

Padilla Bay (PDB) NERR Water Quality Metadata
January – December 2014
Latest Update June 27, 2025

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

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2) Entry verification –

Deployment data are uploaded from the YSI data logger to a Personal Computer (IBM compatible). Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the 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 for upload to the CDMO. Upload after secondary QAQC results in ingestion into the database as provisional plus data, recalculation of cDepth or cLevel parameters, and finally tertiary QAQC by the CDMO and assimilation into the CDMO's authoritative online database. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is generally accepted as being the most accurate. For more information on QAQC flags and codes, see Sections 11 and 12.

Nicole Burnett performs the data management and QAQC procedures at Padilla Bay. Edited and raw files are archived on a PC hard drive at Padilla Bay NERR as well as on the Padilla Bay server. The Padilla Bay server is backed up as per Washington Department of Ecology protocols with backup files created weekly and monthly.

The following QA/QC procedures were used if it was determined that the turbidity values were not from an actual turbidity event (unless it was decided that the data should be marked in another way). All data over 100 NTU were evaluated to determine if the data were from a real event. If they were from a real event they were marked as 0 CTS (except at Joe Leary Estuary because the turbidity frequently is over 100 NTU). If the data were determined to be caused by other factors they were either marked as 1 or -3 and codes added. Other anomalous turbidity values below 100 NTU were also examined for validity.

Starting with the deployment 09-26-13 copper mesh was placed around the outside of the sensor guards at Ploeg and Bayview to reduce the amount of erroneous turbidity data. Two layers of plastic mesh (criss-crossing) were also put in the bottom of the guards. This has lead to much cleaner turbidity data. While all of the data was QAQC'd as described above the change in deployment is obvious in the data. All turbidity data at Ploeg and Bayview before 09-26-13 should be interpreted with caution. This same guard was tried at Gong but without success. Turbidity data from both Gong and Joe Leary (and Joe Leary Estuary) should be interpreted with caution due to numerous spikes whose origin is unknown (i.e. true event or debris).

3) Research objectives – The Bay View Channel site has been set out to detect and monitor short-term variability and long-term changes in the southern part of Padilla Bay. The Ploeg Channel site has been set out to detect and monitor short-term variability and long-term change in the northern part of Padilla Bay for comparison and contrast with water quality in the southern part of the bay. The Joe Leary Slough site was set at the mouth of the slough to measure the effects of tidal "closure" of the tide gates on water in the slough and to detect long-term changes in water quality in the slough associated with implementation of a non point source pollution watershed action plan. The Joe Leary Estuary site has been set out to improve data collection in Joe Leary Slough and replaces the Joe Leary Slough site. Although it is outside the tide gates (on the marine side of the tide gates) it provides data on the freshwater coming out of the tide gates when they are open. The Gong site has been set in the deep water strait west of the northern part of Padilla Bay to monitor short-term variability and long-term change in the waters that are a source for the tidal waters flowing into Padilla Bay. The four sites are set up to provide an indication of the salinity gradient from Joe Leary Estuary (freshwater) through Bayview Channel (downstream of freshwater sources from Indian and No Name Sloughs) to Ploeg Channel (remote from freshwater sources but in a tidal channel) to Gong on the marine end of the gradient. Measurements are taken every 15 minutes at the Bayview, Ploeg, Gong and Joe Leary Estuary sites, unless otherwise noted.

4) Research methods –

YSI 6600 sondes were deployed in Joe Leary Estuary which is near the tide gates on Joe Leary Slough but on the marine side starting March 25, 2009. The sonde is housed in an ABS pipe. The ABS is attached to a wood piling and is positioned so that the sonde is 0.1 m above the bottom on the sloping edge of the slough.

YSI 6600 sondes were deployed in Padilla Bay in a tributary of Bayview Channel. They were deployed using the same design as that in Joe Leary Estuary, except that the ABS pipe was attached to a 8 inch galvanized steel pile. The depth of the YSI was –1.1 m (depth below MLLW) and about 0.6 m above the bottom along the sloping edge of a small channel draining the surrounding intertidal flats. This site often collects large mats of debris (eelgrass, kelp etc), and while all attempts to monitor and remove the debris mats are made this should be taken into account when interpreting the data.

YSI 6600 sondes were deployed in Ploeg Channel using the same design as that in Bayview Channel. The depth of the datalogger was –1.33 m (depth below MLLW) and 0.33 m above the bottom along the sloping edge of a channel draining the surrounding intertidal flats. Sometime between 11/23/10 and 12/30/10 the ABS pipe began to fail and then completely failed becoming detached from the steel pile. The ABS pipe was reinstalled in 1/11/2011 with the bottom of the sonde 0.25 m above the bottom. On 3/8/12 the ABS pipe was adjusted so the bottom of the sonde is 0.50 m above the bottom. This site often collects large mats of debris (eelgrass, kelp etc), and while all attempts to monitor and remove the debris mats are made this should be taken into account when interpreting the data.

YSI 6600 and EXO 2 sondes were deployed at the Gong site with the sonde housing tube located on the side of a 54 inch diameter oceanographic data buoy with an instrument tower and extends into the water so the sonde sits 1 meter below the surface of the water. (Note: the depth data thus reflects depth the sonde is under the surface of the water and prone to wave action on the buoy, not the height above the bottom as in the other sites.) The portion of sonde housing tube around the sensors (to bottom 8" of the tube) has ten 1 ½" holes and the bottom of tube is open to the water. This allows water to circulate around the probes while still having a substantial amount of pipe intact to protect the sonde and sensors. The buoy is anchored to the bottom (~ 18 m) with a 13 ft helical anchor.

In all cases, measurements of temperature, specific conductivity, and salinity, percent saturation of dissolved oxygen, dissolved oxygen mg/L, depth, pH and turbidity are recorded every 15 minutes. At the end of each deployment, the YSI 6600 or EXO 2 is brought back into the laboratory for downloading, cleaning, and recalibration. Before final cleaning and recalibration a post-deployment check is done that consists of recording sensor readings in the standard solutions. The results of these checks are used to help evaluate the validity of the logged data.

All calibrations are conducted according to the protocols in the YSI Environmental Operations Manual for the 6-Series Environmental Monitoring Systems. For the conductivity calibration a conductivity standard of 50 mS/cm was used. The pH calibration is a 2-point calibration using standard buffer solutions with a pH of 7 and 10. ROX oxygen probes only require membrane maintenance every two years and are calibrated in saturated water using 2 air stones to obtained 100% saturation. A 2-point calibration is used for the turbidity probe and the wiper pad is changed prior to each deployment. The standards used are distilled/deionized water for zero and 126 NTU YSI turbidity standard from YSI.

A Sutron Sat-Link2 transmitter was installed at the Joe Leary station from 12/20/05 to 7/24/09 and transmitted data to the NOAA GOES satellite, NESDIS ID #3B004470 (Where # 3B004470 is the GOES ID for that particular station.) The same transmitter was installed at the Ploeg site on 10/7/09 and retains the NESDIS ID. A second Sutron Sat-Link2 transmitter was installed at the Bayview site on 09/02/09 and transmits data to the NOAA GOES satellite, NESDIS ID # 3B041136 (Where # 3B041136 is the GOES ID 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>.

5) Site location and character –

General: Padilla Bay (48° 30' N; 122° 30' W) is a shallow embayment in northern Puget Sound. The tide flats are dominated by the eelgrass *Zostera marina*, which covers approximately 3,000 ha. *Zostera japonica*, a recent introduction to the region, now covers about 350 ha of the bay. Tides are mixed semi-diurnal with a mean range of 2.4 m. Salinity varies from about 23 to 32 PSU. Padilla Bay is an "orphaned" estuary in that the Skagit River no longer empties directly into it. Most of the land in the 9300 ha Padilla Bay watershed is agricultural, and is drained by four sloughs which empty into the bay through tide gates. The salinity in Padilla Bay reflects both the sloughs that flow into the bay and the greater Puget Sound-Georgia Basin estuary in which Padilla Bay is located. Major freshwater flows into this area of the Puget Sound-Georgia Basin estuary come from the Fraser and Nooksack Rivers to the north and from the Skagit River to the south. The small Samish River discharges directly north of Padilla Bay.

Joe Leary Estuary Site: (48° 31' 08.1" N; 122° 28' 29.74" W) The site description for the Joe Leary Estuary Site is the same as for discontinued Joe Leary Slough site (which was in existence from 12/20/00 to 6/16/09) except that Joe Leary Estuary site is located on the marine side of the tide gates and is as follows. Joe Leary Slough drains land that is predominantly annual crop agriculture, pasture land, and berries with some low-density housing. The slough is characterized by high fecal and nutrient inputs, high turbidity, and low dissolved oxygen concentrations. During the summer, there is low flow. There is a dam at the mouth of the slough with twelve 4 ft. diameter outfall pipes that have one-way hinged tide gates. Upstream water flows out of Joe Leary Slough when water height in Padilla Bay is lower than water height in Joe Leary Slough (i.e. ebbing tide and low water). The bottom of the slough is composed of very soft sediment. This site is characterized by fully marine water ranging in salinity 23 to 32 PSU when the tide gates are closed and by water that is fully fresh (0.5 PSU) when the tide gates are open. The switch from marine to fresh water and vice versa occurs rapidly (< 1 hour) each time there is a tide change. The latitude/longitude were measured with a handheld GPS unit with an accuracy of ± 6.7 m.

Bayview Channel Site: (48° 29' 46.1" N; 122° 30' 7.61" W) Bayview Channel, a major Padilla Bay tributary/distributary, floods and drains intertidal flats including eelgrass beds, mats of macroalgae, and flats without macro-vegetation. The datalogger is located in a tributary channel to Bayview Channel. The tributary drains predominately eelgrass (*Zostera marina* and *Z. japonica*) covered intertidal flats. Bottom sediments beneath the deployment site are fine silt and clay overlying sand. Depth at this site is –1.5 m (depth below MLLW). Pollutants entering the bay include with general non-point source, agricultural non-point source, and fecal coliform bacteria from agriculture, failing septic tanks and wildlife. The latitude/longitude were measured with a Trimble GeoExplorer II and differentially corrected with post processing providing a manufacturer's stated accuracy of ± 5 m.

Ploeg Channel Site: (48° 33' 22.76" N; 122° 31' 51.22" W) Ploeg Channel floods and drains intertidal flats at the north end of Padilla Bay that are comprised of intertidal flats with eelgrass beds (*Zostera marina* and *Z. japonica*) and intertidal flats without macro-vegetation in approximately equal amounts. Bottom sediments beneath the deployment site are fine silt. Depth at this site is –1.5 m (depth below MLLW). Pollutants entering the bay include general non-point source, agricultural non-point source, and fecal coliform bacteria from agriculture, failing septic tanks and wildlife. The latitude/longitude were measured with a Trimble GeoExplorer II and differentially corrected with post processing providing a manufacturer's stated accuracy of ± 5 m.

Gong Site: (48° 33' 29.88" N; 122° 34' 21" W) The Gong site is located at –18 m water depth on a gradually sloping bottom (from –1 m to –75 m over 2 km) in the strait between Samish and Guemes Islands. Water in the strait flows north and south with tidal currents, the net water movement is apparently south toward the inlet to Guemes Channel. Water from the strait flows onto the intertidal flats in the northern part of Padilla Bay with each tidal cycle. Bottom sediments are mud. YSI 6600 and EXO 2 sondes are deployed near the surface at this site 0.5 m below the water surface. The only apparent pollution sources are the general sources of pollution to the Strait of Georgia and Northwest Straits. The latitude/longitude were measured with a Trimble GeoExplorer II and differentially corrected with post processing providing a manufacturer's stated accuracy of ± 5 m.

6) Data collection period –

Ploeg

Deploy Date	Deploy Time	Retrieve Date	Retrieve Time	Sonde Model Number (Nickname)	pH Model Number	roxDO Model Number	Turb Model Number	Cond Model Number
12/11/2013	10:15	1/8/2014	9:30	6600EDS (Belle)	6589	6150	6136	6560
1/8/2014	9:45	2/6/2014	9:45	6600EDS ()	6589	6150	6136	6560
2/6/2014	10:00	2/21/2014	10:15	6600EDSV2 ()	6589	6150	6136	6560
2/21/2014	10:30	3/12/2014	13:00	6600EDS ()	6589	6150	6136	6560
3/12/2014	13:30	4/2/2014	8:45	6600EDS ()	6589	6150	6136	6560
4/2/2014	9:00	4/23/2014	11:00	6600EDS (Monte)	6589	6150	6136	6560
4/23/2014	11:15	5/20/2014	9:00	6600EDS (Prince)	6589	6150	6136	6560
5/20/2014	9:15	6/4/2014	8:45	6600EDS (Belle)	6589	6150	6136	6560
6/4/2014	11:00	6/18/2014	8:45	6600EDS (Felix)	6589	6150	6136	6560
				6600EDSV2 (Mr			AF	
6/18/2014	9:00	7/8/2014	13:00	Krabs)	6589	6150	6136	6560
7/8/2014	13:15	8/14/2014	10:00	6600EDS (Monte)	6589	6150	6136	6560
8/14/2014	10:30	9/4/2014	10:00	6600EDSV2 (Sloth)	6589	6150	6136	6560
9/4/2014	10:30	9/9/2014	8:45	6600EDS (Felix)	6589	6150	6136	6560
9/9/2014	9:00	10/1/2014	9:45	6600EDSV2 (Sloth)	6589	6150	6136	6560
10/1/2014	10:15	10/29/2014	10:30	6600EDS (Belle)	6589	6150	6136	6560
10/29/2014	11:00	11/5/2014	10:00	6600EDS (Devo)	6589	6150	6136	6560
				6600EDSV2				
11/5/2014	10:15	11/19/2014	9:45	(Gargamel)	6589	6150	6136	6560
11/19/2014	10:15	12/17/2014	10:45	6600EDS (Devo)	6589	6150	6136	6560
12/17/2014	11:15	1/14/2015	9:45	6600EDSV2 (Buffy)	6589	6150	6136	6560

Bayview

Deploy Date	Deploy Time	Retrieve Date	Retrieve Time	Sonde Model Number (Nickname)	pH Model Number	roxDO Model Number	Turb Model Number	Cond Model Number
12/11/2013	10:45	1/8/2014	8:30	6600EDSV2 (Sloth)	6589	6150	6136	6560
1/8/2014	9:00	2/6/2014	9:00	6600EDSV2 ()	6589	6150	6136	6560
2/6/2014	9:30	3/12/2014	13:30	6600EDS ()	6589	6150	6136	6560
3/12/2014	13:45	4/2/2014	8:15	6600EDSV2 ()	6589	6150	6136	6560
4/2/2014	8:30	4/23/2014	10:30	6600EDS (Belle)	6589	6150	6136	6560
4/23/2014	10:45	5/20/2014	8:30	6600EDS (Devo)	6589	6150	6136	6560
							AF	
5/20/2014	9:00	6/4/2014	10:00	6600EDSV2 (Mr Krabs)	6589	6150	6136	6560

6/4/2014	11:30	6/18/2014	8:00	6600EDS (Monte)	6589	6150	6136	6560
6/18/2014	8:30	7/8/2014	14:00	6600EDSV2 (Sloth)	6589	6150	6136	6560
7/8/2014	14:15	8/14/2014	11:15	6600EDS (Felix)	6589	6150	6136	6560
8/14/2014	11:30	9/4/2014	8:15	6600EDS (Prince)	6589	6150	6136	6560
9/4/2014	8:45	10/1/2014	10:15	6600EDSV2 (Buffy)	6589	6150	6136	6560
10/1/2014	12:30	10/29/2014	12:00	6600EDSV2 (Gargamel)	6589	6150	6136	6560
10/29/2014	12:15	11/19/2014	10:45	6600EDS (Monte)	6589	6150	6136	6560
11/19/2014	11:00	12/17/2014	11:30	6600EDS (Felix)	6589	6150	6136	6560
							AF	
12/17/2014	12:00	1/14/2015	11:00	6600EDSV2 (Mr Krabs)	6589	6150	6136	6560

Gong

Deploy Date	Deploy Time	Retrieve Date	Retrieve Time	Sonde Model Number (Nickname)	pH Model Number	roxDO Model Number	Turb Model Number	Cond Model Number
12/11/2013	10:00	1/8/2014	9:00	6600EDS (Felix)	6589	6150	6136	6560
1/8/2014	9:15	2/6/2014	10:00	6600EDSV2 ()	6589	6150	6136	6560
2/6/2014	10:15	3/4/2014	11:00	6600EDS ()	6589	6150	6136	6560
3/4/2014	11:15	4/2/2014	9:15	6600EDS ()	6589	6150	6136	6560
4/2/2014	9:30	4/23/2014	11:30	6600EDSV2 (Henry)	6589	6150	6136	6560
4/23/2014	11:45	5/20/2014	9:30	6600EDSV2 (Sloth)	6589	6150	6136	6560
5/20/2014	9:45	6/4/2014	8:00	6600EDSV2 (Gargamel)	6589	6150	6136	6560
6/4/2014	8:30	6/18/2014	9:00	6600EDS (Devo)	6589	6150	6136	6560
6/18/2014	9:15	7/8/2014	12:30	6600EDS (Chucky)	6589	6150	6136	6560
7/8/2014	12:45	8/14/2014	9:15	6600EDSV2 (Buffy)	6589	6150	6136	6560
8/14/2014	9:30	9/4/2014	9:30	6600EDSV2 (Henry)	6589	6150	6136	6560
9/4/2014	9:45	10/1/2014	9:15	6600EDSV2 (Mr Krabs)	6589	6150	AF 6136	6560
10/1/2014	9:30	10/29/2014	9:45	6600EDS (Felix)	6589	6150	6136	6560
10/29/2014	10:00	11/19/2014	9:15	6600EDSV2 (Sloth)	6589	6150	6136	6560
11/19/2014	9:45	12/17/2014	9:45	EXO2 (Thing 1)	599702	299100	599101	599870
12/17/2014	10:15	1/14/2015	9:15	EXO2 (Thing 2)	599702	599100	599101	599870

Joe Leary Estuary

Deploy Date	Deploy Time	Retrieve Date	Retrieve Time	Sonde Model Number (Nickname)	pH Model Number	roxDO Model Number	Turb Model Number	Cond Model Number
12/11/2013	12:15	1/8/2014	11:15	6600EDS (Prince)	6589	6150	6136	6560
1/8/2014	11:30	2/6/2014	14:30	6600EDS ()	6589	6150	6136	6560
2/6/2014	15:00	3/4/2014	14:15	6600EDSV2 ()	6589	6150	6136	6560
3/4/2014	14:30	4/2/2014	11:00	6600EDS ()	6589	6150	6136	6560

4/2/2014	11:15	4/23/2014	7:15	6600EDS (Chucky)	6589	6150	6136	6560
4/23/2014	7:30	5/20/2014	12:30	6600EDS (Felix)	6589	6150	6136	6560
				6600EDSV2				
5/20/2014	12:45	6/4/2014	13:15	(Henry)	6589	6150	6136	6560
				6600EDSV2				
6/4/2014	13:30	6/17/2014	12:00	(Buffy)	6589	6150	6136	6560
				6600EDSV2				
6/17/2014	12:15	7/8/2014	9:00	(Henry)	6589	6150	6136	6560
7/8/2014	9:15	8/14/2014	7:15	6600EDS (Devo)	6589	6150	6136	6560
8/14/2014	7:30	9/4/2014	13:30	6600EDS (Chucky)	6589	6150	6136	6560
9/4/2014	13:45	10/1/2014	7:30	6600EDS (Monte)	6589	6150	6136	6560
				6600EDSV2				
10/1/2014	7:45	10/29/2014	8:00	(Henry)	6589	6150	6136	6560
10/29/2014	8:30	11/21/2014	9:30	6600EDS (Monte)	6589	6150	6136	6560
11/21/2014	10:00	12/17/2014	14:00	6600EDS (Belle)	6589	6150	6136	6560
12/17/2014	14:15	1/14/2015	14:00	6600EDS (Prince)	6589	6150	6136	6560

7) Distribution –

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

Requested citation format:

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

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 <http://cdmo.baruch.sc.edu/>. Data are available in comma delimited format.

8) Associated researchers and projects

The Padilla Bay NERR collects weather parameters that include Temperature, Relative Humidity, Barometric Pressure, Wind Speed, Wind Direction, LI-COR and Precipitation. The weather station is located at the Southern end of Padilla Bay and can be viewed in near real-time at <http://cdmo.baruch.sc.edu/>. In addition, water samples are collected at all 4 YSI sites and are filtered for nutrients and chlorophyll a. *See Meteorological and Nutrient data at <http://cdmo.baruch.sc.edu/> for more information.

Outside of the required parts of the System Wide Monitoring Program the Padilla Bay NERR also collects zooplankton samples, annual information on eelgrass distribution and characteristics along permanent transect, and performs an annual sampling as a participating member of the Multi-Agency Rocky Intertidal Network (MARINe; <http://www.marine.gov/>).

II. Physical Structure Descriptors

9) Sensor specifications –

PDB NERR deployed 6600EDS sondes and 6600EDS sondes that were upgraded to the 6600 V2 sondes in 2012. Two of the sondes used at PDB are medium depth sondes while the rest are shallow depth sondes. All of the sondes are configured the same way.

YSI 6600EDS and V2 data sondes:

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

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

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

Sensor Type: Optical probe w/ mechanical cleaning
Model#: 6150 ROX
Range: 0 to 500% air saturation
Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500%
air saturation: +/- 15% or reading
Resolution: 0.1% air saturation

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 or Medium (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
Units: pH units
Sensor Type: Glass combination electrode
Model#: 6589FR
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 EXO Sonde:

Parameter: Temperature
Units: Celsius (C)
Sensor Type: Thermistor
Model#: 599870-01
Range: -5 to 50 C
Accuracy: -5 to 35: +/- 0.01, 35 to 50: +/- .005
Resolution: 0.01 C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: 4-electrode cell with autoranging
Model#: 599870-01
Range: 0 to 200 mS/cm
Accuracy: 0 to 100: +/- 0.5% of reading or 0.001 mS/cm; 100 to 200: +/- 1% of reading
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependant)

Parameter: Salinity
Units: practical salinity units (psu)/parts per thousand (ppt)
Sensor Type: Calculated from conductivity and temperature
Range: 0 to 70 psu
Accuracy: +/- 1.0% of reading or 0.1 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 or medium (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 (0.04 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH

Units: pH units

Sensor Type: Glass combination electrode

Model#: 599702(wiped)

Range: 0 to 14 units

Accuracy: +/- 0.01 units within +/- 10° of calibration temperature, +/- 0.02 units for entire temperature range

Resolution: 0.01 units

Parameter: Turbidity

Units: formazin nephelometric units (FNU)

Sensor Type: Optical, 90 degree scatter

Model#: 599101-01

Range: 0 to 4000 FNU

Accuracy: 0 to 999 FNU: 0.3 FNU or +/-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

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

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 can be corrected.

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

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

Salinity Units Qualifier:

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

Turbidity Qualifier:

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

Chlorophyll Fluorescence Disclaimer:

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

10) Coded variable definitions –

Sampling station:	Sampling site code:	Station code:
Bayview Channel	BY	pdbbywq
Ploeg Channel	BP	pdbbpwq
Joe Leary Estuary	JE	pdbjewq
Gong Surface	GS	pdbgsqw

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 Depth collected from surface or near surface sonde
- 3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
- 4 Historical Data: Pre-Auto QAQC
- 5 Corrected Data

12) QAQC code definitions –

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

General Errors

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

Corrected Depth/Level Data Codes

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

Sensor Errors

SBO	Blocked optic
SCF	Conductivity sensor failure
SCS	Chlorophyll spike
SDF	Depth port frozen
SDG	Suspect due to sensor diagnostics
SDO	DO suspect
SDP	DO membrane puncture
SFD	Depth from a surface or near surface sonde deployed from a floating platform, does not reflect the depth of the water column or tidal change
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
SXD	Depth from a surface or near surface sonde deployed at a fixed depth, offset to substrate may be applied

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

Ploeg

Deploy Date	Sonde Nickname	SpCond	ROXDO1	ROXDO2	pH7	pH10	Turb	Turb	Depth
12/11/2013	Belle	50.94	101.7	100.22	7.02	10.00	0.0 (0.0)	125.0(126.0)	0.061
1/8/2014		49.88	100.9	100.03	7.07	10.07	0.1(0.0)	125.2(126.0)	0.117
2/6/2014		51.05	101.4	100.97	7.03	10.04	-0.2(0.0)	125.5(126.0)	0.091
2/21/2014		49.58	100.6	101.26	7.04	10.03	0.1(0.0)	125.0(126.0)	0.056
3/12/2014		49.70	100.2	99.56	7.07	10.03	0.3(0.0)	125.9(126.0)	-0.377
4/2/2014	Monte	49.66	74.9	98.59	7.02	10.01	0.3(0.0)	126.4(126.0)	-0.123
4/23/2014	Prince	49.36	3.7	100.43	7.07	10.03	0.1(0.0)	125.5(126.0)	0.112
5/20/2014	Belle	49.78	46.1	100.46	7.02	10.02	0.6(0.0)	122.8(126.0)	0.109
6/4/2014	Felix	50.05	88.6	100.26	7.04	10.03	0.1(0.0)	125.2(126.0)	0.083
6/18/2014	Mr Krabs	49.54	96.3	100.30	7.03	9.97	0.2(0.0)	125.0(126.0)	0.002
7/8/2014	Monte	49.61	100.8	100.09	7.07	10.05	-0.1(0.0)	125.7(126.0)	0.026

8/14/2014	Sloth	49.70	101.1	100.36	7.03	10.02	0.2(0.0)	125.4(126.0)	0.073
9/4/2014	Felix	49.86	101.4	100.26	7.00	9.97	0.3(0.0)	124.5(126.0)	0.308
9/9/2014	Sloth	50.19	101.3	100.86	7.07	9.98	0.0(0.0)	126.3(126.0)	0.096
10/1/2014	Belle	49.95	99.7	99.89	7.04	10.02	0.1(0.0)	125.8(126.0)	-0.056
10/29/2014	Devo	*sonde leaked and could not be calibrated							
11/5/2014	Gargomel	50.89	99.5	100.03	7.00	10.04	0.1(0.0)	126.0(126.0)	-0.048
11/19/2014	Devo	*sonde leaked and could not be calibrated							
12/17/2014	Buffy	49.18	101	100.66	7.04	10.04	0.3(0.0)	125.9(126.0)	0.042

Bayview

Deploy Date	Sonde Nickname	SpCond	ROXDO1	ROXDO2	pH7	pH10	Turb	Turb	Depth
1/8/2014		50.00	102.00	100.03	7.05	10.05	0.2(0.0)	125.6(126.0)	0.108
2/6/2014		50.72	100.90	101.26	7.02	10.01	0.0(0.0)	124.2(126.0)	0.047
3/12/2014		49.94	101.10	99.56	7.03	10.01	0.2(0.0)	126.1(126.0)	0.011
4/2/2014	Belle	49.98	99.00	98.59	7.05	10.02	0.1(0.0)	124.8(126.0)	-0.133
4/23/2014	Devo	49.91	102.30	100.36	7.05	9.99	0.1(0.0)	125.2(126.0)	0.115
5/20/2014	Mr Krabs	49.53	103.80	100.46	7.06	10.03	0.5(0.0)	125.1(126.0)	0.105
6/4/2014	Monte	49.62	100.40	100.26	7.02	10.02	0.1(0.0)	125.1(126.0)	0.052
6/18/2014	Sloth	49.01	100.30	100.30	7.05	10.02	0.4(0.0)	124.8(126.0)	0.004
7/8/2014	Felix	49.92	101.10	100.06	7.02	10.02	-0.3(0.0)	126.1(126.0)	-0.007
8/14/2014	Prince	49.63	103.90	100.36	7.03	10.01	637.0(0.0)	probe failure	0.074
9/4/2014	Buffy	probe failure	30.20	100.86	7.02	9.24	0.7(0.0)	198.0(126.0)	0.152
10/1/2014	Gargomel	49.83	100.80	99.79	7.03	10.01	0.1(0.0)	124.7(126.0)	-0.073
10/29/2014	Monte	50.05	100.80	100.03	7.01	10.02	0.2(0.0)	125.0(126.0)	0.029
11/19/2014	Felix	49.96	99.90	99.93	7.05	10.03	0.0(0.0)	124.8(126.0)	0.031
12/17/2014	Mr Krabs	49.85	103.90	100.63	7.12	10.11	0.4(0.0)	125.3(126.0)	0.039

Gong

Deploy Date	Sonde Nickname	SpCond	ROXDO1	ROXDO2	pH7	pH10	Turb	Turb	Depth
1/8/2014		49.95	102.10	100.06	6.99	9.99	0.1(0.0)	125.4(126.0)	0.14
2/6/2014		50.02	99.90	99.16	7.01	10.00	0.1(0.0)	124.9(126.0)	-0.136
3/4/2014		49.47	99.90	99.56	7.07	10.02	0.2(0.0)	124.8(126.0)	-0.08
4/2/2014	Henry	49.02	100.30	98.99	7.07	10.06	0.4(0.0)	125.3(126.0)	-0.025
4/23/2014	Sloth	48.42	101.30	100.60	6.97	9.56	0.3(0.0)	125.1(126.0)	0.097
5/20/2014	Gargomel	49.75	100.50	100.46	7.02	10.00	0.8(0.0)	124.3(126.0)	0.108
6/4/2014	Devo	49.93	100.90	100.26	6.96	9.96	0.1(0.0)	125.6(126.0)	0.051
6/18/2014	Chucky	45.59	100.60	100.30	7.06	10.01	0.3(0.0)	124.7(126.0)	0.003
7/8/2014	Buffy	48.49	101.00	100.09	6.91	9.85	0.3(0.0)	126.4(126.0)	0.024
8/14/2014	Henry	49.62	101.00	100.33	7.04	10.03	0.1(0.0)	124.5(126.0)	0.072
9/4/2014	Mr Krabs	49.14	102.00	100.80	7.02	9.94	0.1(0.0)	126.1(126.0)	0.15

10/1/2014	Felix	49.73	99.80	99.90	7.05	10.01	0.2(0.0)	125.3(126.0)	-0.256
10/29/2014	Sloth	49.84	101.00	100.06	7.00	9.98	0.1(0.0)	125.1(126.0)	0.035
11/19/2014	Thing 1	51.64	102.90	99.82	7.14	10.18	0.45(0.0)	124.06(124.0)	-0.016
12/17/2014	Thing 2	49.45	101.00	100.63	7.07	10.11	0.27(0.0)	123.77(124.0)	0.009

Joe Leary Estuary

Deploy Date	Sonde Nickname	SpCond	ROXDO1	ROXDO2	pH7	pH10	Turb	Turb	Depth
1/8/2014		49.51	100.70	100.06	7.04	10.04	1.3(0.0)	125.9(126.0)	0.144
2/6/2014		50.47	sonde failure		6.98	9.95	0	904.0(126.0)	-0.125
3/4/2014		49.55	100.00	99.56	7.07	10.02	0.3(0.0)	124.4(126.0)	-0.067
4/2/2014	Chucky	49.82	99.50	99.06	7.04	10.02	0.4(0.0)	125.0(126.0)	-0.098
4/23/2014	Felix	49.59	100.90	100.43	7.07	10.00	0.3(0.0)	126.3(126.0)	0.348
5/20/2014	Henry	49.78	101.10	100.46	6.94	9.92	0.4(0.0)	124.7(126.0)	0.096
6/4/2014	Buffy	49.60	100.40	100.26	6.99	10.00	-0.3(0.0)	126.1(126.0)	0.043
6/17/2014	Henry	49.65	100.00	100.30	7.05	10.02	0.2(0.0)	124.6(126.0)	-0.006
7/8/2014	Devo	48.60	101.00	100.09	7.11	9.96	0.4(0.0)	125.1(126.0)	0.051
8/14/2014	Chucky	49.40	100.90	100.36	7.08	10.03	0.3(0.0)	125.1(126.0)	0.066
9/4/2014	Monte	49.90	101.20	100.76	7.06	10.03	0.1(0.0)	125.5(126.0)	0.154
10/1/2014	Henry	49.94	99.70	99.93	7.09	10.07	-0.1(0.0)	125.0(126.0)	-0.085
10/29/2014	Monte	50.10	98.80	99.06	7.13	10.14	0.2(0.0)	125.3(126.0)	-0.109
11/21/2014	Belle	49.62	100.80	99.89	7.05	10.05	0.0(0.0)	127.0(126.0)	0.013
12/17/2014	Prince	49.88	101.90	100.66	7.02	10.01	0.4(0.0)	126.3(126.0)	0.047

14) Other remarks/notes

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

Ploeg:

This site often collects large mats of debris (eelgrass, kelp etc), and while all attempts to monitor and remove the debris mats are made this should be taken into account when interpreting the data.

Some dissolved oxygen (mg/L and %) and pH data from 1/1/14 to 1/21/14 are marked as suspect. The data is real in that the probes were actually measuring these low values and were not due to a probe malfunction. However, it is not known if the anomaly is from a low DO event in the entire body of water or an event only taking place at the deployment site (i.e. biological fouling of the deployment structure or decaying detritus just below the sonde).

PH data from the 1/1/14 to 1/8/14 were marked suspect because this deployment was disjunct from the following deployment.

Dissolved oxygen data during the second quarter that is marked 1 CSM or -3 CSM has been suspected/rejected because a film likely from the algae *Saccharina latissima* is coating the probe membrane and causing very low DO. Although we cannot tell for sure when the affect begins the data is coded based on noticeable abnormal decreases in DO and abnormal deviations from pH data as well.

For the deployment beginning 9/4/14 the depth data is marked suspect because the calibration *may* have been slightly off. This does not appear to have made a noticeable difference in the data when comparing the data before and after however, the data should be interpreted with caution.

Gong:

On 06/26/2025 this dataset was updated to include updated QAQC flags and codes for the Gong Surface surface site at PDB reserve. The GS sonde is a surface sonde that is attached to a floating buoy. The sonde sits in a tube built into the buoy and there is a bolt at the bottom of the tube which sits 1 m below the surface, therefore the sonde's position does not change relative to the buoy. The depth data collected by the sonde reflects the depth the sonde is under the surface of the water. The buoy, and therefore sonde, experiences wave action, unlike the stable platform of the other sites. Any changes in depth are from barometric pressure changes (prior to correction) and wave action. The overall depth at the buoy location changes based on the fluctuation of the tide and ranges from 16 to 21m. The buoy is anchored to the bottom (~ 18 m) with a 13 ft helical anchor.

pH data during the deployment 1/8/14 to 2/6/14 was marked as 1 CSM because it was disjunct from the previous deployment. The cause is unknown.

Depth data from 1/12/14 at 22:00 to 2/6/14 were marked as 1 CSM because of the jump in data. This was probably due to some biofouling although none was noted when the instrument was retrieved.

Some specific conductivity and salinity data were marked as 1 CSM during the second quarter (4/15/14 – 7/8/14) of data because of biofouling that occurred. The biofouling is likely to be the cause of the overall decrease in the recorded data which resulted in the disjunction of the end of one deployment and the beginning of the next. However, the main drops in the data are likely to be real events caused by freshwater input from increased river flow and are also seen at Ploeg. The data should be interpreted with caution.

Salinity data for the deployment beginning 07/08/14 and ending 08/14/14 is marked as SPC CSM because the post calibration was quite low. However, the overall trends agree with both Bayview and Ploeg sites, and the end of the deployment data matches up with the beginning of the next deployment data. The data should be interpreted with caution.

For the deployment beginning 10/1/14 and ending 10/29/14 the depth data is marked suspect because the calibration may have been slightly off. This does not appear to have made a noticeable difference in the data when comparing the data before and after however, the data should be interpreted with caution.

Bayview:

This site often collects large mats of debris (eelgrass, kelp etc), and while all attempts to monitor and remove the debris mats are made this should be taken into account when interpreting the data.

PH data from 1/8/14 to 2/6/14 were marked as suspect because the data from this deployment were disjunct from the previous and following deployments. Data should be interpreted with caution.

Data from 10/1/14 are missing because of attempts to troubleshoot problems with the telemetry system.

pH data from the deployment beginning 11/19/14 and ending 12/17/14 was marked as suspect because the data was lower than the previous or following deployments. The post calibration was fine but the data should be interpreted with caution.

Joe Leary Estuary:

Salinity data from 8/22/14 6:30 to 9/11/14 15:30 is unusually high for an extended period of time. This could be a natural phenomenon or it could be from some kind of unknown disturbance (i.e. the tide gates not functioning properly). The data should be interpreted with caution.

Depth data on 11/23, 12/9, and 12/11 are marked CSM because of the variability in the data.