**Estero Bay Aquatic Preserve Continuous Water Quality Metadata January 1, 2011- December 31, 2011**

Latest Update: September 14, 2022

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 with any additional questions.

## Data Set and Research Descriptors

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## Entry verification

To begin, deployment data are uploaded from the YSI data logger (datasonde) to a Personal Computer (IBM compatible). Files are exported from EcoWatch in a comma-delimited format (.CSV) and transferred into separate Microsoft Excel files by site, year, and month. Excessive pre- and post-deployment data are removed from the files at this time. The monthly files are then prepared, processed, and reviewed following the procedures in the Centralized Data Management Office’s (CDMO) National Estuarine Research Reserves (NERR) System-wide Monitoring Program (SWMP) Data Management Manual Version 6.3 (February 2010). Currently, Estero Bay Aquatic Preserve (EBAP) does not submit data to the CDMO and therefore does not apply the associated procedures. The monthly data file is then opened in Microsoft Excel and processed using the NERRQAQC macro. The macro automatically inserts station codes, combines date and time, creates metadata worksheets for flagged data, summary statistics, and graphs the data for review. It allows the reviewer to apply QA/QC flags and codes to the data and append files. During primary QA/QC, data are flagged and coded if they are missing, out of sensor range, or anomalous. Where deployment overlap occurs between files, the data produced by the newly calibrated datasonde (sonde) is generally accepted as being the most accurate. Data management is currently performed by Rebecca Cray.

Beginning in July 2018, data underwent additional Quality Assurance/Quality Control (QA/QC) procedures. An automated primary QA/QC process was performed by the CDMO and involved checking the standardized flags and codes that were previously applied to the data by the Aquatic Preserve Office. The process applied additional standardized flags to the data if values were outside sensor specifications and were not previously flagged. Yearly data files that completed the primary QA/QC process were returned to the Office of Resilience and Coastal Protection (RCP) staff for a secondary QA/QC procedure. Data were evaluated, and standardized flags and codes were either modified or new codes were applied to individual data points by insertion into the flag columns using the CDMO’s NERRQAQC Excel macro to provide further documentation of the data. Data files were then returned to the CDMO for ingestion into the Florida Aquatic Preserves database as provisional data. For more information on QA/QC flags and codes, see Sections 11 and 12 and for more information on NERRQAQC macro versions, see Section 14.

## Research objectives

In 2004, the Florida Department of Environmental Protection’s (FDEP) Office of Coastal and Aquatic Managed Areas (CAMA), now RCP, began a pilot program using extended deployed water quality monitoring devices, or datasondes, across several of its field offices. After the Estero Bay Aquatic Preserve (EBAP) office was selected, three datasonde monitoring sites were set up within the bay. There were several factors considered when selecting the monitoring sites including salinity gradients, water depth, freshwater inputs, tidal circulation patterns and the location of navigational markers. Additionally, to correlate existing data collection efforts and refrain from duplicating data, locations of other water quality studies were also taken into consideration.

The datasondes, located in a long, shallow estuary, are affected by saltwater inclusion from several Gulf of Mexico inlets and freshwater input from five tributaries. The passes are, from north to south: Hurricane Pass, Matanzas Pass, Big Carlos Pass, New Pass, Big Hickory Pass, and Wiggins Pass in Collier County. The tributaries are, from north to south: Hendry Creek, Mullock Creek, Estero River, Spring Creek, and the Imperial River. The watershed for Estero Bay spans 359.6 square miles and encompasses both the Southern Coastal Plain and Southern Florida Coastal Plain ecoregions, which comprise areas that are typical of low, flat, southern Florida lands dominated by wetlands and characterized by slow, sheet-flow drainage patterns. Natural communities include mangrove-dominated islands along the coast with salt marsh habitats occurring landward of the mangrove zone, pine flatwoods, cypress swamps, and cabbage palm hammocks. The communities within the bay include seagrass beds, mangrove islands, salt marshes, tidal flats, and oyster bars. In the past, the naturally dispersed water patterns distributed nutrients over broad areas of wetland vegetation and seasonal fluctuations in flow from rainfall created the necessary salinity regime in Estero Bay for good estuarine productivity. However, increased development in the area since the 1960’s has led to changes in the natural river systems around Estero Bay, altering freshwater inflow patterns. The watershed activities that potentially impact the bay include point-source wastewater discharge and non-point source runoff or leaching of pollution from roads, agriculture lands, urban areas, and un-vegetated lands which contain fertilizers, pesticides, herbicides, metals, sediments, petroleum compounds, and bacteria.

The datasonde data provides information on the overall health of Estero Bay on a continuous basis. Specifically, the data from these stations provide a baseline of water quality measurements for identifying, monitoring, and comparing differences in the parameters over time. The data also aid in the interpretation of changes observed in indicator organisms, bay communities, and for making comparisons to other geographical areas. The data may also assist with the understanding of effects from anthropogenic changes within the bay. The principle goal of the program is to attain baseline data on the overall water quality of Estero Bay for the purpose of preventing further degradation.

## Research methods

Beginning July 14, 2004 two water quality stations, EB01 (Tom Winter) in the north end of Estero Bay and EB02 (Spring Creek) in the central portion of the bay, were designated as permanent Continuous Water Quality Monitoring Program sites for Estero Bay Aquatic Preserve. A third water quality station, EB03 (Fish Trap Bay), was added on November 23, 2004 at the southern end of the preserve. The dataset from these three monitoring stations has been essentially uninterrupted since the first day of deployment.

Currently, all sondes are YSI 6600 Extended Deployment System (EDS) with three that are the V2-2 model. Prior to deployment, the sondes are calibrated for pH, specific conductivity, turbidity, dissolved oxygen, and depth following the procedures outlined in the YSI Operating and Service Manual. Prior to the December 2011 deployment, the depth was calibrated using a barometric pressure value of 760 mmHg for each calibration, actual atmospheric pressure was not calculated. For the December 6, 2011 deployment a NIST certified barometer was used to obtain the actual atmospheric pressure and determine the depth offset value.

A two-point calibration is used for pH (YSI buffers 7 & 10) and turbidity (0 NTU distilled water & 126 NTU YSI, Inc.). A 0.5M KCL solution (YSI conductivity calibrator) is used to calibrate specific conductivity. Dissolved oxygen (DO) is calibrated in oxygen saturated water, using a bucket and an aerator. Prior to June 29, 2010, rapid pulse dissolved oxygen sensors were calibrated using water saturated air, using a small amount of water in a vented calibration cup. The percent saturation value is determined by using the current barometric pressure to convert to the adjusted value and entered into EcoWatch. ROX optical DO probes are deployed at all three sites. The depth is also calibrated by using the current barometric pressure to determine the depth offset value and entered into EcoWatch.

All sondes are deployed within 4-inch diameter PVC pipes, which are attached to either a private residential dock (EB01) or “aid-to-navigation” pilings (EB02 and EB03). The pipes are oriented vertically and attached with stainless steel rods molded to wrap around the piling and bolted to galvanized hangers. Up to three hangers are used depending on the height of the pipe. A stainless steel bolt is also installed at the end of the pipes to keep the sonde from falling through. The submerged end of the PVC has two rows of rectangular holes whose short ends are rounded (pill/stadium shaped). There are 4 holes per row measuring vertically approximately 8 inches tall and horizontally 2 inches wide. Sondes are secured by rope to an eyebolt in the top of the PVC caps. An additional hole is drilled through the top of the pipes and caps in order to insert a bolt and lock for security. The bottoms of the pipes are open and positioned such that the sensors are 0.5 meters above the bottom.

The sondes are further protected from crabs and other live organisms by attempting to restrict the openings on the sonde guard with plastic mesh screening. The plastic mesh (with 1/8 inch diamond-shaped holes) is attached to the outside of the sondes guard’s circumference using low- profile zip ties.

Sondes are deployed, generally, for two weeks to one month at a time. The sampling period is set for 15-minute intervals (readings are made every 15 minutes). The following physical water quality parameters are recorded: temperature (degrees Celsius), specific conductivity (mS/cm), salinity (parts per thousand), dissolved oxygen (mg/L and % saturation), depth (m), pH and turbidity (NTU). To test how well the sondes hold calibration, field measurements are performed using a handheld YSI instrument (YSI 85 2004-Feb. 2008, YSI556 Feb. 2008-present) which serves as a “spot check” at the time of deployment and retrieval. The parameters recorded are temperature, specific conductivity, conductivity, salinity, dissolved oxygen (mg/L and % saturation), and depth. Additionally, a post-deployment calibration verification is conducted in the lab. The parameters include pH (7.0), turbidity (0 NTU), specific conductivity (50 mS/cm), DO%, depth, and battery volts.

***NOTE: All data associated with this metadata file are reported in Local Standard Time (Oct- March) and NOT adjusted for daylight savings time.***

## Site location and character

**EB01 (Tom Winter):**

Lat/Long (Decimal Degrees): 26.434944 -81.911389

The EB01 datasonde is located on the bay side of Estero Island in Matanzas Pass, across from Julies Island, and is the most northern of the three site locations. The Tom Winter labeling is to clarify the sonde location which is affixed to a residential dock (parcel 28-46-24- W3-0020B.0390) approximately 300 meters across the channel from Julie’s Island. The monitoring site is approximately 5.0 km (linear dimension) from Matanzas Pass Bridge to the northwest and 4.4 km from Big Carlos Pass to the southeast. The closest tributary is the Y- junction of the mouths of Hendry Creek and Mullock Creek, approximately 5.1 km northeast of the sonde location. Matanzas Pass is roughly 8.9 km long and has a mid-channel depth of approximately 1.0 to 3.6 meters at MHW. At the sampling site, the depth is 2.05 meters at MHW and the width of the water body is 335 meters. Tides at EB01 are mixed semidiurnal and range from 0.85 m to 1.39 m according to the NOAA Tides and Currents website; Estero Island, Estero Bay, FL Datum, Station ID 8725351, 1983-2001 Epoch. Salinities range from 2.2 ppt to 34.4 ppt and fluctuate daily with tides, wind, rainfall, and freshwater discharge (USGS Scientific Investigations Report 2007-5217, Estero Bay near Horseshoe Keys data, 10/1/2004 – 09/30/2005). The channel substrate is predominantly fine sand and there is no bottom vegetation. Generally, Estero Island’s shoreline, on the bay side, is sea walled and will not have any vegetation. The closest vegetation are red and black mangrove islands across the channel. The land to the north of the site contains a significant amount of protected state-owned preserve area known as Estero Bay Preserve State Park.

# EB02 (Spring Creek):

Lat/Long (Decimal Degrees): 26.385917 -81.846333

The EB02 site is located northwest of the mouth of Spring Creek and south of Coconut Point. The sonde is affixed to navigational marker 9A within the Spring Creek access channel. The average depth at this site is approximately 1.70 meters at MHW. Tides at EB02 are mixed semidiurnal and range from 0.74 m to 1.27 m according to the NOAA Tides and Currents website; Coconut Point, Estero Bay, FL Datum, Station ID 8725319, 1983-2001 Epoch. Salinities range from 8.2 ppt to 35.9 ppt and fluctuate daily with tides, wind, rainfall, and freshwater discharge (USGS Scientific Investigations Report 2007-5217, Big Carlos Pass data, 10/5/2004 – 09/30/2005). The substrate within the channel is a mixture of sand and silt with no bottom vegetation. However, there is seagrass found in the vicinity. Mature red and black mangrove forests dominate the nearby banks of the bay and several mangrove islands are nearby. The mouth of Spring Creek is approximately 4.4 km downstream from where a six-lane highway (SR 41) crosses over the tributary.

# EB03 (Fish Trap Bay):

Lat/Long (Decimal Degrees): 26.354972 -81.844528

The EB03 site is located east of Broadway Channel and north of Intrepid Waters at the southern end of EBAP. The sonde is affixed to a piling (manatee caution sign) in the center of Big Hickory Bay. The mouth of the Imperial River is approximately 2.1 km to the south of the sonde’s location and is the closest tributary. The average depth at MHW is approximately 1.40 meters. Tides are mixed semidiurnal and range from 0.62m to 0.81m (NOAA Tides and Currents website; Fish trap Bay, Estero Bay, FL Datum, Station ID 8725272, 1983-2001 Epoch). Salinities range from 1.6 ppt to 33.6 ppt and fluctuate daily with tides, wind, rainfall, and freshwater discharge (USGS Scientific Investigations Report 2007-5217, Fishtrap Bay data, 10/1/2004 – 09/30/2005). The substrate within the channel is a mixture of sand and silt with no bottom vegetation. Mature red and black mangrove forests dominate the nearby banks of the preserve. The dominant natural vegetation of the watershed is hydric pine, scrubby flatwoods, and cypress. The mouth of Imperial River is approximately 2.1 km downstream from a six-lane highway (SR 41) and approximately 7.6 km from I-75, both of which cross over the tributary.

## Data collection period

Water quality data collection began July 14, 2004 at EB01 and EB02 and November 23, 2004 at EB03. This collection period began January 1st, 2011 and ended December 31, 2011. During this time period there were 13 deployments at each site.

|  |  |  |
| --- | --- | --- |
| **EB01 (Tom Winter)** | | |
| *Deployment* | *Start* | *End* |
| 01112910 | 11/30/2010 11:00 | 01/05/2011 14:15 |
| 01010411 | 01/05/2011 14:30 | 02/08/2011 12:30 |
| 01020611 | 02/08/2011 12:45 | 03/02/2011 11:45 |
| 01030111 | 03/02/2011 12:00 | 04/06/2011 12:45 |
| 01040511 | 04/06/2011 13:00 | 05/04/2011 12:00 |
| 01050211 | 05/04/2011 12:15 | 06/08/2011 08:30 |
| 01060611 | 06/08/2011 08:45 | 07/11/2011 10:00 |
| 01070611 | 07/11/2011 10:30 | 08/03/2011 07:30 |
| 01080211 | 08/03/2011 08:00 | 09/07/2011 10:15 |
| 01090611 | 09/07/2011 10:30 | 09/29/2011 12:15 |
| 01092611 | 09/29/2011 12:45 | 11/01/2011 08:30 |
| 01103111 | 11/01/2011 08:45 | 12/06/2011 10:00 |
| 01120511 | 12/06/2011 10:15 | 01/05/2012 11:30 |
| **EB02 (Spring Creek)** | | |
| *Deployment* | *Start* | *End* |
| 02112910 | 11/30/2010 11:00 | 01/05/2011 14:15 |
| 02010411 | 01/05/2011 14:30 | 02/08/2011 12:30 |
| 02020611 | 02/08/2011 12:45 | 03/02/2011 11:45 |
| 02030111 | 03/02/2011 12:00 | 04/06/2011 12:45 |
| 02040511 | 04/06/2011 13:00 | 05/04/2011 12:00 |
| 02050211 | 05/04/2011 12:15 | 06/08/2011 08:30 |
| 02060611 | 06/08/2011 08:45 | 07/11/2011 10:00 |
| 02070611 | 07/11/2011 10:30 | 08/03/2011 07:30 |
| 02080211 | 08/03/2011 08:00 | 09/07/2011 10:15 |
| 02090611 | 09/07/2011 10:30 | 09/29/2011 12:15 |
| 02092611 | 09/29/2011 12:45 | 11/01/2011 08:30 |
| 02103111 | 11/01/2011 08:45 | 12/06/2011 10:00 |
| 02120511 | 12/06/2011 10:15 | 01/05/2012 11:30 |
| **EB03 (Fish Trap Bay)** | | |
| *Deployment* | *Start* | *End* |
| 03112910 | 11/30/2010 11:00 | 01/05/2011 14:15 |
| 03010411 | 01/05/2011 14:30 | 02/08/2011 12:30 |
| 03020611 | 02/08/2011 12:45 | 03/02/2011 11:45 |
| 03030111 | 03/02/2011 12:00 | 04/06/2011 12:45 |
| 03040511 | 04/06/2011 13:00 | 05/04/2011 12:00 |
| 03050211 | 05/04/2011 12:15 | 06/08/2011 08:30 |
| 03060611 | 06/08/2011 08:45 | 07/11/2011 10:00 |
| 03070611 | 07/11/2011 10:30 | 08/03/2011 07:30 |
| 03080211 | 08/03/2011 08:00 | 09/07/2011 10:15 |
| 03090611 | 09/07/2011 10:30 | 09/29/2011 12:15 |
| 03092611 | 09/29/2011 12:45 | 11/01/2011 08:30 |
| 03103111 | 11/01/2011 08:45 | 12/06/2011 10:00 |
| 03120511 | 12/06/2011 10:15 | 01/05/2012 11:30 |

## Distribution

Considerable effort has been made to ensure the accuracy of the information provided and meet quality assurance guidelines used by the Florida’s Department of Environmental Protection Estero Bay Aquatic Preserve program. Please note that the included data are estimates of actual conditions subject to improvements in accuracy and precision of field methods over time as well as infrequencies in sampling duration, rendering data in some instances, to be unsuitable for temporal or spatial comparisons. As a result, the user is responsible for interpretations based on supplied data.

Neither the State of Florida nor the Florida Department of Environmental Protection makes any warranty, expressed or implied, including the warranties of merchantability and fitness for a particular purpose arising out of the use or inability to use the data, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights.

The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and Estero Bay Aquatic Preserve, 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.

Estero Bay Aquatic Preserve water quality data and metadata can be obtained from the Research Coordinator at the individual site (please see Principal Investigators and Contact Persons).

## Associated researchers and projects

In addition to this water quality dataset, Estero Bay Aquatic Preserve conducts epibenthic monitoring of five seagrass sites. Starting in 2002, five fixed stations located throughout the aquatic preserve are monitored twice a year, once in the dormant season and once in the growing season, using Braun-Blanquet techniques. Abundance scores are also applied to algae as part of the seagrass monitoring. Two of these seagrass sites are located within close proximity of the EB02 and EB03 sonde locations.

Since 1998, volunteers with the Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network (CHEVWQMN) have collected water quality data once a month at up to 7 sites within Estero Bay (or 46 sites within the greater Charlotte Harbor region). This program is currently coordinated through the Charlotte Harbor Aquatic Preserves office in Punta Gorda, FL.

In 2008, EBAP began monitoring the nesting effort of wading and diving birds which use mangrove islands within the bay as rookeries.

Lee County and FDEP’s Division of Environmental Assessment and Restoration collect water quality samples within Estero Bay and the watershed.

## Physical Structure Descriptors

1. **Sensor specifications:**

Estero Bay Aquatic Preserve deploys YSI 6600 EDS and YSI 6600 – V2 (2) EDS datasondes

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

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#: 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: +/- 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

**Dissolved Oxygen Qualifier:**

The reliability of the dissolved oxygen (DO) data 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). Many Aquatic Preserves have upgraded to YSI 6600 EDS data sondes, which increase DO accuracy and longevity by reducing the environmental effects of fouling. The user is therefore advised to consult the metadata and to exercise caution when utilizing the DO data beyond the initial 96-hour time period. However, this potential drift is not always problematic for some uses of the data (e.g., periodicity analysis). It should be noted that the amount of fouling is site specific and that not all data are affected. The Principal Investigator should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the fouling of the DO sensor. EBAP transitioned all dissolved oxygen sensors from rapid pulse to optical type sensors during the June 30, 2010 deployment.

**Depth Qualifier:**

The YSI datasondes utilized by Estero Bay Aquatic Preserve are equipped with non-vented depth/level sensors. Readings for 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. EBAP began calibrating depth with an offset with the December 6, 2011 deployment.

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). If accurate atmospheric pressure data are available, non-vented sensor depth measurements can be corrected. After 04/04/12, depth sensors were calibrated with an offset using local barometric pressure measured on site with a Fisher Scientific TM Traceable tm digital barometer.

**Salinity Units Qualifier:**

6600 series sondes report salinity in parts per thousand (ppt) units and the EXO sondes report in practical salinity units (psu). These units are essentially the same and for the AP water quality program purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the AP program will assign psu salinity units for all data regardless of sonde type.

**Turbidity Qualifier:**

6600 series sondes report turbidity in nephelometric turbidity units (NTU) and the EXO sondes use formazin nephelometric units (FNU). These units are essentially the same but indicate a difference in sensor methodology, for AP water quality program purposes they will be considered equivalent. Moving forward, the AP 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.

## Coded variable definitions

|  |  |  |
| --- | --- | --- |
| Sampling Station: | Sampling Site Code: | Station Code: |
| Tom Winter | EB01 | EB01 |
| Spring Creek | EB02 | EB02 |
| Fish Trap Bay | EB03 | EB03 |

1. **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 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

## 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. A short description of each flag and code combination also appears on the notes tabs of the excel file. 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 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

Sensor Errors

SBO Blocked optic

SCF Conductivity sensor failure SDF Depth port frozen

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 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

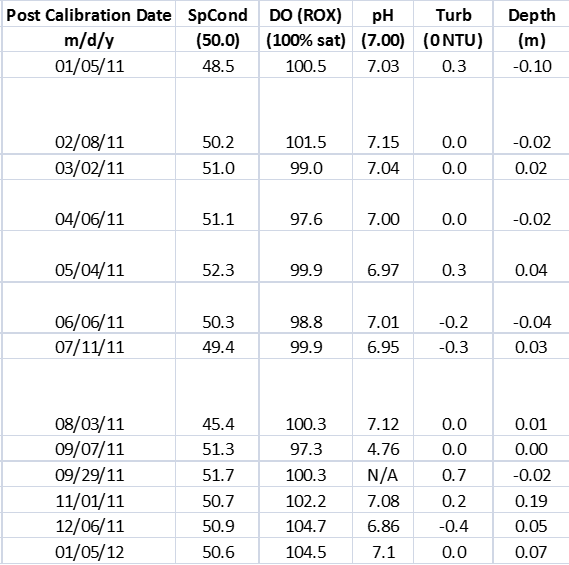
CMC In field maintenance/cleaning CMD Mud in probe guard

CND New deployment begins CRE Significant rain event CSM See metadata

CTS Turbidity spike

CVT Possible vandalism/tampering CWD Data collected at wrong depth

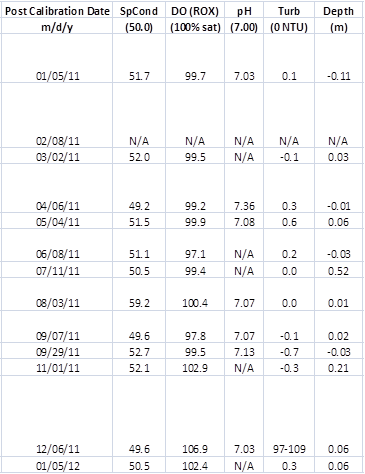
## Post deployment calibration information EB01 (Tom Winter)



**EB02 (Spring Creek)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Post Calibration Date** | **SpCond** | **DO (ROX)** | **pH** | **Turb** | **Depth** |
| **m/d/y** | **(50.0)** | **(100% sat)** | **(7.00)** | **(0 NTU)** | **(m)** |
| 01/05/11 | 49.6 | 99.7 | 7.06 | 0.2 | -0.10 |
| 02/08/11 | 50.2 | 100.7 | 6.98 | 0.0 | -0.01 |
| 03/02/11 | 50.1 | 98.8 | 7.12 | -0.2 | 0.03 |
| 04/06/11 | 49.8 | 96.9 | 7.02 | 0.0 | -0.02 |
| 05/04/11 | 50.6 | 108.5 | 7.08 | 0.1 | 0.04 |
| 06/08/11 | 51.7 | 97.3 | 7.02 | 0.2 | -0.03 |
| 07/11/11 | 50.3 | 99.9 | 7.12 | 961.7 | 0.10 |
| 08/03/11 | 50.0 | 101.8 | 7.16 | 0.2 | 0.00 |
| 09/07/11 | 43.2 | 99.6 | 6.92 | -0.1 | 0.01 |
| 09/29/11 | 52.5 | 99.9 | 7.15 | -0.3 | 0.01 |
| 11/01/11 | 51.4 | 102.5 | 7.00 | -0.2 | 0.02 |
| 12/06/11 | 50.2 | 107.8 | 7.00 | 2356.0 | 0.05 |
| 01/05/12 | 50.9 | 104.1 | 6.98 | -0.2 | 0.06 |

**EB03 (Fish Trap Bay)**



1. **Other remarks/notes**

All data files are QAQC’d using the 2012 CDMO Excel macro. This macro automatically flags negative turbidity values between 0 and -2 NTU as Suspect <1> with the comment Acceptable Calibration/Accuracy Error of Sensor (CAF). In addition, the macro automatically flags DO values less than 3 mg/L as Passed Initial QAQC Checks <0> with the comment DO Hypoxia (<3 mg/L) (CDA). The DO flag is based on Federal standards. During the primary QAQC session, any reading that falls outside a sensor’s range (see section II. Physical Structure descriptors) is rejected (-3). For example, all turbidity readings over 1000 NTU are rejected (-3, SBO). Small negative depth readings where all other data is in line are marked suspect (1, SNV, CAP) per the CDMO manual since this is within the accuracy of the sensor. The shallow depth sensor is a non-vented probe that is susceptible to changes in barometric pressure when deployed in shallow estuaries, please refer to the depth qualifier under Section II. Additionally, negative turbidity readings between 0 and -2 have been flagged as suspect data (1, SNV, CAF) since the value is within the accuracy of the probe per the CDMO operations manual. Data from all out of water events (distinguished by both low SpCond values and low/negative depths) has all been rejected (-3, GOW, CLT)

Additionally, for Estero Bay, anomalous turbidity readings >126 NTU (the high calibration value), not within a well-defined turbidity peak (e.g., neighboring readings are not close), are marked as a suspect turbidity spike (1, STS). These readings may either be caused by optical interference by animals or fouling, or an unknown local disturbance. A description of all other flag/code combinations that appear in the dataset are noted below.

## EB01 (Tom Winter)

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| During the **01010411** deployment, the temperature probe began to fail which was evident by the sudden rise in temperature (50.00); therefore the temperature readings were erroneous. All corresponding data were also rejected because the temperature data were erroneous beginning on 01/07/2011 01:30 and the accuracy of the sensors were not certain (-3, STF). And fouling was found on the turbidity brush on datasonde retrieved 02/08/2011 which may have  contributed to anomalous turbidity spikes |
| For the **01020611** deployment, an egg was found on the crab guard at datasonde retrieval which may have contributed to the turbidity spikes |
| For the **01030111** deployment nekton, including shrimp and small crabs, were generally found inhabiting the sonde crab guard which may have contributed to the turbidity spikes. Anomalous turbidity towards the last half of the 01030111 deployment has been flagged (1, SQR, CCU). There are no notes on fouling for this deployment, however the slow increase over time is indicative of fouling near the turbidity sensor which, like bryozoans, growing larger over time. Upon return, staff inadvertently dropped the bucket containing the datasondes. The sonde passed post calibration and did not show any effects from the incident. |
| For the **01040511** deployment the turbidity wiper was not parked correctly on datasonde retrieval. The large number of out of range readings by the turbidity sensor indicate the wiper was incorrectly parking over the optics. All turbidity readings from 4/9/11 15:45 to 5/04/11 14:00 have been rejected (-3, SWM). |
| For the **01050211** deployment, During the 01050111 deployment, the SpCond/salinity readings suddenly jumped on 05/14/11 from 51.173 to 62.302, then followed by a period of SpCond/salinity lower than the readings preceding the disruption. During the field check on 06/06/11, the retrieval datasonde SpCond reading was ~6.5 mS/cm lower than YSI 556 and newly deployed datasonde. However, during post-cal the sonde was reading 50.29 mS/cm in 50 mS/cm calibration solution. Something may have caused anomalous readings in situ that resolved itself during post-calibration. For this reason, SpCond and salinity from 05/14/11 15:00 to 06/06/11 14:15 have been marked suspect (1, SSM, CSM). Turbidity wiper was not parked correctly on datasonde retrieved 06/06/2011. The large number of out of range readings by the turbidity sensor indicate the wiper was incorrectly parking over the optics. All turbidity readings after 05/20/11 5:30 have been rejected (-3, SWM). |
| During the **01060611** deployment, the datasonde stopped recording data on 6/30/2011 17:30 due to an unknown instrument malfunction. Missing data points have been flagged (-2, GIM). |
| For the **01070611** deployment, the field and post calibration check for datasonde retrieved 8/3/11 showed SpCond/salinity was out of range. Additionally, the field check on 07/11/11 showed SpCond/salinity readings at the beginning of the deployment were different from the YSI 556 readings, indicating an issue may have occurred during pre-calibration.  Fouling on the crab guard and the large number of small crabs may have contributed to anomalous turbidity spikes. |
| During the **01080211** deployment, the pH probe failed on 09/05/11 at 11:15 which was evident by the sharp decline of pH units from 8.00 at 11:00 to 6.49 at 11:15. All pH readings after 09/05/11 11:15 have been rejected for this deployment due to a malfunctioning pH probe (-3, SSM) |
| During the **01090611** deployment, the pH probe broke on 09/26/11 at 03:00 which was visible on the datasonde graph at post calibration and the readings as a sharp decline in pH units. All pH readings after 09/26/11 03:00 have been rejected (- 3, SSM) for this deployment. A large crab was found in the guard during datasonde retrieval which may have contributed to anomalous turbidity spikes. |
| For the **01092611,** no other notes |
| During the **01103111** deployment, a red tide event, documented by the Fish and Wildlife Research Institute, resulted in a  fish kill that was observed by Florida Gulf Coast University’s marine lab located on the south end of Estero Aquatic Preserve. Eggs, egg casings, moderate fouling and lots of small crabs were present on crab guard upon retrieval, 12/06/2011. Numerous, high turbidity values (scatterplot effect) were recorded starting 11/10/2011 9:30am, ending abruptly with new datasonde deployment (12/06/2011). Because of this all turbidity readings 11/18/2011 to 12/06/2011 have been marked suspect (1, CBF) due to biofouling. There is a sharp discontinuity in pH that directly correlates with the new datasonde deployment on 12/06/11 The ph probe (09E) was nearing the end of its useful life (per YSI 12-18 months) and had a low slope (168.7) prior to deployment. For these reasons, ph data from 11/1/2011 to 12/06/2011 has been marked suspect (1, CSM). |
| For the **01120511** deployment, the Optical DO sensors were calibrated to a percent saturation value that incorporates local  barometric pressure (measured on site with Fisher Scientific TM Traceable TM digital barometer) instead of a standard pressure of 760 mm Hg. A DO data point on 12/21/11 at 19:30 was rejected due to an anomalous value that was inconsistent with adjacent DO and probe values. YSI Incorporated was contacted and identified the value as a possible result of a loose oscillator. |

**EB02 (Spring Creek)**

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| During the **02010411** deployment, the pH slope was out of spec during pre-calibration, all pH data for the deployment has been rejected (-3, SQR) |
| There are no other notes for the **02020611** deployment |
| For the **02030111** deployment, the pH slope was out of spec during pre-calibration all pH data from 01/05/11 to 02/08/11 has been rejected (-3, SQR). Lots of crabs and shrimp were present in the crab guard on sonde retrieval and no turbidity wiper was recovered from the datasonde, although this was not noticed until the datasonde arrived at the office. Due to the large number of high and out of range readings recorded by the sensor, turbidity readings after 03/27/11 20:45 have been rejected (-3, SWM) for the rest of the deployment. |
| For the **02040511** deployment, the turbidity wiper was not parked at 180° upon sonde retrieval and the large number of high and out-of-range readings indicate a potential problem with the wiper parking over the optics, or other optical interference. However, there are no other notes about wiper malfunction were recorded during the post calibration check. All turbidity data from the 02040511 deployment has been marked suspect due to possible wiper malfunction (1, SWM). |
| For the **02050211** deployment, all pH readings were rejected since the pH probe pre-calibration slope was out of range (-3, SQR). Additionally, a large stone crab was found in the crab guard of during datasonde retrieval, which may have contributed to anomalous turbidity spikes. |
| During the **02060611** deployment, the turbidity sensor wiper malfunctioned due to the wiper motor shaft sliding down, all turbidity points have been rejected (-3, SWM). |
| During the **02070611** deployment, all pH readings were rejected since the pre-calibration slope was out of range (-3, SQR) |
| For the **02080211** deployment, field checks showed SpCond and salinity were different (from YSI 556 and other datasondes) for the deployed datasonde both during deployment and retrieval, and sharp discontinuities can be seen in the data that correspond to deployment and retrieval times. Additionally, the sensor was reading 43.18 mS/cm in 50 mS/cm solution during the post-calibration check. For this reason, all SpCond and salinity data during this deployment has been rejected (-3, SSM, CCU) along with all dependent parameters (-3, CSM). |
| For the **02090611** deployment, A period of very high and out of range turbidity that ends abruptly with the new deployment on 09/29/11 12:00 indicates possible optical interference with the turbidity sensor. Due to this all turbidity readings from 09/12/11 to 09/29/11 12:00 have been marked suspect (1, STS). All pH readings between 09/07/2011 09/29/11 have been rejected since pH slope was out of spec (-3, SQR) |

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| For the **02092611** deployment, the power supply started to fail on 10/16/11 7:00 and resulted in a complete power failure  by 17:00, all missing data points have been flagged (-2, GPF). Additionally, a field check on 09/29/11 showed the newly deployed datasonde SpCond/salinities readings were substantially differently from the YSI 556 and the datasonde being retrieved, however due to the power failure a field comparison could not be performed during datasonde retrieval. At post-calibration the sensor was reading 51.41 mS/cm in 50 mS/cm solution. For these reasons all SpCond/salinity data for this deployment have been marked suspect (1, SSM) along with all dependent parameters (1, CSM). A period of high turbidity readings (together with out-of-range turbidity values) just prior to battery failure has been marked suspect (1, SBO). Turbidity wiper may have been failing before batteries completely died. |
| For the **02103111** deployment, the turbidity wiper was not parked correctly upon datasonde retrieval and was not turning  during post calibration. It is apparent from the data that the wiper was parking over the optics. All turbidity data from this deployment has been rejected (-3, SWM). |
| For the **02120511** deployment, the Optical DO sensors were calibrated to a percent saturation value that incorporates local  barometric pressure (measured on site with Fisher Scientific TM Traceable TM digital barometer) instead of a standard pressure of 760 mm Hg. A large number of crabs, shrimp and snails were present on the datasonde retrieved 01/05/12 which may have contributed to anomalous turbidity spikes |

**EB03 (Fish Trap Bay)**

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| For the **03010411** deployment, all readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (-3, GOW). A catastrophic temperature sensor failure occurred on 01/13/11 10:15. All readings have been rejected for the rest of the deployment. |
| For the **03020611** deployment, all readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (-3, GOW). Additionally, all pH readings were rejected after 02/26/11 due to a broken pH bulb (-3, SSM). |
| For the **03030111** deployment, all readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (-3, GOW). A period of anomalous turbidity started near the end of the deployment. Beginning around 3/28/11, turbidity slowly increased erratically over the next week until the next deployment where is abruptly stopped and went back to normal. This type of slow increase is consistently with fouling growing near the optics of the turbidity sensor. Retrieval notes indicate fouling was present on the datasonde, but not where it occurred. For this reason, turbidity readings after 03/28/11 have been marked suspect due to biofouling (1, CBF). |
| For the **03040511** deployment all readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (-3, GOW). |
| For the **03050211** deployment all readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (-3, GOW). All pH readings after 05/12/11 21:15 were rejected due to a broken pH bulb (-3, STF) |
| For the **03060611** deployment, All readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (-3, GOW). All pH readings after 06/26/11 19:15 have been rejected due to a broken bulb. |
| During the **03070611** deployment, SpCond/Salinity readings recorded were markedly different than bracketing deployments as seen graphically and during both field checks. During post-calibration, the sensor was reading 59.22 mS/cm on 50 mS/cm calibration solution. All SpCond/salinity readings have been rejected (-3, SIC) due to possible contaminated standard/incorrect calibration, as well as all dependent parameters (-3, CSM). |
| During the **03080211** deployment, no other notes |
| During the **03090611** deployment, crabs were found on the datasonde upon retrieval which may have contributed to anomalous turbidity spikes. |
| During the **03092611** deployment, All readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (-3, GOW). All pH readings after 10/11/11 09:15 (Row ID 999) have been rejected due to a broken bulb (-3, SSM). A large stone crab found in crab guard on datatsonde retrieval, turbidity brush not parked @180 which may have contributed to anomalous turbidity spikes. |

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| During the **03103111** deployment, the turbidity sensor was jumping between 97-109 during post-calibration in 0 NTU  standard (distilled water). While the are no gross irregularities evident in the turbidity readings for the deployment, all turbidity has been marked suspect due (1, SPC) due to sensor not passing post calibration. Additionally, toadfish and stone crab were found in crab guard on datasonde retrieval which may have contributed to anomalous turbidity readings. |
| During the **03120511** deployment, the Optical DO sensors were calibrated to a percent saturation value that incorporates  local barometric pressure (measured on site with Fisher Scientific TM Traceable TM digital barometer) instead of a standard pressure of 760 mm Hg. When datasonde was retrieved there was a very large stone crab in the crab guard and the turbidity wiper was missing. All pH data after 12/15/11 7:15 was rejected (-3, SSM) due to a broken bulb and all turbidity readings have been marked suspect (1, SWM) due to wiper loss. All readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (-3, GOW). |

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