 | 7.18 | 49.56 | 99.2, 99.8 | 0.0 | -0.158 |
| 10/09/18 | 7.20 | 49.49 | 101.8, 101.9 | 1.6 | 0.028 |
| 10/24/18 | 7.40 | 51.28 | 100.1, 99.7 | -0.1 | 0.025 |
| 11/07/18 | 7.23 | 49.80 | 101.4, 101.4 | -0.1 | 0.107 |
| 11/21/18 | 7.08 | 48.63 | 101.8, 101.9 | 0.1 | 0.103 |
| 12/05/18 | 7.16 | 49.83 | 100.5, 100.0 | -0.3 | 0.072 |
| 12/26/18 | 7.13 | 49.41 | 101.6, 101.2 | 0.1 | 0.068 |

**14) Other remarks/notes:**

1. Calibration of dissolved oxygen was performed on the day of deployment. Two dissolved oxygen values are recorded during the post-deployment evaluation process.
2. This style of metadata was formerly used by National Estuarine Research Reserve program; more specifically, this report was modeled after metadata reports created at the Guana Tolomato Matanzas National Estuarine Research Reserve.
3. Copies of calibration/deployment logs can be obtained through the Principal Investigator.
4. Accreditation must be given to Florida Department of Environmental Protection’s Florida Coastal Office staff of the Big Bend Seagrasses and St. Martins Marsh Aquatic Preserves for all data used.

e) Hurricane Michael rode up the Gulf Coast of Florida making landfall in Mexico Beach of Florida’s Panhandle as a Category 4 hurricane. The eye of Hurricane Michael passed the Chassahowitzka datalogger site in the early hours of Wednesday, October 10, 2018. The storm surge in Citrus County was experienced later that evening.

**Missing Data**

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 Principal Investigator.

**July 1-31, 2018**

**CH**

1. Missing data 07/18/18 08:30:00; associated with sonde exchange. Unknown sonde error. Later found it may be contributed to a temporary disconnect in the battery compartment.

**August 1-31, 2018**

**CH**

1. Missing data 08/02/18 08:15:00; associated with sonde exchange. Unknown sonde error. Later found it may be contributed to a temporary disconnect in the battery compartment.

**September 1-30, 2018**

**CH**

1. Missing data 09/13/18 09:30:00; unknown sonde error.

**See Metadata “CSM” “GSM” Notes/Comments from Data Files**

**Anomalous/Suspect data:**

**Note #1:** Slight shifts in data are sometimes correlated with sonde exchanges. These shifts are most noticeable in pH, specific conductivity, salinity, DO% and DO conc, and may be related to sensor drift (e.g., due to fouling) and/or calibration/performance differences between sondes.

**Note #2:** Turbidity “outliers” (i.e., values that are negative or greater than 1000 NTU for 6600 series sondes and 4000 NTU for EXO series sondes) were not deleted from the monthly records. Readings greater than 1000 NTU for 6600 series sondes and 4000 NTU for EXO series sondes are considered out of range and are rejected. They have been left in the database to provide users with a complete dataset and to allow true visual representation of the data in graphs. Negative turbidity values occur throughout the year at all four sites. Some of these negative values are within the accuracy range of the sensor (+/- 2.0 %) and, therefore, were not removed from the dataset. They were marked suspect with the CAF code.

**Note #3**: Turbidity data is subject to single and clusters of spikes that occur in the beginning and middle of deployments. Turbidity values that fall between 500 and 1000 are not specifically indicated as suspect data, but possibly could be interpreted as suspect. Turbidity spikes may be associated with wiper malfunction but mostly the reason is unknown. Data users should exercise caution when interpreting turbidity data that fall within this range.

**Note #4:** Time series profiles of the dissolved oxygen data at all monitoring stations sometimes exhibits brief “spikes” of reduced DO concentrations. These events appear to be coupled with the occurrence of slack tide conditions as well as the level of fouling associated with the sonde.

**Note #5:** All times in data files at all sites had to be adjusted post-deployment; more specifically, times were altered such that the readings occurred on the hour and half hour. It has been determined that this clock error is a software issue and has been resolved.

**July 1-31, 2018**

**CH**

1. Suspect negative turbidity data; 07/06/2018 09:30:00-07/09/2018 15:30:00; 07/09/2018 20:00:00-07/11/2018 16:00:00; 07/11/2018 18:00:00-18:45:00; 07/11/2018 19:15:00-22:00:00; 07/11/2018 22:45:00-07/12/2018 00:15:00; 07/12/2018 00:45:00-07:45:00; 07/12/2018 18:15:00; 07/13/2018 02:30:00-04:30:00; 07/13/2018 05:15:00; 07/13/2018 05:45:00-06:15:00; 07/13/2018 13:15:00-15:45:00; 07/14/2018 00:45:00; 07/14/2018 01:30:00; 07/14/2018 04:00:00-04:15:00; 07/14/2018 05:00:00; 07/14/2018 05:30:00-07:00:00; 07/14/2018 14:15:00-14:30:00; 07/14/2018 15:00:00-17:30:00; 07/15/2018 14:45:00-17:45:00; due to calibration offset from expired 126.0 NTU turbidity standard. New 126.0 NTU standard was purchased and used immediately after.

**August 1-31, 2018**

**CH**

1. Suspect negative turbidity data 08/02/2018 15:45:00-20:30:00; may be contributed to calibration offset.

**September 1-30, 2018**

**CH**

1. Suspect negative turbidity data 09/04/2018 23:00:00- 23:15:00; 09/05/2018 02:45:00; 09/05/2018 03:15:00-05:45:00; 09/05/2018 09:30:00-10:00:00; 09/05/2018 11:00:00; 09/05/2018 11:30:00-12:00:00; 09/05/2018 22:15:00; 09/06/2018 00:15:00-03:30:00; 09/06/2018 04:15:00; 09/06/2018 08:15:00-08:45:00; 09/06/2018 09:15:00; 09/06/2018 10:00:00-11:45:00; 09/06/2018 12:15:00-12:30:00; 09/06/2018 13:30:00; 09/06/2018 14:00:00; 09/06/2018 21:00:00-21:30:00; 09/06/2018 23:00:00- 09/07/2018 05:45:00; 09/07/2018 07:45:00; 09/07/2018 9:00:00-09:45:00; 09/07/2018 10:15:00-16:30:00; 09/07/2018 20:00:00-07:30:00; 09/08/2018 08:00:00-09:15:00; 09/08/2018 09:45:00-17:00:00; 09/08/2018 19:30:00-19:45:00; 09/08/2018 20:30:00; 09/08/2018 21:00:00; 09/08/2018 21:30:00-21:45:00; 09/08/2018 22:15:00-09/09/2018 06:00:00; 09/09/2018 07:15:00-07:45:00; 09/09/2018 08:15:00-08:30:00; 09/09/2018 09:00:00; 09/09/2018 09:30:00-17:00:00; 09/09/2018 17:30:00-18:00:00; 09/09/2018 18:30:00; 09/09/2018 19:45:00-23:45:00; 09/10/2018 0:15:00-10:00:00; 09/10/2018 10:30:00-09/11/2018 09:15:00; 09/11/2018 11:00:00-11:15:00; 09/11/2018 11:45:00; 09/11/2018 12:30:00-18:45:00; 09/11/2018 19:15:00-23:45:00; 09/12/2018 00:15:00-10:00:00; 09/12/2018 11:30:00-12:30:00; 09/12/2018 13:00:00-16:30:00; 09/12/2018 17:15:00; 09/12/2018 17:45:00-09/13/2018 01:45:00; 09/13/2018 02:15:00-08:15:00; 09/13/2018 08:45:00; may be contributed to calibration offset.

**October 1-31, 2018**

**CH**

1. Suspect negative turbidity data 10/12/2018 04:15:00-04:45:00; 10/12/2018 17:00:00-17:15:00; 10/12/2018 19:30:00-19:45:00; 10/12/2018 20:15:00-22:45:00; 10/12/2018 23:15:00-10/13/2018 0:15:00; 10/13/2018 00:45:00; 10/13/2018 01:30:00; 10/13/2018 02:00:00-04:45:00; 10/13/2018 05:15:00-06:15:00; 10/14/2018 08:15:00-08:45:00; 10/14/2018 09:30:00-10:30:00; 10/14/2018 11:30:00; 10/14/2018 12:00:00; 10/14/2018 12:45:00-13:15:00; 10/14/2018 13:45:00-14:15:00; 10/14/2018 16:00:00-17:30:00; 10/14/2018 18:00:00-18:15:00; 10/14/2018 18:45:00-19:15:00; 10/15/2018 06:15:00-08:30:00; 10/15/2018 09:30:00-10:15:00; 10/15/2018 10:45:00-12:30:00; may be contributed to calibration offset.

**November 1-30, 2018**

**CH**

1. Suspect negative turbidity data 11/16/2018 09:45:00; may be contributed to calibration offset.

**Rejected Data:**

Obvious outliers, data associated with probe malfunction, and/or calibration (both pre and post) problems are rejected as specified below. For more details about rejected data, contact the Principal Investigator.

**July 1-31, 2018**

**CH**

1. Turbidity data deleted 07/18/18 02:30:00; value out of range. See Note #2.

**November 1-30, 2018**

**CH**

1. Turbidity data deleted 11/16/2018 09:15:00-09:35:00; value out of range. See Note #2.