**Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR)**

**Water Quality Metadata Report**

**January – December 2018**

**Latest Update:** 07/02/2019

**I. Data Set and Research Descriptors**

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**2) Entry verification:**

Data from each deployment are uploaded from the YSI data sonde to a Personal Computer (IBM compatible). Files are exported from EcoWatch in a comma-delimited format (.CDF) or KOR Software in an Excel file (.XLS) and uploaded to the Centralized Data Management Office (CDMO) where they undergo automated primary QAQC; automated depth/level corrections for changes in Barometric Pressure (cDepth or cLevel parameters); and become part of the CDMO’s online provisional database. All pre- and post-deployment data are removed from the file prior to upload. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve for secondary QAQC where it is opened in Microsoft Excel and processed using the CDMO’s NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, remove any overlapping deployment data, append files, and export the resulting data file to the CDMO. Upload after secondary QAQC results in ingestion into the database as provisional plus data, recalculation of cDepth or cLevel parameters, and finally tertiary QAQC by the CDMO and assimilation into the CDMO’s authoritative online database. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is generally accepted as being the most accurate. For more information on QAQC flags and codes, see Sections 11 and 12.

Anomalous data are evaluated to determine whether to flag or reject the suspect values. Data outside the "normal" range of water quality parameters for each site are investigated for validity based on weather data, field observations, QC checks, graphs and instrument diagnostics. Data are rejected if the anomalies are attributed to sensor malfunction and/or excessive fouling. In addition to observations of any physical damage (e.g., compromised DO probe membrane), sensor malfunctions are detected if the reading of the probe is outside the range established for the sensor or the sensor will not post calibrate. All raw “.dat” and “.bin” files are also uploaded to the CDMO for archiving. Shannon Dunnigan and Katie Petrinec are responsible for these tasks.

**3) Research objectives:**

The System-wide Monitoring Program (SWMP) water quality initiative began within the GTMNERR in 2000. There are presently four permanent stations at which YSI data sondes have been deployed for continuously monitoring a suite of selected abiotic parameters at 15 min intervals. Nutrient analyses are also performed on water samples collected monthly at each of these sites. The positions of these stations allow for comparisons between relatively pristine and more urbanized drainage basins, as well as higher versus lower salinity regions of the estuary (see “Station Descriptions” under “Site Location and Character”). The objective of this effort is to quantify the spatial/temporal variability in water quality within the Reserve. Studies of factors that influence and are influenced by changes in water quality complement this foundational dataset (see Section 8, Associated researchers and projects).

**4) Research methods:**

YSI 6600 EDS, V2 or EXO2 data sondes have been operating continuously at the Pine Island and Fort Matanzas monitoring stations since December 2000 and at the San Sebastian and Pellicer Creek monitoring stations since February 2002. At each site the data sonde is contained within a 10 cm (inside diameter) PVC housing pipe mounted vertically onto a piling. A steel pin at the bottom of the pipe holds the sonde at a position within 1 meter from the bottom. To facilitate water flow across the sensors, the submerged portion of the pipe contains multiple 2-cm-diameter holes. Hole density is greatest near the base where the sonde sensors are located. As of April 2, 2003, at 16:30:00, deployment of the sonde at the Pine Island station was reconfigured using a PVC housing that does not have drilled holes or a steel pin at the bottom. The sonde is now suspended by a stainless-steel chain (attached to the cap of the PVC pipe) such that the sensor portion of the sonde extends beyond the end of the PVC housing at a position within 1 meter from the bottom. As of February 7, 2014, 11:00:00, deployment of the sonde at the San Sebastian site was reconfigured using a PVC housing that has drilled holes in the tube but does not have a steel pin at the bottom. The sonde is now suspended by a rope attached to the cap of the PVC pipe such that the sensor portion of the sonde extends beyond the end of the PVC housing at a position within 1 meter from the bottom.

As of January 21, 2004, all sondes were upgraded to the 6600 EDS models. These new 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. In 2013, GTMNERR began using EXO2 data sondes at Pine Island, San Sebastian, and Fort Matanzas monitoring stations. As of September 10, 2015, all sondes were upgraded to the EXO2 models. These EXO2 models come with wet-mateable connectors that resist corrosion (a problem with previous models). Additional anti-fouling improvements are titanium bulkheads as well as a single, central wiper apparatus that regularly wipes all sensors. These sondes also have lower power consumption which allows for longer deployments.

Data sonde exchanges at all sites are made at approximately two-week intervals and usually take less than 5 minutes to complete the exchange (thus completed between sampling intervals and no data is lost). At the end of a sampling period, data sondes are returned to the laboratory where post-deployment readings and reconditioning take place in accordance with the methods outlined in the YSI Operating and Service Manual as well as the NERRS EXO Standard Operating Procedures manual (released in March 2016). The EDS turbidity wiper brush is removed and replaced with a clean wiper to avoid contamination of standards during post-calibration procedures. With the EXO2 sondes, the wiper brush of the central wiper is completely removed prior to post-calibration. After a superficial rinse of the sonde in tap water, post deployment readings are recorded. Temperature and dissolved oxygen (DO) data are recorded from the 2-hour post deployment data; pH (Fisher 7.00, 10.00 and 4.00 buffer solution) and conductivity (Exaxol 50.00 mS/cm standard) are recorded from values collected in standards; and a post-deployment turbidity reading in 0.0 NTU standard (DI water) is recorded after a wiper exchange and a more thorough rinse of the turbidity sensor. The results of these post-deployment readings are used to evaluate the validity of data (See Tables 1-4). Whenever the DO membrane is replaced, it is allowed to equilibrate before the DO sensor is calibrated in air-saturated water for the following deployment.

A Sutron Sat-Link2 transmitter was installed at the Pellicer Creek monitoring station on June 29, 2006 and transmits data to the NOAA GOES satellite, NESDIS ID #3B02C790 (where #3B02C790 is the GOESID for that particular station). The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen-minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. The “real-time” telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO’s authoritative online database. Provisional and authoritative data are available at <http://cdmo.baruch.sc.edu>.

The GOES satellite telemetry for the Pellicer Creek monitoring station did not operate during this period. The telemetry system stopped working on September 10, 2015 because the station instruments were upgraded from YSI 6600 models to YSI EXO2 models. Research staff have upgraded the system to support the new data sondes but are now troubleshooting existing equipment.

**5) Site location and character:**

The GTMNERR (North section [NW and SE corners]: 30.1632º N, 81.3447º W and 29.9698º N, 81.2488º W; South section: 29.8295º N, 81.3294º W and 29.6017º N, 81.1936º W), located in the Florida upper east coast drainage basin, includes over 24,281 ha of publicly owned forested uplands, tidal wetlands, estuarine lagoons and offshore seas. Geographically separated by the greater St. Augustine area, the Reserve is associated with the riverine systems of the Tolomato and Guana River estuaries to the north and the Matanzas River estuary to the south. The Tolomato River Basin is about 18 miles (29 km) in length with a drainage area of approximately 53,802 acres (21,773 hectares); it converges with the Matanzas River and Salt Run from the south before flowing into the Atlantic Ocean at the St. Augustine Inlet. The headwaters of the Guana River originate in the Diego Plains drainage area in Ponte Vedra Beach. This drainage basin encompasses approximately 7,800 acres (3,157 hectares). The Guana River runs parallel to the Tolomato on the seaward side, with the two lagoons joining 7 miles (11.3 km) north of the St. Augustine Inlet. The Matanzas River estuary is approximately 20 miles (32 km) in length and extends 8 miles (13 km) south of the Matanzas Inlet. The Matanzas River sub-basin has a drainage area of approximately 103,615 acres (41,931 hectares) and is bounded to the west by the Atlantic Coastal Ridge, which separates it from the lower St. Johns River basin. Both the St. Augustine and Matanzas Inlets provide oceanic exchange to the system. The Matanzas Inlet, one of the last “natural” inlets on Florida’s east coast, has been unimproved and is suitable only for small watercrafts. The natural hydrology of the Guana Tolomato Matanzas system has been somewhat altered by water control structures, including dikes, inland wells, drainage ditches and a dam across a portion of the Guana River. In addition, the Intracoastal Waterway traverses both the Tolomato and Matanzas estuaries.

The climate of northeast Florida is classified as humid subtropical and is characteristic of the Gulf and Atlantic coastal plain of the southeastern United States. The average annual rainfall is approximately 52 inches (132 cm) per year, with the wet season extending from June through September. Seasonal variation in temperature within the Reserve follows that of rainfall with a summer period of high temperatures between June and September and a cooler period extending from December through March. The annual mean air temperature recorded at the GTMNERR SWMP Weather Station was 21.4°C for 2018.

**Station Descriptions:**

The **Pine Island (PI)** station is at Channel Marker 25 (30° 03.051´N; 81° 22.048´W) in the Tolomato River. This site is located within the Guana River Marsh Aquatic Preserve in the northern section of the GTMNERR. Channel Marker 25 is adjacent to Pine Island near the mouth of Deep Creek, which provides freshwater drainage from silviculture-dominated uplands in the northwestern portion of the Tolomato River basin. The average depth at this site is approximately 3.3 m with a tidal range of about 1.6 m; the bottom type is muddy sand. Salinity ranged from 7.2 to 34.5 psu during 2018. The **Fort Matanzas (FM)** site (in the southern section of the GTMNERR) is located at Channel Marker 75 (29° 44.222´N; 81° 14.757´W) in the Matanzas River. This site is approximately 4 km north of the Matanzas Inlet and near a shoreline on Anastasia Island that is undergoing residential development. The average depth at this site is approximately 2.2 m with a tidal range of about 1.2 m; the bottom type is muddy sand. Salinity ranged from 16.3 to 36.4 psu during 2018. Both the FM and PI stations are situated within Class II Shellfish Harvesting Waters. The **San Sebastian (SS)** station is at Channel Marker 1 (29° 52.131´N; 81° 18.446´W) located at the confluence of the San Sebastian and Matanzas Rivers, approximately 4 km south of the St. Augustine Inlet. The San Sebastian River drains an urbanized watershed in the western portion of St. Augustine; it is characterized by both residential and commercial development including five marinas and a wastewater treatment facility. The average depth at this site is approximately 5.3 m with a tidal range of about 1.5 m; the bottom type is muddy sand. Salinity ranged from 21.4 to 36.5 psu during 2018. The **Pellicer Creek (PC)** station (29° 40.024´N; 81° 15.444´W) is at the end of a recreational dock in Faver-Dykes State Park located within the Pellicer Creek Aquatic Preserve in the southern section of the GTM Reserve. Pellicer Creek is tidal and bordered for much of its length by publicly-owned conservation lands. The average depth at this site is approximately 1.2 m with a tidal range of about 0.5 m; the bottom type is muddy sand. Salinity ranged from 0.0 to 31.5 psu during 2018.

**SWMP Station Timeline:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Station Code | SWMP Status | Station Name | Location | Active Dates | Reason Decommissioned | Notes |
| gtmfmwq | P | Fort Matanzas | 29° 44' 13.20 N, 81° 14' 45.60 W | 01/01/2001 00:00 - current | NA | NA |
| gtmpcwq | P | Pellicer Creek | 29° 40' 01 N,  81° 15' 27 W | 02/01/2002 00:00 - current | NA | NA |
| gtmpiwq | P | Pine Island | 30° 3' 2.88 N, 81° 22' 3.00 W | 01/01/2001 00:00 - current | NA | NA |
| gtmsswq | P | San Sebastian | 29° 52' 08 N,  81° 18' 27 W | 02/01/2002 00:00 - current | NA | NA |

**6) Data collection period:**

YSI 6600 EDS or YSI 6600 EDS V2 data sondes have been operating continuously at the Pine Island and Fort Matanzas monitoring stations since December 2000 and at the San Sebastian and Pellicer Creek monitoring stations since February 2002. In 2013, GTMNERR began using EXO2 data sondes at Pine Island, San Sebastian, and Fort Matanzas monitoring stations and at Pellicer Creek in 2015. Wiped Temperature/Conductivity sensors (Model #599827) were deployed at Pine Island, San Sebastian, and Pellicer Creek stations in 2018; see table below for sensor use information.

The deployment and retrieval date/times for the 2018 sampling season are listed below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Pine Island | | | | | | |
| Deployment  Date/Time | Retrieval  Date/Time | Data sonde Model Number | pH Model Number | ROX DO Model Number | Turb Model Number | Cond Model Number |
| 12/20/2017, 11:00 | 01/11/2018, 14:45 | EXO2  599090-01  (Spoonbill) | 599701 | 599100-01 | 599101-01 | 599870 |
| 01/11/2018, 15:00\* | 02/01/2018, 10:15\* | EXO2 599090-01  (Marlin) | 599701 | 599100-01 | 599101-01 | 599870 |
| 02/01/2018, 10:30 | 02/20/2018, 12:00 | EXO2 599090-01  (Spoonbill) | 599701 | 599100-01 | 599101-01 | 599870 |
| 02/20/2018, 12:15 | 03/07/2018, 11:30 | EXO2 599090-01  (Marlin) | 599701 | 599100-01 | 599101-01 | 599870 |
| 03/07/2018, 11:45 | 03/27/2018, 07:45 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599870 |
| 03/27/2018, 08:00 | 04/12/2018, 09:45 | EXO2 599090-01  (Marlin) | 599701 | 599100-01 | 599101-01 | 599870 |
| 04/12/2018, 10:00 | 05/01/2018, 11:30 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599870 |
| 05/01/2018, 11:45 | 05/15/2018, 10:15 | EXO2 599090-01  (Marlin) | 599702 | 599100-01 | 599101-01 | 599870 |
| 05/15/2018, 10:30 | 05/31/2018, 08:15 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599827 |
| 05/31/2018, 08:30 | 06/12/2018, 08:15 | EXO2 599090-01  (Marlin) | 599702 | 599100-01 | 599101-01 | 599870 |
| 06/12/2018, 08:30 | 07/03/2018, 14:15 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599827 |
| 07/03/2018, 14:30 | 07/24/2018, 08:45 | EXO2 599090-01  (Marlin) | 599702 | 599100-01 | 599101-01 | 599870 |
| 07/24/2018, 09:00 | 08/07/2018, 07:00 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599827 |
| 08/07/2018, 07:15 | 08/23/2018, 10:00 | EXO2 599090-01  (Marlin) | 599702 | 599100-01 | 599101-01 | 599870 |
| 08/23/2018, 10:15 | 09/12/2018, 09:15 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599827 |
| 09/12/2018, 09:30 | 09/25/2018, 09:45 | EXO2 599090-01  (Marlin) | 599702 | 599100-01 | 599101-01 | 599870 |
| 09/25/2018, 10:00 | 10/10/2018, 09:15 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599827 |
| 10/10/2018, 09:30 | 10/23/2018, 10:45 | EXO2 599090-01  (Marlin) | 599701 | 599100-01 | 599101-01 | 599870 |
| 10/23/2018, 11:00 | 11/15/2018, 13:45 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599827 |
| 11/15/2018, 14:00 | 12/04/2018, 08:45 | EXO2 599090-01  (Marlin) | 599701 | 599100-01 | 599101-01 | 599870 |
| 12/04/2018, 09:00 | 12/19/2018, 10:00 | EXO2 599090-01  (Spoonbill) | 599702 | 599100-01 | 599101-01 | 599827 |
| 12/19/2018, 10:15 | 01/08/2019, 11:30 | EXO2 599090-01  (Marlin) | 599701 | 599100-01 | 599101-01 | 599870 |

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| --- | --- | --- | --- | --- | --- | --- |
| **San Sebastian** | | | | | | |
| Deployment  Date/Time | Retrieval  Date/Time | Data sonde Model Number | pH Model Number | ROX DO Model Number | Turb Model Number | Cond Model Number |
| 12/14/2017, 10:15 | 01/11/2018, 16:00 | EXO2 599090-01  (Egret) | 599702 | 599100-01 | 599101-01 | 599870 |
| 03/06/2018, 11:15 | 03/27/2018, 09:00 | EXO2 599090-01 (Heron) | 599701 | 599100-01 | 599101-01 | 599870 |
| 03/27/2018, 09:15 | 04/12/2018, 07:30 | EXO2 599090-01 (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 04/12/2018, 07:45 | 05/01/2018, 09:30 | EXO2 599090-01 (Heron) | 599701 | 599100-01 | 599101-01 | 599870 |
| 05/01/2018, 09:45 | 05/15/2018, 09:30 | EXO2 599090-01 (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 05/15/2018, 09:45 | 05/31/2018, 09:00 | EXO2 599090-01 (Heron) | 599702 | 599100-01 | 599101-01 | 599827 |
| 05/31/2018, 09:15 | 06/12/2018, 10:00 | EXO2 599090-01 (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 06/12/2018, 10:15 | 07/03/2018, 12:15 | EXO2 599090-01 (Heron) | 599702 | 599100-01 | 599101-01 | 599827 |
| 07/03/2018, 12:30 | 07/24/2018, 10:00 | EXO2 599090-01 (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 07/24/2018, 10:15 | 08/07/2018, 07:45 | EXO2 599090-01 (Heron) | 599701 | 599100-01 | 599101-01 | 599827 |
| 08/07/2018, 08:00 | 08/23/2018, 07:15 | EXO2 599090-01 (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 08/23/2018, 07:30 | 09/12/2018, 10:15 | EXO2 599090-01 (Heron) | 599701 | 599100-01 | 599101-01 | 599827 |
| 09/12/2018, 10:30 | 09/25/2018, 08:00 | EXO2 599090-01 (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 09/25/2018, 08:15 | 10/10/2018, 08:00 | EXO2 599090-01 (Heron) | 599701 | 599100-01 | 599101-01 | 599827 |
| 10/10/2018, 08:15 | 10/23/2018, 09:30 | EXO2 599090-01 (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 10/23/2018, 09:45 | 11/15/2018, 11:30 | EXO2 599090-01 (Heron) | 599701 | 599100-01 | 599101-01 | 599827 |
| 11/15/2018, 11:45 | 12/04/2018, 10:00 | EXO2 599090-01 (Flounder) | 599702 | 599100-01 | 599101-01 | 599870 |
| 12/04/2018, 10:15 | 12/19/2018, 07:45 | EXO2 599090-01 (Heron) | 599701 | 599100-01 | 599101-01 | 599827 |
| 12/19/2018, 08:00 | 01/08/2019, 09:30 | EXO2 599090-01 (Flounder) | 599702 | 599100-01 | 599101-01 | 599870 |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Fort Matanzas** | | | | | | | |
| Deployment  Date/Time | Retrieval  Date/Time | Data sonde Model Number | pH Model Number | ROX DO Model Number | | Turb Model Number | Cond Model Number |
| 12/20/2017, 12:30 | 01/11/2018, 13:00 | EXO2 599090-01 (Triton) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 01/11/2018, 13:15\* | 02/01/2018, 12:00\* | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 02/01/2018, 12:15 | 02/20/2018, 13:45 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 02/20/2018, 14:00 | 03/06/2018, 11:45 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 03/06/2018, 13:30 | 03/27/2018, 10:15 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 03/27/2018, 10:30 | 04/12/2018, 08:15 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 04/12/2018, 08:30 | 05/01/2018, 10:15 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 05/01/2018, 10:30 | 05/15/2018, 08:45 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 05/15/2018, 09:00 | 05/31/2018, 10:30 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 05/31/2018, 10:45 | 06/12/2018, 11:15 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 06/12/2018, 11:30 | 07/03/2018, 13:00 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 07/03/2018, 13:15 | 07/24/2018, 11:15 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 07/24/2018, 11:30 | 08/07/2018, 09:30 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 08/07/2018, 09:45 | 08/23/2018, 07:45 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 08/23/2018, 08:15 | 09/11/2018, 11:45 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 09/11/2018, 12:00 | 09/25/2018, 08:30 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 09/25/2018, 08:45 | 10/10/2018, 07:00 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 10/10/2018, 07:15 | 10/23/2018, 08:30 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 10/23/2018, 08:45 | 11/15/2018, 12:15 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 11/15/2018, 12:30 | 12/04/2018, 11:15 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |
| 12/04/2018, 11:30 | 12/19/2018, 08:30 | EXO2 599090-01 (Nemo) | 599702 | | 599100-01 | 599101-01 | 599870 |
| 12/19/2018, 08:45 | 01/08/2019, 10:15 | EXO2 599090-01 (Pelican) | 599701 | | 599100-01 | 599101-01 | 599870 |

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| --- | --- | --- | --- | --- | --- | --- |
| **Pellicer Creek** | | | | | | |
| Deployment  Date/Time | Retrieval  Date/Time | Data sonde Model Number | pH Model Number | ROX DO Model Number | Turb Model Number | Cond Model Number |
| 12/14/2017, 11:15 | 01/10/2018, 10:00 | EXO2  599090-01  (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 01/10/2018, 10:15 | 01/16/2018, 11:00 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599870 |
| 01/16/2018, 11:15 | 02/02/2018, 12:45 | EXO2 599090-01  (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 02/02/2018, 13:00 | 02/09/2018, 13:30 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599870 |
| 02/09/2018, 13:45\* | 02/13/2018, 11:30\* | EXO2 599090-01  (Heron) | 599701 | 599100-01 | 599101-01 | 599870 |
| 02/13/2018, 11:45 | 02/20/2018, 14:45 | EXO2 599090-01  (Flounder) | 599701 | 599100-01 | 599101-01 | 599870 |
| 02/20/2018, 15:00 | 03/07/2018, 09:00 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599870 |
| 03/07/2018, 09:15 | 03/27/2018, 10:15 | EXO2 599090-01  (Triton) | 599701 | 599100-01 | 599101-01 | 599870 |
| 03/27/2018, 10:30 | 04/11/2018, 12:15 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 04/11/2018, 12:30 | 04/25/2018, 09:30 | EXO2 599090-01  (Triton) | 599701 | 599100-01 | 599101-01 | 599870 |
| 04/25/2018, 09:45 | 05/01/2018, 10:30 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 05/01/2018, 10:45 | 05/16/2018, 13:30 | EXO2 599090-01  (Triton) | 599701 | 599100-01 | 599101-01 | 599870 |
| 05/16/2018, 13:45 | 05/29/2018, 09:45 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 05/29/2018, 10:00 | 06/12/2018, 09:30 | EXO2 (Triton) | 599701 | 599100-01 | 599101-01 | 599827 |
| 06/12/2018, 09:45 | 06/27/2018, 13:45 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 06/27/2018, 14:00 | 07/09/2018, 12:15 | EXO2 599090-01  (Triton) | 599701 | 599100-01 | 599101-01 | 599827 |
| 07/09/2018, 12:30 | 07/24/2018, 09:45 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 07/24/2018, 10:00 | 08/07/2018, 09:45 | EXO2 599090-01  (Triton) | 599701 | 599100-01 | 599101-01 | 599827 |
| 08/07/2018, 10:00 | 09/05/2018, 09:30 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 09/05/2018, 09:45 | 09/24/2018, 10:45 | EXO2 599090-01  (Triton) | 599701 | 599100-01 | 599101-01 | 599827 |
| 09/24/2018, 11:00 | 10/11/2018, 10:30 | EXO2 599090-01  (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 10/11/2018, 10:45 | 10/23/2018, 10:00 | EXO2 599090-01 (Triton) | 599701 | 599100-01 | 599101-01 | 599827 |
| 10/23/2018, 10:15 | 11/06/2018, 11:30 | EXO2 599090-01 (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 11/06/2018, 11:45 | 11/13/2018, 08:15 | EXO2 599090-01 (Triton) | 599701 | 599100-01 | 599101-01 | 599827 |
| 11/16/2018, 11:15 | 12/04/2018, 10:45 | EXO2 599090-01 (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |
| 12/04/2018, 11:00 | 12/21/2018, 12:30 | EXO2 599090-01 (Triton) | 599701 | 599100-01 | 599101-01 | 599827 |
| 12/21/2018, 12:45 | 01/09/2019, 12:30 | EXO2 599090-01 (Nautilus) | 599701 | 599100-01 | 599101-01 | 599827 |

\* - Deployments contained no data but sonde was in water during these times.

**7) Distribution:**

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

Requested citation format:

NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: <http://www.nerrsdata.org/>; *accessed* 12 October 2018.

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

**8) Associated researchers and projects:**

Other significant water quality research and monitoring initiatives within the GTMNERR include regular monitoring by DEP’s Division of Environmental Assessment and Restoration, studies of nutrient profiles and plankton ecology by University of Florida and Flagler College, and regular monitoring of fecal coliform levels in shellfish harvesting waters by the Department of Agriculture and Consumer Services. A complete database of research conducted within the GTMNERR and a list of publications are available upon request and online at <https://www.gtmnerr.org/research/research-publications/>.

The SJRWMD Northern Coastal Basin (NCB) Program, established in 1995, covers the watersheds along the Intracoastal Waterway from Ponce Inlet in Volusia County, north through Flagler and St. Johns Counties, to the Georgia border. This program was developed in response to concerns about the impacts of population growth and development on water quality in the NCB. Some of the major research activities conducted within the boundaries of the GTMNERR through the NCB program include hydrodynamic modeling; land use, emergent marsh vegetation, shoreline and oyster habitat mapping; and water quality monitoring. Many of the water quality monitoring and assessment activities of the NCB program are aimed at pollution source identification and the development of pollution load reduction goals.

Other significant water quality research and monitoring initiatives within the GTMNERR include: regular monitoring by DEP’s Division of Environmental Assessment and Restoration, studies of nutrient profiles and plankton ecology by Dr. Edward Phlips at the University of Florida, regular monitoring of fecal coliform levels in shellfish harvesting waters by the Department of Agriculture and Consumer Services, monitoring of nutrients and size fractionated chlorophyll by Dr. Matthew Brown at Flagler College. A complete database of research conducted within the GTMNERR and a list of publications are available upon request.

To complement the water quality data, the GTMNERR also operates a weather station (data available at [www.nerrsdata.org](http://www.nerrsdata.org)) and monitors biological components of the estuary such as emergent vegetation, marsh sediment elevation, plankton, and oyster reefs. Biological data are available upon request (please see Principal Investigators and Contact Persons).

For further information on the GTMNERR, see the Site Profile at: https://coast.noaa.gov/data/docs/nerrs/Reserves\_GTM\_SiteProfile.pdf

**II. Physical Structure Descriptors**

**9) Sensor specifications:**

GTMNERR deployed only YSI data sondes (EXO2) in 2018. All data sondes have the same probe configuration (Temperature, Conductivity, Salinity, Optical Dissolved Oxygen, Depth, pH and Turbidity). Types of data sondes used for each deployment are defined in the data collection period section.

**YSI 6600 EDS and YSI 6600 EDS V2 data sonde (used from 2000-2015):**

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 auto ranging

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 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 – 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

**YSI EXO2 data sonde:**

Parameter: Temperature

Units: Celsius (°C)

Sensor Type: CT2, Thermistor

Model#: 599870

Range: -5 to 50°C

Accuracy: -5 to 35°C +/- 0.01°C; 35 to 50°C +/- 0.005°C

Resolution: 0.01°C

Parameter: Conductivity

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

Sensor Type: CT2 Probe, 4-electrode nickel cell

Model#: 599870

Range: 0 to 200 mS/cm

Accuracy: 0-100 mS/cm: +/- 0.5% of reading or 0.001 mS/cm, whichever is greater; 100-200 mS/cm: +/- 1% of reading

Resolution: 0.001 to 0.1 mS/cm (range dependent)

Parameter: Salinity

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

Sensor Type: CT2 probe, 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 psu

OR

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Wiped probe; Thermistor

Model#: 599827

Range: -5 to 50 C

Accuracy: ±0.2 C

Resolution: 0.001 C

Parameter: Conductivity

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

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

Model#: 599827

Range: 0 to 100 mS/cm

Accuracy: ±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

Units: percent air saturation (%)

Sensor Type: Optical, luminescence lifetime

Model#: 599100

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, luminescence lifetime

Model#: 599100

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: meters (m)

Sensor Type: Stainless steel strain gauge

Range: Shallow: 0 to 33 ft (10 m)

Accuracy: +/- 0.04% FS (+/-0.013 ft or +/- 0.004 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH – guarded or unguarded bulb

Units: pH units

Sensor Type: Glass combination electrode

Model#: 599797

Range: 0 to 14 units

Accuracy: +/- 0.1 units within +/-10°C of calibration temperature; +/-0.2 pH units for entire temp range

Resolution: 0.01 units

Parameter: Turbidity

Units: Formazin nephelometric units (FTU)

Sensor Type: Optical, 90-degree scatter,

Model#: 599101

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: 0-999 FNU: 0.1 FNU; 1000-4000 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 Research Coordinator at the specific NERR site regarding site and seasonal variation in fouling of the DO sensor.

**Depth Qualifier:**

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

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

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

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

**Salinity Units Qualifier:**

In 2013, EXO sondes were approved for SWMP use and began to be utilized by Reserves. While the 6600 series sondes report salinity in parts per thousand (ppt) units, the EXO sondes report practical salinity units (psu). These units are essentially the same and for SWMP purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the NERR System will assign psu salinity units for all data regardless of sonde type.

**Turbidity Qualifier:**

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

**10) Coded variable definitions:**

Sampling station Sampling site code Station code

Pine Island PI gtmpiwq

San Sebastian SS gtmsswq

Fort Matanzas FM gtmfmwq

Pellicer Creek PC gtmpcwq

**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 QAQC checks

GSM See metadata

Corrected Depth/Level Data Codes

GCC Calculated with data that were corrected during QAQC

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:**

Note: pH post-deployment readings are temperature dependent and minor variations are expected as a result.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 1. Post-deployment readings of all sondes deployed at the Pine Island site during 2018.** | | | | | | | | | | |
| **Deployment Date** |  | **Temp (°C)** | **SpCond (mS/cm)** | **ROX DO %** | **ROX DO %** | **pH** | **pH** | **pH** | **Turbidity (NTU)** | **Depth (m)** |
|  | **Std.** | **N/A** | **50.00** | **100.0** | **100.0** | **7.00** | **10.00** | **4.00** | **0.0** | **N/A** |
| 12/20/17 |  | N/A | 50.07 | 100.4 | 100.4 | 7.05 | 10.04 | 4.05 | 1.0 | -0.064 |
| 01/11/18 |  | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 02/01/18 |  | N/A | 49.67 | 100.4 | 100.3 | 7.20 | 10.17 | 4.24 | 0.3 | 0.190 |
| 02/20/18 |  | N/A | 49.97 | 99.6 | 99.5 | 7.01 | 10.10 | 4.02 | 0.1 | 0.019 |
| 03/07/18 |  | N/A | 49.87 | 102.3 | 102.3 | 7.17 | 10.19 | 4.15 | 1.8 | 0.090 |
| 03/27/18 |  | N/A | 50.17 | 99.7 | 99.5 | 7.03 | 9.97 | 4.10 | -0.0 | 0.096 |
| 04/12/18 |  | N/A | 49.73 | 100.3 | 98.4 | 7.05 | 10.05 | 4.12 | 0.2 | 0.136 |
| 05/01/18 |  | N/A | 49.71 | 100.3 | 100.3 | 7.17 | 10.14 | 4.12 | 0.1 | 0.047 |
| 05/15/18 |  | N/A | 50.07 | 102.1 | 102.1 | 8.63 | 11.13 | 6.00 | -0.5 | 0.027 |
| 05/31/18 |  | N/A | 48.96 | 101.1 | 101.2 | 7.05 | 10.03 | 4.10 | 0.1 | 0.088 |
| 06/12/18 |  | N/A | 50.23 | 100.5 | 100.6 | 7.22 | 10.22 | 4.19 | 0.9 | 0.034 |
| 07/03/18 |  | N/A | 50.06 | 99.7 | 99.8 | 7.20 | 10.10 | 4.13 | 1.4 | -0.002 |
| 07/24/18 |  | N/A | 49.94 | 99.3 | 99.1 | 7.14 | 10.15 | 4.14 | 9.4 | 0.065 |
| 08/07/18 |  | N/A | 46.36 | 100.6 | 100.5 | 7.09 | 10.06 | 4.11 | -0.0 | 0.003 |
| 08/23/18 |  | N/A | 49.91 | 98.1 | 98.1 | 7.12 | 10.11 | 4.15 | 3.3 | 0.058 |
| 09/12/18 |  | N/A | 50.23 | 98.7 | 98.8 | 7.23 | 10.20 | 4.26 | 4.4 | 0.068 |
| 09/25/18 |  | N/A | 49.33 | 97.1 | 96.8 | 7.26 | 10.20 | 4.28 | 4.2 | -0.030 |
| 10/10/18 |  | N/A | 55.02 | 99.4 | 99.4 | 7.14 | 10.11 | 4.08 | 0.6 | 0.072 |
| 10/23/18 |  | N/A | 48.78 | 98.6 | 98.7 | 7.18 | 10.11 | 4.15 | 3.9 | 0.057 |
| 11/15/18 |  | N/A | 49.88 | 100.5 | 100.6 | 7.12 | 10.11 | 4.10 | 0.1 | 0.116 |
| 12/04/18 |  | N/A | 50.08 | 98.3 | 98.3 | 7.13 | 10.13 | 4.15 | 0.1 | -0.069 |
| 12/19/18 |  | N/A | 47.42 | 98.1 | 97.9 | 7.22 | 10.14 | 4.29 | 1.4 | 0.057 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 2. Post-deployment readings of all sondes deployed at the San Sebastian site during 2018.** | | | | | | | | | | |
| **Deployment Date** |  | **Temp (°C)** | **SpCond (mS/cm)** | **ROX DO %** | **ROX DO %** | **pH** | **pH** | **pH** | **Turbidity (NTU)** | **Depth (m)** |
|  | **Std.** | **N/A** | **50.00** | **100.0** | **100.0** | **7.00** | **10.00** | **4.00** | **0.0** | **N/A** |
| 12/14/17 |  | N/A | 49.73 | 98.4 | 98.3 | 7.00 | 10.03 | 4.00 | 0.0 | -0.064 |
| 03/06/18 |  | N/A | 49.86 | 101.3 | 101.3 | 7.19 | 10.17 | 4.26 | -0.3 | 0.119 |
| 03/27/18 |  | N/A | 49.95 | 99.8 | 99.7 | 6.96 | 9.94 | 3.98 | 0.1 | 0.101 |
| 04/12/18 |  | N/A | 49.83 | 100.3 | 100.3 | 7.15 | 10.12 | 4.21 | 1.3 | 0.142 |
| 05/01/18 |  | N/A | 50.05 | 101.9 | 101.9 | 7.03 | 10.05 | 4.00 | 0.1 | 0.000 |
| 05/15/18 |  | N/A | 50.11 | 101.5 | 101.5 | 7.11 | 10.15 | 4.05 | 0.4 | 0.023 |
| 05/31/18 |  | N/A | 49.34 | 102.1 | 102.0 | 7.08 | 10.03 | 4.01 | -0.3 | 0.430 |
| 06/12/18 |  | N/A | 50.23 | 99.7 | 99.7 | 4.84 | 7.18 | 3.34 | 1.3 | 0.007 |
| 07/03/18 |  | N/A | 49.81 | 100.2 | 100.1 | 7.15 | 10.06 | 4.08 | 0.2 | 0.002 |
| 07/24/18 |  | N/A | 50.12 | 100.2 | 100.2 | 7.11 | 10.09 | 4.10 | 0.5 | 0.057 |
| 08/07/18 |  | N/A | 49.68 | 99.7 | 99.7 | 7.20 | 10.19 | 4.17 | -0.2 | 0.010 |
| 08/23/18 |  | N/A | 49.93 | 98.7 | 98.7 | 7.19 | 10.18 | 4.18 | 1.0 | 0.030 |
| 09/12/18 |  | N/A | 49.91 | 99.7 | 99.6 | 7.12 | 10.11 | 4.12 | 0.4 | 0.077 |
| 09/25/18 |  | N/A | 50.04 | 101.8 | 101.7 | 7.20 | 10.29 | 4.12 | 0.9 | -0.033 |
| 10/10/18 |  | N/A | 49.70 | 100.8 | 100.7 | 7.18 | 10.16 | 4.14 | 1.3 | 0.055 |
| 10/23/18 |  | N/A | 50.03 | 99.5 | 99.5 | 7.11 | 10.06 | 4.05 | 0.2 | 0.039 |
| 11/15/18 |  | N/A | 50.22 | 102.8 | 102.7 | 7.12 | 10.11 | 4.07 | -0.5 | 0.122 |
| 12/04/18 |  | N/A | 50.19 | 98.9 | 98.9 | 7.15 | 10.12 | 4.17 | 0.5 | 0.046 |
| 12/19/18 |  | N/A | 49.83 | 101.7 | 101.7 | 7.08 | 10.00 | 4.07 | 0.0 | 0.089 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 3. Post-deployment readings of all sondes deployed at the Fort Matanzas site during 2018.** | | | | | | | | | | |
| **Deployment Date** |  | **Temp (°C)** | **SpCond (mS/cm)** | **ROX DO %** | **ROX DO %** | **pH** | **pH** | **pH** | **Turbidity (NTU)** | **Depth (m)** |
|  | **Std.** | **N/A** | **50.00** | **100.0** | **100.0** | **7.00** | **10.00** | **4.00** | **0.0** | **N/A** |
| 12/20/17 |  | N/A | 50.17 | 100.2 | 100.6 | 7.08 | 10.06 | 4.13 | 0.6 | -0.014 |
| 01/11/18 |  | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 02/01/18 |  | N/A | 49.50 | 99.7 | 99.6 | 7.11 | 10.21 | 4.13 | -0.7 | 0.173 |
| 02/20/18 |  | N/A | 50.07 | 99.7 | 99.7 | 7.07 | 10.09 | 4.04 | 0.1 | -0.013 |
| 03/06/18 |  | N/A | 49.55 | 101.6 | 101.5 | 7.09 | 10.06 | 4.09 | 0.5 | 0.095 |
| 03/27/18 |  | N/A | 49.58 | 101.0 | 101.0 | 7.01 | 10.00 | 4.04 | 0.2 | 0.098 |
| 04/12/18 |  | N/A | 49.97 | 100.4 | 100.4 | 7.14 | 10.19 | 4.21 | 0.7 | 0.146 |
| 05/01/18 |  | N/A | 50.20 | 108.1 | 108.0 | 7.13 | 10.08 | 4.13 | 1.0 | 0.022 |
| 05/15/18 |  | N/A | 49.85 | 101.9 | 101.8 | 7.12 | 10.16 | 4.10 | 0.3 | 0.053 |
| 05/31/18 |  | N/A | 49.54 | 101.3 | 101.2 | 7.11 | 10.10 | 4.12 | -0.1 | 0.520 |
| 06/12/18 |  | N/A | 49.66 | 100.5 | 100.6 | 7.03 | 10.01 | 3.98 | 0.0 | 0.059 |
| 07/03/18 |  | N/A | 49.86 | 100.6 | 100.6 | 7.13 | 10.11 | 4.11 | 4.6 | 0.008 |
| 07/24/18 |  | N/A | 50.03 | 100.5 | 100.5 | 7.21 | 10.20 | 4.09 | 0.7 | 0.048 |
| 08/07/18 |  | N/A | 48.72 | 103.9 | 103.9 | 7.16 | 10.15 | 4.16 | -0.5 | 0.006 |
| 08/23/18 |  | N/A | 49.65 | 100.1 | 100.1 | 7.14 | 10.07 | 4.12 | 1.0 | 0.061 |
| 09/11/18 |  | N/A | 50.22 | 99.9 | 99.8 | 7.17 | 10.16 | 4.15 | 0.1 | 0.074 |
| 09/25/18 |  | N/A | 49.75 | 99.7 | 99.8 | 7.12 | 10.08 | 4.12 | 1.8 | -0.052 |
| 10/10/18 |  | N/A | 50.09 | 100.3 | 100.3 | 7.10 | 10.06 | 4.07 | 1.3 | 0.062 |
| 10/23/18 |  | N/A | 49.26 | 100.2 | 100.2 | 7.19 | 10.17 | 4.16 | 1.9 | 0.053 |
| 11/15/18 |  | N/A | 50.22 | 101.0 | 100.9 | 7.18 | 10.18 | 4.14 | 0.4 | 0.103 |
| 12/04/18 |  | N/A | 50.06 | 99.7 | 99.8 | 7.18 | 10.15 | 4.16 | 0.3 | 0.046 |
| 12/19/18 |  | N/A | 49.85 | 100.5 | 100.4 | 7.02 | 9.95 | 3.98 | 0.5 | -0.083 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 4. Post-deployment readings of all sondes deployed at the Pellicer Creek site during 2018.** | | | | | | | | | | |
| **Deployment Date** |  | **Temp (°C)** | **SpCond (mS/cm)** | **ROX DO %** | **ROX DO %** | **pH** | **pH** | **pH** | **Turbidity (NTU)** | **Depth (m)** |
|  | **Std.** | **N/A** | **50.00** | **100.0** | **100.0** | **7.00** | **10.00** | **4.00** | **0.0** | **N/A** |
| 12/14/17 |  | N/A | 50.08 | 100.6 | 100.5 | 7.00 | 9.93 | 4.00 | 0.3 | 0.060 |
| 01/10/18 |  | N/A | 49.80 | 101.5 | 101.4 | 7.03 | 10.03 | 4.03 | 0.3 | 0.097 |
| 01/16/18 |  | N/A | 50.14 | 101.2 | 101.2 | 7.04 | 9.99 | 4.08 | 0.2 | 0.109 |
| 02/02/18 |  | N/A | 50.31 | 100.9 | 100.9 | 7.02 | 10.02 | 4.03 | -0.2 | 0.107 |
| 02/09/18 |  | N/A | 50.00 | 101.2 | 101.3 | 7.02 | 10.01 | 4.02 | -0.5 | 0.197 |
| 02/13/18 |  | N/A | 50.14 | 100.3 | 100.3 | 7.11 | 10.08 | 4.10 | 0.1 | 0.188 |
| 02/20/18 |  | N/A | 49.99 | 101.5 | 101.3 | 7.05 | 10.00 | 4.03 | -0.5 | 0.042 |
| 03/07/18 |  | N/A | 50.02 | 101.0 | 102.2 | 7.12 | 10.11 | 4.16 | -0.0 | 0.157 |
| 03/27/18 |  | N/A | 50.13 | 101.1 | 101.1 | 7.09 | 10.10 | 4.12 | -0.4 | 0.087 |
| 04/11/18 |  | N/A | 49.84 | 99.1 | 99.1 | 7.76 | 10.61 | 4.91 | 0.1 | -0.013 |
| 04/25/18 |  | N/A | 50.04 | 100.5 | 100.7 | 7.03 | 9.98 | 3.99 | 0.3 | 0.138 |
| 05/01/18 |  | N/A | 50.26 | 100.7 | 100.7 | 7.17 | 10.17 | 4.15 | 0.2 | 0.041 |
| 05/16/18 |  | N/A | 50.25 | 100.5 | 99.9 | 7.06 | 10.05 | 3.99 | 0.2 | 0.030 |
| 05/29/18 |  | N/A | 49.97 | 105.5 | 106.0 | 7.10 | 10.06 | 4.01 | -0.2 | 0.152 |
| 06/12/18 |  | N/A | 49.82 | 100.8 | 100.6 | 7.02 | 10.01 | 3.98 | 0.1 | 0.098 |
| 06/27/18 |  | N/A | 49.87 | 100.8 | 100.8 | 7.02 | 10.02 | 4.00 | 0.0 | 0.026 |
| 07/09/18 |  | N/A | 50.16 | 100.9 | 101.0 | 7.02 | 10.00 | 4.01 | 0.3 | 0.010 |
| 07/24/18 |  | N/A | 49.98 | 101.0 | 101.2 | 7.12 | 10.10 | 4.06 | 0.5 | 0.066 |
| 08/07/18 |  | N/A | 49.73 | 103.3 | 103.7 | 7.13 | 10.12 | 4.08 | 0.4 | 0.046 |
| 09/05/18 |  | N/A | 49.96 | 101.0 | 100.9 | 7.16 | 10.09 | 4.11 | 0.7 | 0.055 |
| 09/24/18 |  | N/A | 50.22 | 99.9 | 99.9 | 7.11 | 10.10 | 4.02 | 0.6 | -0.053 |
| 10/11/18 |  | N/A | 50.08 | 100.9 | 100.9 | 6.99 | 9.96 | 3.93 | 0.1 | 0.080 |
| 10/23/18 |  | N/A | 50.15 | 99.9 | 99.6 | 7.33 | 10.29 | 4.19 | 1.0 | 0.019 |
| 11/06/18 |  | N/A | 49.99 | 99.7 | 99.5 | 7.09 | 10.00 | 4.02 | 0.1 | 0.058 |
| 11/13/18 |  | N/A | 50.04 | 99.8 | 99.9 | 7.25 | 10.09 | 4.27 | 0.2 | 0.036 |
| 12/04/18 |  | N/A | 50.25 | 98.3 | 98.8 | 7.05 | 10.03 | 4.02 | 0.4 | -0.127 |
| 12/21/18 |  | N/A | 50.17 | 100.3 | 100.5 | 7.14 | 10.08 | 4.10 | 0.1 | 0.067 |

**14) Other remarks/notes:**

1. Copies of calibration logs can be obtained through the CDMO.
2. Daily, Monthly, Annual Precipitation Totals are collected at the Pellicer Creek Weather Station (gtmpcmet).

**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 Research Coordinator at the reserve submitting the data.

**January 1-31, 2018**

**PI**

1. Missing data (all parameters) 01/11 15:00 through 01/31 23:45; attributed to sonde malfunction. No data collected during deployment.

**SS**

1. Missing data (all parameters) 01/11 16:15 through 01/31 23:45; attributed to sonde tube replacement.

**FM**

1. Missing data (all parameters) 01/11 13:15 through 01/31 23:45; attributed to sonde malfunction. No data collected during deployment.

**February 1-28, 2018**

**PI**

1. Missing data (all parameters) 02/01 00:00 through 02/01 10:15; attributed to sonde malfunction. No data collected during deployment.

**SS**

1. Missing data (all parameters) 02/01 00:00 through 02/28 23:45; attributed to sonde tube replacement.

**FM**

1. Missing data (all parameters) 02/01 00:00 through 02/01 12:00; attributed to sonde malfunction. No data collected during deployment.

**PC**

1. Missing data (all parameters) 02/09 13:45 through 02/13 11:30; attributed to sonde malfunction. No data collected during deployment.

**March 1-31, 2018**

**SS**

1. Missing data (all parameters) 03/01 00:00 through 03/06 11:00; attributed to sonde tube replacement.

**FM**

1. Missing data (all parameters) 03/06 12:00 through 03/06 13:15; attributed to sonde tube replacement.

**August 1-31, 2018**

**FM**

1. Missing all data 08/23 08:00; attributed sonde tube maintenance.

**November 1-30, 2018**

**PC**

1. Missing all data 11/13 11:00 through 11/16 11:00; attributed sonde being out of water due to piling installation for future water level gauge.

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

**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.

**January 1-31, 2018**

**SS**

1. Sonde tube broke; exact time and cause is unknown. Data collected 01/01 00:00 through 01/11 16:00 were collected outside of sonde tube. Data appear to fit conditions unless otherwise noted.
2. Suspect Depth data 01/01 00:00 through 01/11 16:00; attributed to the possibility that data was collected at wrong depth resulting from the broken sonde tube.
3. Reject all data 01/11 15:45; attributed to broken sonde tube. Depth data do not appear to fit conditions.
4. Suspect pH data 01/01 00:00 through 01/11 16:00; attributed to shift in values associated with sonde exchange.

**March 1-31, 2018**

**SS**

1. Suspect Turbidity data 03/21 13:30 through 03/27 09:00; possibly attributed to a Central Wiper malfunction and silt fouling. Values ramp up and decrease after sonde exchange on 03/27 09:15.

**May 1-31, 2018**

**PI**

1. Wiper brush fell off Central wiper sometime during 05/15 10:30 through 05/31 08:15 deployment. Data appear to fit conditions.

**August 1-31, 2018**

**PC**

1. Suspect depth data 08/07 10:00 through 08/31 23:45; attributed to values not matching previous and next sonde exchanges.

**September 1-30, 2018**

**PC**

1. Suspect depth data 09/01 00:00 through 09/05 09:30; attributed to values not matching previous and next sonde exchanges.

**November 1-30, 2018**

**PC**

1. Reject all data 11/13 08:30 through 11/13 10:45; attributed sonde being out of water due to piling installation for future water level gauge.

**December 1-31, 2018**

**FM**

1. Suspect pH data 12/19 08:45 through 12/31 23:45; attributed to shift in values associated with sonde exchange.

**Daily, Monthly, and Annual Precipitation Totals (from raw data)**

Pellicer Creek Weather Station (gtmpcmet)

|  |  |
| --- | --- |
| **Date** | **Daily Precip. Totals (mm)** |
| 01/01/2018 | 3.810 |
| 01/03/2018 | 23.114 |
| 01/09/2018 | 11.684 |
| 01/10/2018 | 12.192 |
| 01/11/2018 | 13.462 |
| 01/12/2018 | 13.462 |
| 01/23/2018 | 3.810 |
| 01/28/2018 | 17.018 |
| 01/29/2018 | 31.242 |
|  |  |
| **January Monthly Total** | **129.794** |
|  |  |
| 02/04/2018 | 3.048 |
| 02/09/2018 | 1.778 |
| 02/10/2018 | 0.254 |
| 02/11/2018 | 18.796 |
| 02/12/2018 | 2.540 |
| 02/13/2018 | 4.064 |
| 02/20/2018 | 0.254 |
| 02/21/2018 | 0.254 |
|  |  |
| **February Monthly Total** | **30.988** |
|  |  |
| 03/02/2018 | 0.254 |
| 03/19/2018 | 13.208 |
| 03/20/2018 | 7.112 |
| 03/25/2018 | 3.302 |
| 03/26/2018 | 10.922 |
| 03/30/2018 | 1.270 |
|  |  |
| **March Monthly Total** | **36.068** |
|  |  |
| 04/07/2018 | 3.302 |
| 04/08/2018 | 0.762 |
| 04/09/2018 | 30.480 |
| 04/10/2018 | 51.054 |
| 04/11/2018 | 0.508 |
| 04/15/2018 | 9.906 |
| 04/21/2018 | 6.604 |
| 04/22/2018 | 2.794 |
| 04/23/2018 | 10.414 |
|  |  |
| **April Monthly Total** | **115.824** |
|  |  |
| 05/16/2018 | 0.254 |
| 05/17/2018 | 3.048 |
| 05/18/2018 | 38.608 |
| 05/19/2018 | 0.508 |
| 05/20/2018 | 18.034 |
| 05/21/2018 | 18.034 |
| 05/22/2018 | 1.016 |
| 05/27/2018 | 34.798 |
| 05/29/2018 | 18.034 |
| 05/30/2018 | 28.702 |
| 05/31/2018 | 2.286 |
|  |  |
| **May Monthly Total** | **163.068** |
|  |  |
| 06/01/2018 | 17.780 |
| 06/02/2018 | 0.508 |
| 06/04/2018 | 0.254 |
| 06/06/2018 | 1.778 |
| 06/08/2018 | 0.254 |
| 06/11/2018 | 28.956 |
| 06/12/2018 | 14.224 |
| 06/13/2018 | 27.686 |
| 06/15/2018 | 7.366 |
| 06/16/2018 | 3.302 |
| 06/20/2018 | 23.114 |
| 06/21/2018 | 42.926 |
| 06/22/2018 | 0.254 |
| 06/28/2018 | 14.986 |
| 06/30/2018 | 1.270 |
|  |  |
| **June Monthly Total** | **184.658** |
|  |  |
| 07/06/2018 | 9.144 |
| 07/09/2018 | 2.540 |
| 07/16/2018 | 28.448 |
| 07/18/2018 | 4.826 |
| 07/20/2018 | 1.016 |
| 07/22/2018 | 6.858 |
| 07/23/2018 | 5.334 |
| 07/24/2018 | 0.508 |
| 07/25/2018 | 14.478 |
| 07/26/2018 | 10.922 |
| 07/27/2018 | 4.826 |
| 07/28/2018 | 12.446 |
| 07/30/2018 | 18.288 |
| 07/31/2018 | 32.512 |
|  |  |
| **July Monthly Total** | **152.146** |
|  |  |
| 08/01/2018 | 38.354 |
| 08/02/2018 | 21.844 |
| 08/03/2018 | 5.588 |
| 08/09/2018 | 5.588 |
| 08/12/2018 | 40.640 |
| 08/13/2018 | 1.778 |
| 08/14/2018 | 7.366 |
| 08/21/2018 | 17.272 |
| 08/22/2018 | 6.350 |
| 08/23/2018 | 1.016 |
| 08/27/2018 | 4.572 |
| 08/28/2018 | 3.810 |
|  |  |
| **August Monthly Total** | **154.178** |
|  |  |
| 09/02/2018 | 9.906 |
| 09/03/2018 | 14.478 |
| 09/06/2018 | 11.430 |
| 09/08/2018 | 7.366 |
| 09/17/2018 | 5.588 |
| 09/18/2018 | 1.778 |
| 09/21/2018 | 11.684 |
| 09/22/2018 | 0.254 |
|  |  |
| **September Monthly Total** | **62.484** |
|  |  |
| 10/01/2018 | 21.082 |
| 10/04/2018 | 1.778 |
| 10/07/2018 | 5.334 |
| 10/08/2018 | 1.778 |
| 10/09/2018 | 38.354 |
| 10/10/2018 | 7.366 |
| 10/18/2018 | 2.540 |
| 10/19/2018 | 2.286 |
| 10/23/2018 | 0.254 |
| 10/24/2018 | 6.096 |
| 10/25/2018 | 28.702 |
| 10/26/2018 | 1.270 |
|  |  |
| **October Monthly Total** | **116.840** |
|  |  |
| 11/02/2018 | 10.160 |
| 11/04/2018 | 1.524 |
| 11/05/2018 | 0.508 |
| 11/09/2018 | 4.064 |
| 11/12/2018 | 10.668 |
| 11/14/2018 | 4.064 |
| 11/20/2018 | 1.524 |
| 11/22/2018 | 18.034 |
| 11/23/2018 | 6.096 |
| 11/26/2018 | 18.542 |
|  |  |
| **November Monthly Total** | **75.184** |
|  |  |
| 12/01/2018 | 2.286 |
| 12/02/2018 | 1.524 |
| 12/03/2018 | 2.794 |
| 12/04/2018 | 0.508 |
| 12/09/2018 | 34.036 |
| 12/14/2018 | 61.214 |
| 12/15/2018 | 19.304 |
| 12/18/2018 | 0.254 |
| 12/20/2018 | 41.402 |
| 12/21/2018 | 0.254 |
| 12/28/2018 | 11.684 |
| 12/29/2018 | 27.686 |
| 12/30/2018 | 0.254 |
|  |  |
| **December Monthly Total** | **203.200** |
|  |  |
| **January – December Total** | **1424.432** |