**Charlotte Harbor Aquatic Preserves (CHAP)   
Water Quality Metadata Report**

January - December 2019  
Latest Update: 09/08/2021

**I. Data Set and Research Descriptors**

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

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1. **Entry verification:**

Each 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. Pre- and post-deployment data are removed from the files at this time. The monthly files are then prepared, processed, and reviewed to determine outliers, compare deployment readings from both datasondes as well as the tertiary in field reading. During primary QA/QC, data are flagged and coded if they are missing, out of sensor range, anomalous, or did not pass post calibration. This is determined through a post-deployment calibration conducted in the lab after the datasonde is pulled from the water. The parameters include two-point pH (7.0 and 10.0), pH MV range, turbidity (0 NTU), specific conductivity (50 mS/cm), DO%, DO mg/L, temperature C, NIST temperature C, depth, and battery volts. The post calibration values for each parameter is recorded as either passing or failing, using the DEP FTE 1100, 1200, 1500 (pH; +/- 0.2, DO+/- 0.3mg/L based off temperature, Sp. Conductivity 5% of standard). For more information about the Florida DEP Standard Operating Procedures, please visit <https://floridadep.gov/dear/quality-assurance/content/dep-sops>.

Anomalous data are evaluated to determine if the suspect data should be rejected. Data are flagged if the values are: 1) not within the DEP post calibration (verification) criteria or 2) outside the range of measurements established for the sensors (see Table 1). For example, negative depth values and turbidity values greater than 1,000 NTU are rejected. 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 rejected if the anomalies are attributed to sensor malfunction. In addition to observations of any physical damage (e.g., cracked pH bulb), 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.

Rejected data are flagged with a comment and saved in an Excel tab entitled “monthly data.” Once the initial QA/QC has been performed, a copy of the monthly data is then created as a separate tab and entitled “QA’d data.” For this dataset, the flagged data is replaced with a period (.) so that it reflects the true water quality conditions for that month and the min/max and average values (such as turbidity) will be within “normal” range. For data analyses, the QA’d dataset is used. The original data is *not* deleted and can be referred back to under the “monthly data” tab. The file is saved on the server under \\fldep1\FCO\CHAP\Data Sonde\Data\(Site Name)\monthly data. Data management is currently performed by Mary McMurray.

Beginning in July 2018, data underwent a two-step (primary and secondary) Quality Assurance/Quality Control (QA/QC) procedure as outlined in the NERRS CDMO Data Management Manual Version 6.6 (<http://cdmo.baruch.sc.edu/request-manuals/>).

The primary QA/QC process was performed by the CDMO and involved inserting flag columns into the data files for each water quality parameter, creating a flag record column, and creating an automated process that applied standardized flags to data if the values were outside sensor specifications as determined by YSI, the instrument manufacturer. Yearly data files that completed the primary QA/QC process were returned to RCP staff for secondary QA/QC. Data were evaluated, and standardized flags and 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. Katie Petrinec was responsible for these tasks. For more information on QA/QC flags and codes, see Sections 11 and 12.

1. **Research objectives:**

In 2004, the Florida Department of Environmental Protection’s (FDEP) Office of Resilience and Coastal Protection (formerly Office of Coastal and Aquatic Managed Areas (CAMA)) began a pilot program using extended deployed water quality monitoring devices, or datasondes, across several of its field offices. In September 2005, two datasonde monitoring sites were set up in Matlacha Pass Aquatic Preserve, one in the north (MP1A) and one in the south (MP2B). A third site (MP3C) was added near the Matlacha bridge in 2009.

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.

These sites in Matlacha Pass were selected to monitor the extent of the tidal node in Matlacha Pass Aquatic Preserve in addition to the tidal influence of the Caloosahatchee River to the south, Charlotte Harbor to the north and runoff from adjacent Cape Coral and Matlacha. The tidal division occurs at State Road 78, the Matlacha bridge, with waters to the north more affected by Charlotte Harbor waters, and southern Matlacha Pass influenced by the Caloosahatchee River.

Continual monitoring of water quality in Matlacha Pass provides important data and complements other monthly water quality monitoring programs including CHEVWQMN and CCHMN. Specifically, the data from these stations provides a baseline of water quality measurements for identifying, monitoring, and comparing differences in the parameters over time. The data also aids in the interpretation of changes observed in indictor organisms, habitats such as seagrass, and for making comparisons to other geographical areas. The data may also assist with the understanding of anthropogenic changes within the bay.

1. **Research Methods:**

Beginning September 2005, two water quality stations, MP1A in the north end of Matlacha Pass and MP2B in the southern portion, were established. A third water quality station, MP3C was added March 2009 in the middle of Matlacha Pass, just south of the drawbridge. The dataset from these three monitoring stations have been essentially uninterrupted since the first day of deployment.

MP1A are YSI 6600 Extended Deployment System (EDS) with three that are the V2-2 model. MP2B and MP3C used the same model up until April 2018 and October 2018 when the stations transitioned to using the YSI EXOз 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 March 2012 deployment, the depth was calibrated using a barometric pressure value of 760 mmHg for each calibration, actual atmospheric pressure was not calculated. For the March 13, 2012 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 100% saturated air using a YSI calibrating cup (per manufacturer specs). 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 CHAP installed and permitted pilings at sites MP1A and MP2B. Site MP3C is installed on a Lee County owned and maintained manatee sign and piling. 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. Holes three inches in diameter are drilled circumferentially around the lower third of the pipes to ensure adequate water flow around the probes. The interior of the PVC housing pipes are painted with anti-fouling paint. 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 bottom of the pipes are open and positioned 0.5 meters above the bottom.

The sondes are further protected from crabs and other live organisms by using C-spray on the body and plastic mesh screening on the sonde guard. 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 for a 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 ProPlus since Feb. 2008) which serves as a “spot check” at the time of retrieval. The parameters recorded are temperature, specific conductivity, conductivity, salinity, dissolved oxygen (mg/L and % saturation), and depth. Secchi readings are also recorded and monthly bottom (0.5m off the bottom) grab samples are taken at each site for red tide, chlorophyll a, total nitrogen and total phosphorous. These water samples, except for red tide, are sent to the DEP Lab in Tallahassee for analyses and entered into a CHAP Access database. The red tide bottles are sent to the FWC’s Florida Marine Research Institute for analyses.

1. **Site location and character:**

The Charlotte Harbor Aquatic Preserves encompass five aquatic preserves and protect more than 180,000 acres, set aside so that their aesthetic, biologic and scientific values endure for the enjoyment of future generations. The datasondes are currently deployed at three stations in Matlacha Pass Aquatic Preserve. Matlacha Pass is a narrow linear estuary, roughly 21 km long and at its widest point 3.2 km. Depths range from 2 ft nearshore to almost 8 ft mid- channel at MHW in the northern part of the pass.

**MP1A (northern)**

Lat/Long (Decimal Degrees): 26.6678, -82.0946

The MP1A datasonde station is the most northern of the three datasonde sites, located north of channel marker #76. The station is located on a CHAP permitting piling and sign. The monitoring site is influenced by Charlotte Harbor and is approximately 0.75 km SW of Bird Rookery Keys and 1.1 km east of Pine Island. At the sampling site, the depth is approximately 1.3m at mid tide. Tides at MP1A are mixed semidiurnal and range from 0.072m (0.23ft) to 0.481m (1.57ft) according to the NOAA Tides and Currents website; nearest station: Bokeelia, Charlotte Harbor FL Datum, Station ID 8725541, 1983-2001 Epoch.

Historical range of salinities at this site are 5 ppt to 34 ppt and fluctuate seasonally and daily with tides, wind, rainfall, and runoff. The substrate is predominantly fine sand and there is seagrass (*Halodule wrightii* and *Thalassia testudinum*) adjacent. To the west of the site, a significant amount of the land is protected either through the state, Lee County, Calusa Land Trust or USFWS. Mangrove islands predominately, red and black mangroves, are found .40 km to the east and are owned by USFWS or the state. There is open water to the north (Charlotte Harbor) and Matlacha Pass continues to the south.

**MP2B (southern)**

Lat/Long (Decimal Degrees): 26.5627, -82.0704

The MP2B datasonde station is the southern most of the three datasonde sites, located west of channel marker #29 and just south of the powerlines. The station is located on a CHAP permitting piling and sign. The monitoring site is influenced primarily by waters from San Carlos Bay and the Caloosahatchee River and is approximately 0.8 km east of Pine Island’s mangrove shoreline of and 1.0 km west of mangrove shoreline on the Cape Coral side. At the sampling site, the depth is approximately 2.0m at mid tide. Tides at MP2B are mixed semidiurnal and range from 0.145m (0.47ft) MLW to 0.614m (2.01ft) MHW according to the NOAA Tides and Currents website; nearest station: Punta Rassa, San Carlos Bay FL Datum, Station ID 8725391, 1983-2001 Epoch.

Historical range of salinities at this site are 2 ppt to 36 ppt and fluctuate seasonally and daily with tides, wind, rainfall, and freshwater discharge. The substrate is predominantly fine sand and there is seagrass (*Halodule wrightii*) adjacent. To the east of the site, a significant amount of the land is protected wetlands, owned by the state or the Calusa Land Trust, buffering Cape Coral development to the east. The undeveloped mangroves shoreline to the west are owned by Calusa Land Trust and several privately-owned parcels. Matlacha Pass continues to the north and the south, and the aquatic preserve boundary ends just south of this site location.

**MP3C (middle of Matlacha Pass)**

Lat/Long (Decimal Degrees): 26.6288, -82.0674

The MP3C datasonde station is located in the middle portion of Matlacha Pass, just south of the drawbridge on the west side of the main channel, and east of Porpoise Point dock. The station is located on a Lee County owned manatee sign. The monitoring site is influenced by a conflux of waters from nearby Matlacha, Cape Coral (from the Spreader Waterway canal), Charlotte Harbor to the north and San Carlos Bay and the Caloosahatchee River to the south. The Matlacha community is approximately 0.15km to the west, and preserved lands, owned by the state, 0.65km to the east. At the sampling site, the depth is approximately 2.0m at mid tide. Tides at MP2B are mixed semidiurnal and range approximately 0.37m (1.2ft). The tidal node for Matlacha Pass occurs at this location, as tides typically go out to the north *and* the south, and tides can come in from both directions depending on Caloosahatchee River flow rates. There is no NOAA tide station nearby, and tides are calculated using both the Punta Rassa, San Carlos Bay FL Datum, Station ID 8725391, and the Bokeelia, Charlotte Harbor FL Datum, Station ID 8725541.

Historical range of salinities at this site are 2 ppt to 36 ppt and fluctuate seasonally and daily with tides, wind, rainfall, and freshwater runoff and discharge. The substrate is more of a loamy mucky sediment with oyster clumps. To the east of the site, a significant amount of the land is protected wetlands, owned by the state, buffering Cape Coral development to the east. The developed island of Matlacha is directly north and west. Matlacha Pass continues to the north and the south of this station.

**Station description:**

**Charlotte Harbor Aquatic Preserves** manages three continuous datasonde stations in Matlacha Pass Aquatic Preserve. MP1A in the north and MP2B in the south were set up in 2005, and MP3C just south of the Matlacha bridge was set up in 2009.

**Station timeline:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Station Code** | **Station Name** | **Location** | **Active Dates** | **Reason Decommissioned** | **Notes** |
| MP1A | MP1A | 26.667800°N,  -82.094600°W | 10/2005 - Present | N/A | N/A |
| MP2B | MP2B | 26.562700°N, -82.070400°W | 9/2005 - Present | N/A | N/A |
| MP3C | MP3C | 26.628800°N,  -82.067400°W | 3/2009 - Present | N/A | N/A |

1. **Data collection period:**

YSI 6600 EDS datasondes have been operating continuously at the Matlacha Pass 1A since October 2005, at Matlacha Pass 2B since September 2005, and at the Matlacha Pass 3C monitoring station since March 2009.

Matlacha Pass 3C transitioned to using YSI EXOз datasondes in April 2018 and Matlacha Pass 2B in October 2018.

The deployment and retrieval date/times for the 2019 sampling season are listed below.

|  |  |
| --- | --- |
| MP1A | |
| Deployment  Date/Time | **Retrieval**  **Date/Time** |
| 12/11/2018, 11:15 | 01/15/2019, 11:30 |
| 01/15/2019, 11:30 | 02/12/2019, 10:45 |
| 02/12/2019, 10:45 | 03/12/2019, 10:00 |
| 03/12/2019, 10:00 | 04/09/2019, 10:00 |
| 04/09/2019, 10:00 | 05/13/2019, 10:15 |
| 05/13/2019, 10:15 | 06/11/2019, 10:30 |
| 06/11/2019, 10:45 | 07/16/2019, 10:30 |
| 07/16/2019, 10:30 | 08/13/2019, 10:30 |
| 08/12/2019, 10:30 | 09/10/2019, 10:15 |
| 09/10/2019, 10:15 | 10/16/2019, 11:30 |
| 10/16/2019, 11:30 | 11/13/2019, 10:45 |
| 11/13/2019, 10:45 | 12/10/2019, 10:15 |
| 12/10/2019, 10:30 | 01/14/2020, 11:30 |

|  |  |
| --- | --- |
| MP2B | |
| Deployment  Date/Time | **Retrieval**  **Date/Time** |
| 12/11/2018, 10:30 | 01/15/2019, 10:30 |
| 01/15/2019, 10:45 | 02/12/2019, 10:15 |
| 02/12/2019, 10:15 | 03/12/2019, 09:15 |
| 03/12/2019, 09:15 | 04/09/2019, 09:30 |
| 04/09/2019, 09:30 | 05/13/2019, 09:30 |
| 05/13/2019, 09:45 | 06/11/2019, 09:30 |
| 06/11/2019, 10:45 | 07/16/2019, 10:30 |
| 07/16/2019, 09:30 | 08/13/2019, 09:45 |
| 08/13/2019, 10:00 | 09/10/2019, 09:30 |
| 09/10/2019, 09:30 | 10/16/2019, 10:45 |
| 10/16/2019, 10:45 | 11/13/2019, 10:15 |
| 11/13/2019, 10:15 | 12/10/2019, 11:00 |
| 12/10/2019, 11:00 | 01/14/2020, 10:45 |

|  |  |
| --- | --- |
| MP3C | |
| Deployment  Date/Time | **Retrieval**  **Date/Time** |
| 12/12/2018, 14:45 | 01/15/2019, 11:45 |
| 01/15/2019, 12:00 | 02/12/2019, 11:15 |
| 02/12/2019, 11:15 | 03/12/2019, 10:15 |
| 03/12/2019, 10:30 | 04/09/2019, 10:30 |
| 04/11/2019, 10:30 | 05/13/2019, 10:45 |
| 05/13/2019, 10:45 | 06/11/2019, 11:15 |
| 06/11/2019, 11:15 | 07/16/2019, 11:00 |
| 07/16/2019, 11:00 | 08/13/2019, 11:00 |
| 08/13/2019, 11:00 | 09/10/2019, 10:30 |
| 09/10/2019, 10:30 | 10/16/2019, 12:00 |
| 10/16/2019, 12:00 | 11/13/2019, 12:00 |
| 11/13/2019, 11:15 | 12/10/2019, 11:30 |
| 12/10/2019, 11:30 | 01/14/2020, 12:00 |

**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. 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, Charlotte Harbor Aquatic Preserves will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons.

1. **Associated researchers and projects:**

Other monitoring projects occurring in Matlacha Pass Aquatic Preserve include:

* CHAP’s monthly volunteer water quality monitoring program (CHEVWQMN), 4 sites in Matlacha Pass
* Coastal Charlotte Harbor Monitoring Program (CCHMN) random water quality sampling, conducted by Lee County in Matlacha Pass
* Harmful Algal Bloom sampling- analyzed by FWC-FWRI and sampled by CHAP staff and others (DACs)
* CHAP’s annual seagrass transect monitoring program- 5 sites within Matlacha Pass. DEAR also monitors two sites on a quarterly basis.
* Seagrass mapping by SFWMD
* Oyster restoration by SCCF in the southern end of Matlacha Pass
* FWC’s Fisheries Independent Monitoring
* FWC-FWRI Manatee Population Aerial Surveys
* CHAP’s monthly Wading and Diving Bird surveys in coordination with Ding Darling NWR

**II. Physical Structure Descriptors**

1. **Sensor specifications**:

### Table 1. YSI 6600 EDS data sonde

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Thermistor

Model #: 6560

Range: -5 to 45 °C

Accuracy: +/-0.15 °C

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 dependent)

Parameter: Salinity

Units: parts per thousand (ppt)

Sensor Type: Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: +/- 1.0% of reading or 0.1 ppt, whichever is greater

Resolution: 0.01 ppt

Parameter: Dissolved Oxygen % saturation

Units: percent air 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 (specify whether EDS probe or not)

Units: units

Sensor Type: Glass combination electrode

Model #: 6561

Range: 0 to 14 units

Accuracy: +/- 0.2 units

Resolution: 0.01 units

Parameter: Turbidity

Units: nephelometric turbidity units (NTU)

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

Model #: 6136

Range: 0 to 1000 NTU

Accuracy: +/- 5 % reading or 2 NTU (whichever is greater)

Resolution: 0.1 NTU

**Table 2. YSI EXO Sonde:**

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Wiped probe; Thermistor

Model#: 599827

Range: -5 to 50 C

Accuracy: ±0.2 C

Resolution: 0.001 C

Parameter: Conductivity

Units: milli-Siemens per cm (mS/cm)

Sensor Type: Wiped probe; 4-electrode cell with autoranging

Model#: 599827

Range: 0 to 100 mS/cm

Accuracy: ±1% of the reading or 0.002 mS/cm, whichever is greater

Resolution: 0.0001 to 0.01 mS/cm (range dependent)

Parameter: Salinity

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

Model#: 599827

Sensor Type: Wiped probe; Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: ±2% of the reading or 0.2 ppt, whichever is greater

Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 5% or reading

Resolution: 0.1% air saturation

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

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 50 mg/L

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

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

Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 33 ft (10 m)

Accuracy: +/- 0.013 ft (0.004 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH

Units: pH units

Sensor Type: Glass combination electrode

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

Range: 0 to 14 units

Accuracy: +/- 0.1 units within +/- 10° of calibration temperature, +/- 0.2 units for entire temperature range

Resolution: 0.01 units

Parameter: Turbidity

Units: formazin nephelometric units (FNU)

Sensor Type: Optical, 90 degree scatter

Model#: 599101-01

Range: 0 to 4000 FNU

Accuracy: 0 to 999 FNU: 0.3 FNU or +/-2% of reading (whichever is greater); 1000 to 4000 FNU +/-5% of reading

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

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 Aquatic Preserve office regarding site and seasonal variation in fouling of the DO sensor.

Depth Qualifier: The water quality monitoring program utilizes YSI data sondes that can be equipped with either depth or water level sensors. Both sensors measure water depth, but by convention, level sensors refer to atmospherically vented measurements and depth refers to non-vented measurements. Standard calibration protocols for the non-vented sensor use the atmosphere pressure at the time of calibration. Therefore, changes in atmospheric pressure between calibrations appear as changes in water depth. The error is equal to approximately 1.03 cm for every 1millibar change in atmospheric pressure. This error is eliminated for level sensors because they are vented to the atmosphere throughout the deployment time interval. If proper atmospheric pressure data is available, non-vented sensor depth measurements can be corrected for deployments between calibrations. Readings for both vented and non-vented sensors are automatically compensated for water density changes due to variations in temperature and salinity. The Principal Investigator should be contacted in order to obtain information regarding atmospheric pressure data availability. The YSI 6600 data sondes used at all sites in 2018 were non-vented models. The YSI EXOз data sondes are vented. These were used at MP3C beginning in April and MP2B beginning in October.

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.

1. **Coded variable definitions:**

**Site definitions:**

|  |  |  |
| --- | --- | --- |
| **Sampling Station:** | **Sampling Site Code:** | **Station Code:** |
| MP1A | MP1A | MP1A |
| MP2B | MP2B | MP2B |
| MP3C | MP3C | MP3C |

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 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

1. **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

1. **Post deployment information:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 1. Post-deployment readings of all sondes deployed at the MP1A site during 2019.** | | | | | | | | | |
| **Deployment Date** |  | **Temp (°C)** | **SpCond (mS/cm)** | **ROX DO %** | **ROX DO mg/L** | **pH** | **pH** | **Turbidity (NTU)** | **Depth (m)** |
|  | **Std.** | **N/A** | **50.00** | **100.0** | **N/A** | **7.00** | **10.00** | **0.0** | **N/A** |
| 12/11/2018 |  | N/A\* | N/A\* | N/A | N/A\* | N/A\* | N/A\* | N/A\* | N/A\* |
| 01/15/2019 |  | 23.40 | 49.77 | 102.6 | 8.7 | 7.24 | 10.20 | 0.6 | -0.026 |
| 02/12/2019 |  | 23.73 | 49.36 | 102.3 | 8.6 | 7.23 | 10.18 | 2.1 | -0.016 |
| 03/12/2019 |  | 24.12 | 49.50 | 100.4 | 8.4 | 7.27 | 10.26 | 0.2 | -0.117 |
| 04/09/2019 |  | 25.46 | 49.71 | 103.5 | 8.4 | 7.24 | 10.19 | 0.8 | -0.036 |
| 05/13/2019 |  | 24.63 | 53.44 | 100.3 | 8.3 | 7.15 | 10.00 | 0.5 | 0.012 |
| 06/11/2019 |  | 27.97 | 49.36 | 99.2 | 7.7 | 6.86 | 9.59 | 36.7 | 0.018 |
| 07/16/2019 |  | 26.89 | 49.86 | 100.1 | 7.9 | 7.07 | 10.06 | 0.1 | -0.041 |
| 08/13/2019 |  | 26.33 | 49.99 | 99.1 | 8.0 | 6.89 | 9.75 | 1.5 | 0.026 |
| 09/10/2019 |  | 25.15 | 51.12 | 100.7 | 8.3 | 7.06 | 10.00 | 0.8 | -0.065 |
| 10/16/2019 |  | 21.31 | 49.10 | 102.5 | 9.0 | 7.08 | 10.03 | -1.1 | -0.014 |
| 11/13/2019 |  | 24.70 | 50.11 | 103.1 | 8.5 | 7.18 | 10.12 | 0.0 | 0.027 |
| 12/10/2019 |  | 22.85 | 50.00 | 101.7 | 8.7 | 7.03 | 9.90 | -2.0 | 0.032 |

\* Probe malfunction and/or data not collected

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 1. Post-deployment readings of all sondes deployed at the MP2B site during 2019.** | | | | | | | | | |
| **Deployment Date** |  | **Temp (°C)** | **SpCond (mS/cm)** | **ROX DO %** | **ROX DO mg/L** | **pH** | **pH** | **Turbidity (NTU)** | **Depth (m)** |
|  | **Std.** | **N/A** | **50.00** | **100.0** | **N/A** | **7.00** | **10.00** | **0.0** | **N/A** |
| 12/11/2018 |  | 19.17 | 49.61 | 101.2 | 9.39 | 7.10 | 10.11 | 0.22 | 0.041 |
| 01/15/2019 |  | 24.10 | 49.51 | 107.3 | 9.03 | 7.07 | 10.10 | 0.51 | -0.014 |
| 02/11/2019 |  | 23.40 | 50.01 | 101.6 | 8.65 | 7.10 | 10.05 | 0.45 | N/A\* |
| 03/12/2019 |  | 24.40 | 49.60 | 99.8 | 8.34 | 6.92 | 9.90 | 0.26 | -0.069 |
| 04/09/2019 |  | 26.02 | 49.60 | 100.3 | 8.13 | 7.25 | 10.26 | 0.59 | 0.009 |
| 05/13/2019 |  | 24.26 | 49.34 | 99.3 | 8.32 | 7.10 | 10.08 | 0.16 | 0.07 |
| 06/11/2019 |  | 28.94 | 45.5 | 99.9 | 7.80 | 7.10 | 10.01 | 0.49 | 0.018 |
| 07/16/2019 |  | 23.72 | 49.33 | 99.9 | 8.46 | 7.27 | 10.41 | 0.66 | -0.038 |
| 08/14/2019 |  | 23.50 | 50.05 | 102.0 | 8.67 | 7.18 | 10.21 | 0.84 | 0.04 |
| 09/10/2019 |  | 25.30 | 50.19 | 100.4 | 8.26 | 7.15 | 10.10 | 1.80 | -0.055 |
| 10/16/2019 |  | 22.40 | 50.17 | 102.1 | 8.85 | 7.09 | 10.09 | 0.09 | 0.010 |
| 11/13/2019 |  | 25.0 | 49.76 | 100.0 | 8.25 | 7.14 | 10.14 | 0.01 | 0.031 |
| 12/11/2019 |  | 24.15 | 49.49 | 102.4 | 8.61 | 7.19 | 10.12 | 0.07 | 0.39 |

\* Probe malfunction and/or data not collected

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 1. Post-deployment readings of all sondes deployed at the MP3C site during 2019.** | | | | | | | | | |
| **Deployment Date** |  | **Temp (°C)** | **SpCond (mS/cm)** | **ROX DO %** | **ROX DO mg/L** | **pH** | **pH** | **Turbidity (NTU)** | **Depth (m)** |
|  | **Std.** | **N/A** | **50.00** | **100.0** | **N/A** | **7.00** | **10.00** | **0.0** | **N/A** |
| 12/12/2018 |  | 18.96 | 50.45 | 101.1 | 9.37 | 7.16 | 10.14 | 0.35 | 0.054 |
| 01/15/2019 |  | 22.90 | 49.62 | 99.4 | 8.55 | 6.85 | 9.82 | N/A\* | 0.006 |
| 02/12/2019 |  | 24.27 | 49.85 | 100.8 | 8.45 | 7.09 | 10.16 | 0.46 | 0.048 |
| 03/12/2019 |  | 24.57 | 49.50 | 100.0 | 8.33 | 7.22 | 10.21 | N/A\* | -0.071 |
| 04/09/2019 |  | 26.20 | 49.73 | 100.9 | 8.16 | 7.17 | 10.11 | 0.41 | 0.02 |
| 05/13/2019 |  | 24.57 | 49.63 | 100.9 | 8.41 | 7.16 | 10.20 | N/A\* | 0.09 |
| 06/11/2019 |  | 27.45 | 48.80 | 100.7 | 7.96 | 7.18 | 10.11 | 0.66 | 0.023 |
| 07/18/2019 |  | 22.84 | 48.81 | 100.1 | 8.64 | N/A\* | N/A\* | 0.48 | -0.041 |
| 08/13/2019 |  | 29.58 | 51.70 | 100.3 | 7.64 | 7.08 | 10.12 | 0.80 | 0.039 |
| 09/10/2019 |  | 25.13 | 50.70 | 100.4 | 8.28 | 7.22 | 10.27 | 0.25 | -0.048 |
| 10/16/2019 |  | 22.30 | 49.70 | 100.0 | 8.69 | 7.18 | 10.12 | -0.10 | -0.013 |
| 11/13/2019 |  | 24.30 | 49.90 | 100.8 | 8.44 | 7.18 | 10.17 | 0.16 | 0.049 |
| 12/10/2019 |  | 25.00 | 48.70 | 100.9 | 8.33 | 7.09 | 10.08 | 0.04 | 0.00 |

\* Probe malfunction and/or data not collected

1. **Other remarks/notes:**

**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.

**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.

**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) were flagged from the monthly records. Readings greater than 1000 NTU for 6600 series sondes are considered out of range and are rejected. They have been left in the monthly tab database to provide users with a complete dataset and to allow true visual representation of the data in graphs.

**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 or with organisms such as crabs blocking the sensor. Data users should exercise caution when interpreting turbidity data that fall within this range.

**Acknowledgement:** The data included with this document were collected by the staff of the Florida Department of Environmental Protection. Any products derived from these data should clearly acknowledge this source (please use the attached logos below). This recognition is important for ensuring that these long-term monitoring programs continue to receive the necessary political and financial support.

