Waquoit Bay (WQB) **NERR Water Quality Metadata**
January – April 2024
Latest Update: 04/11/2025

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact the CDMO (cdmosupport@baruch.sc.edu) or reserve with any additional questions.

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

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  Waquoit, MA 02536
  Website: http://www.waquoitbayreserve.org

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2) Entry verification –

Deployment data are uploaded from the YSI data logger to a personal computer with Windows 7 or newer operating system. Files are exported from EcoWatch in a comma-delimited format (.CDF) , EcoWatch Lite in a comma separated file (CSV) or KOR Software in a comma separated file (CSV) 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.

3) Research objectives –

For the NERR System-Wide Monitoring Program (SWMP), the YSI EXO data loggers are programmed to record water quality parameters every 15 minutes. A total of four SWMP sites were located in the Waquoit Bay estuarine system during 2015. These four are: 1) Metoxit Point (MP), in operation since 1998, is located in the middle of Waquoit Bay's main basin; 2) Menauhant (MH), in operation since March 2001, is located adjacent to Eel Pond Inlet on Vineyard Sound – one of the two tidal inlets into the Waquoit Bay estuary; 3) Child's River (CR), in operation since May 2002, located near the head of the tidal section of Child's River— one of the two main surface fresh water sources to Waquoit Bay; and 4) Sage Lot (SL), in operation since May 2002, located in Sage Lot Pond—a tidal pond surrounded by salt marsh and barrier beach, possessing one of the bay's few remaining eelgrass stands.

The main purpose of the SWMP water quality monitoring program is to aid Waquoit Bay NERR in one of its priority missions - to perform as a natural laboratory and platform for coastal and estuarine research. The long term, continuous detailed monitoring of the estuary's basic hydro-physical parameters is an essential tool and context for any research activities located here. Besides this overarching mission, there are also several specific research interests. One primary issue for the Waquoit Bay ecosystem is the influence of anthropogenic induced alterations by nitrogen enrichment. Waquoit Bay receives nitrogen from several sources, including but not limited to septic systems (their leachate percolates into groundwater which then enters the bay), run off from roads, run off containing domestic and agricultural fertilizer and animal waste, and atmospheric sources. This elevated nitrogen loading to the bay has resulted in enhanced eutrophication that has contributed to the alteration of the bay's habitats. For example, thick mats of macroalgae now cover the bottom where eelgrass meadows thrived in the 1970's. Unfortunately, there are few definitive records of the bay's water quality conditions during that period, which makes it difficult to evaluate the rates of change. To facilitate future evaluation, long-term records from SWMP can be used to track water column conditions. Of particular interest, in this regard are measurements of dissolved oxygen (DO) and turbidity, as well as dissolved nitrogen and chlorophyll concentration (this data is available by contacting the reserve). Such records will facilitate evaluation of changes which may come about from a continuation of watershed alteration that result from current development patterns (i.e., non-sewered residential areas served by private septic systems typically consisting of septic tanks and leach fields) as well as non-industrial commercial development, such as golf courses, cranberry bogs, and retail shopping outlets. The records will be useful for evaluating the efficacy of remediation efforts intended to reduce the nitrogen loading from these sources to Waquoit Bay.

Another focus of long-term research interest is the detection of climate change and the determination of its effects on the estuarine environment. Characterizing the variability of the various water column parameters, such as their scale, magnitude, and frequency, is an important aspect of the estuarine ecosystem that is affected by climate change. Related to this focus is an interest in the impact of storms (hurricanes and northeasters) and other extreme meteorological events on the estuary. For example, what temperature and wind field thresholds exist that might bring about or trigger certain conditions within the bay? The observations recorded by the SWMP will allow for these types of studies.

4) Research methods –

Multi-parameter YSI EXO2 data loggers, hereafter referred to as sondes, are deployed at each permanent water quality monitoring station at the Waquoit Bay Reserve. Since in-situ instrumentation can only record conditions at a specific location, permanent monitoring stations for SWMP are chosen to be representative of the overall estuary. This is difficult in practice since estuaries by their very definition are coastal regions where large physical, chemical, and biological variations tend to occur in space and time, so that often no particular location within the system is "typical" of the overall system. Establishing several stations can overcome this problem, and as of 2002 four permanent stations were established in the Waquoit Bay estuaries. Our current SWMP stations are situated to represent, as much as possible, the diversity of the estuary and its inputs/outputs. Additional details concerning the station characteristics are discussed in the next section.

The YSI sondes measure and record ambient water temperature, specific conductivity (and calculate salinity), dissolved oxygen (mg/L and % saturated), turbidity (FNU), Chlorophyll-a (ug/L) water level (m), and pH at 15 minute intervals during deployment periods extending for approximately four weeks. Note that the pressure sensors currently in use are non-vented and so variations in atmospheric pressure are recorded as changes in water depth (atmospheric data are available from our SWMP meteorological station (as of January 2002) and other nearby meteorological observatories), so it is possible to make this correction to the depth data (approximately +1 cm of depth is equal to +1 mb of air pressure), for increased accuracy. Also, at the Metoxit Point site (from 12/2000 to present), Child's River site (from 3/2003 to present), Menauhant site (from 7/2006 to present), and our Sage Lot site (from 6/2006 to present) we have been using an optic chlorophyll fluorescence sensor.

Multi-parameter YSI sondes are deployed and retrieved every four weeks. The "old" sonde is retrieved, and a "new" replacement sonde is deployed immediately so that ideally no record gap occurs. The four-week deployment duration is constrained by a combination of battery life and fouling of the optic sensors during the warm summer months. Prior to deployment (usually within 24 hrs), each instrument is checked and its sensors re-calibrated using standard YSI (Operating Manual) protocols. Similarly, after a deployment, each sonde is brought back to the laboratory for a post-deployment check, data downloading, instrument and sensor cleaning. The conductivity sensors are calibrated with 50.00 mS/cm YSI standard. The pH sensors are calibrated with 7.0 and 10.0 pH standard solutions (2-point calibrations). The turbidity standard used is 126.0 NTU/124.0 FNU, and distilled water (DI) for 0 NTU/FNU. Temperature sensors are checked periodically against a calibrated mercury thermometer. The chlorophyll probe is calibrated on a 2-point calibration with distilled water (DI) and a Fluorescent Red Dye (Rhodamine WT) at a 0.5 mg/L concentration. See the Chlorophyll Qualifier in Sensor Specifications section below regarding chlorophyll fluorescence accuracy. As another check on instrument performance, in-situ measurements of water temperature, DO, salinity, specific conductance, and pH are made using a handheld YSI device (pre-December 2016: YSI 650; post-December 2016: YSI EXO1) at deployment/retrieval times. Deployment/retrieval in-situ data is available at the end of this document.

In July 2016, we upgraded the Metoxit Point site from the 6600-series sondes to the EXO2 sondes. In April 2017, the Childs River site was also upgraded from the 6600-series sondes to the EXO2 sondes. In December 2017, we upgraded the Menauhant site from the 6600-series to the EXO2 sondes. Sage Lot Pond transitioned to the EXO2 in July 2018.

Two types of silos house the YSI sondes during their deployment. One type for dock side stations (Menauhant and Childs River) and the other for open water stations away from shore structures (Metoxit Point and Sage Lot). The Menauhant site, located at a yacht club dock, is adjacent to a tidal inlet, and the Child's River site, located at commercial marina and boat yard, is adjacent to the upper reaches of a tidal river.

For open water, a two-part structure has been designed consisting of a submerged fixed tower and a separate removable silo apparatus that sleeves over the fixed tower. The Metoxit Point and Sage Lot silos are constructed so that the sonde's sensor package is 0.5 m off the bottom. The removable silo apparatus can be lifted on and off the tower for inspection, cleaning or other maintenance. The sondes are deployed into the removable silos consisting of open-ended vertically mounted 4" PVC pipe (each silo is perforated in its lower portion around the business end of the sonde). The fixed tower structure consists of a vertical reinforced concrete filled 3" PVC pipe about 1.3 meters in height extending upward from a 300 lb cast reinforced concrete base (30" in diameter and 6" thickness) anchored into the bottom by a reinforced concrete filled 4" PVC pipe about 1 m in length. The whole structure is somewhat reminiscent of large "child's toy top".

For dock-side locations, the silo apparatuses are a more typical type – a single PVC section (4" ID) mounted vertically onto a pier piling or bulkhead. The base of these silos is also ventilated with large holes (1.0" diameter). All silos are painted with antifouling paint at the beginning of the spring season, and periodically checked and scrubbed during the summer season.

A YSI WaterLog Storm 3 transmitter was installed at the Mehauhant (wqbmhwq) station on mm/dd/yy and transmits data to the NOAA GOES satellite, NESDIS ID #3B030074. (Where 3B030074 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 www.nerrsdata.org.

5) Site location and character –

The Waquoit Bay National Estuarine Research Reserve (WBNERR) is located in the northeastern United States on the southern coast of Cape Cod, Massachusetts. About 8,000 people maintain permanent residency

in Waquoit Bay's drainage area, which covers parts of the towns of Falmouth, Mashpee, and Sandwich. During summer months, the population swells 2-3 times with the greatest housing concentrations immediate to the coastline (water views and frontage). In addition, the upper portions of the watershed include a military base, Otis Air Force Base and the Massachusetts Military Reservation, portions of which have been designated by the EPA as Superfund sites due to past practices of dumping jet fuel and other volatile groundwater contaminants.

WBNERR's estuaries are representative of shallow tidal lagoons that occur from Cape Cod to Sandy Hook, New Jersey. WBNERR is within the northern edge of the Virginian biogeographic province, on the transitional border (Cape Cod) with the Acadian biogeographic province to the north and east. Like many embayments located on glacial outwash plains, Waquoit Bay is shallow (< 5 m), fronted by prominent barrier beaches (i.e., those of South Cape Beach State Park and Washburn Island), and backed by salt marshes and upland coastal forests of scrub pine and oak. Two narrow, navigable inlets, reinforced with granite jetties, pass through two barrier beaches to connect Waquoit Bay with Vineyard Sound to the south. A third shallow and generally un-navigable inlet opened through the Washburn Island barrier beach during Hurricane Bob in August 1991. This shallow inlet closed in February 2002.

Bottom sediments in the bay are organic rich (C organic conc. ~ 3-4%) silts and medium sands. Sediment cores obtained in summer of 2002 indicate that the depth of these estuarine sediments is up to 9 m thick in places. Dating work on these sediment cores suggests that the Waquoit Bay basin has been inundated by the sea for about 5000 years, and sediment accumulation rates were estimated to be between 2-10 mm/yr, with higher rates in the upper 1 m of sediments (Maio et al. 2016). Thick (up to 0.3 m) macroalgae mats overlie much of the bottom of the bay, and largely consist of species *Cladophora vagabunda*, *Gracilaria tikvahiae*, and *Enteromorpha* spp. The dominant marsh vegetation in Waquoit Bay is *Spartina alterniflora* and *Spartina patens*. Dominant upland vegetation includes mixed forests of red oak, white oak, and pitch pine, and other shrubs and plants common to coastal New England. Land-use in the bay's watershed is about 60% natural vegetation, but the remaining land is largely residential housing, with some commercial (retail malls) development, and minor amounts of agriculture (~3%; e.g., cranberry bogs).

Dense housing developments cover the two peninsulas that form the western shore of the Waquoit Bay estuarine system. Although the developments are outside of the Reserve boundaries, dissolved nitrogen in discharge from the septic systems (via groundwater) and in fertilizer run-off from lawns has significant effects on the functioning of the Waquoit Bay ecosystem. These impacts have been a primary subject of study at the Reserve since its designation (1988). One outcome of this research has been the delineation of sub-watersheds within the overall drainage area for Waquoit Bay, of which WBNERR is a small part. This knowledge allows for the design of experiments based on the spatial variation of nutrient loading and other land-use related impacts.

At the northern end of the bay, an area comprising a separate sub-watershed, coastal bluffs of glacial till rise 30 feet above sea level. The northern basin of the bay, just below these bluffs, is its deepest area (approximately 3 m MLW), while much of the remainder of the bay is about 1.5 m. Bourne, Bog, and Caleb Ponds are freshwater kettle hole ponds on the northern-most shore of the bay. As components of the same sub-watershed, they have a common albeit minor freshwater outflow into the bay's northern basin via a narrow channel through a brackish marsh. To the east and south, other sub-watersheds surround several tidal and freshwater ponds, including Hamblin and Jehu Ponds, brackish salt ponds that are connected to the main bay by the tidal waters of Little and Great Rivers, respectively. The shorelines of the ponds are developed with residences that are occupied both seasonally and year round. Hamblin Pond and Little River are components of one sub-watershed, and Jehu Pond and Great River are elements of a separate sub-watershed. Further south lays Sage Lot Pond. It is in the least developed sub-watershed and contains a barrier beach and salt marsh ecosystem of the reserve's South Cape Beach State Park. To the east of Sage Lot Pond and within the same sub-watershed, lies the highly brackish Flat Pond. It receives minimal tidal flows of salt water from Sage Lot Pond through a narrow, excavated, and culverted channel. In the spring of 2008 two (2) channel culverts were replaced, one with a bridge and the second with a wider, less restrictive culvert to increase tidal flushing in the pond. The preponderance of the input to Flat Pond is groundwater and run off, both of which are likely

affected (e.g., nutrients, pesticides, bacteria) by an adjacent golf course and nearby luxury residential development.

The largest source of surface freshwater to Waquoit Bay is the Quashnet/Moonakis River. Although named "river", this and Child's River are more appropriately described as "streams" because of their small channels and discharge ~1.0 CFS. A component of yet another sub-watershed, the Quashnet River originates in Johns Pond situated north of the bay and traverses forests, cranberry bogs, residential areas, and the Quashnet Valley Golf Course before entering the bay near the southern "boundary" of the northern basin. ("Quashnet" applies to that portion of the river within the town of Mashpee, and "Moonakis" refers to the brackish estuary at the river's mouth, in the town of Falmouth. Quashnet will be used hereafter to refer to the entire river.) The Quashnet River's tidal portion has enough coliform bacteria to cause it to be closed to shell fishing most of the time. The source(s) of these bacteria (human or avian) is currently unknown.

The Childs River is the second largest input of surface freshwater to the bay. A component of another sub-watershed, it runs through densely developed residential areas. The Childs River sub-watershed receives the highest nitrogen loading and is the largest nitrogen contributor to the Waquoit Bay system of all the sub-watersheds. In the upper tidal portions of the river the highest nutrient and chlorophyll levels and the lowest dissolved oxygen readings of any region in the bay have been recorded and so this location represents an end-member for looking at anthropogenic inputs and impacts on the system. Another, albeit smaller, source of freshwater to Waquoit Bay is the discharge of Red Brook through brackish marshlands into Hamblin Pond. Additional freshwater enters the bay elsewhere through groundwater seepage (perhaps up to 50% of all freshwater input into the bay), precipitation, and the flows of smaller brooks. There is relatively little surface water runoff entering directly into the bay due to the high percolation rates of Cape Cod's coarse, sandy soils.

Knowledge of the homo/heterogeneity of the water masses in Waquoit Bay was originally derived from measurements made by reserve staff and from data obtained by the reserve's volunteer water quality monitoring group, the Waquoit BayWatchers who have collected depth profiles of Waquoit Bay water quality since 1993. Subsequent research by reserve staff has revealed that lateral mixing has considerable influence because tidal currents follow a general course through the bay. This results in an overall structure to horizontal patterns of water quality characteristics. The pattern it produces is a gyre in the central portion of the main bay whereby currents follow a generally counterclockwise flow around a central area that exhibits reduced exchange with the remainder of the bay. The flushing rate within the gyre is diminished when compared with other more peripheral areas of the bay. The location of the gyre meanders slightly, apparently under the influence of tides and wind. Due to the shallow conditions, restricted tidal inlets, and low amplitude tidal forcing of Vineyard Sound here (tides are semi-diurnal with a range ~1 m) water levels in the bay are also strongly influenced by wind forcing. Southerly winds increase tidal heights and advance the phase of the flood and retard the phase of ebb. Northerly winds have the opposite effect.

Site name	Metoxit Point (MP)
Latitude and longitude	*41° 34' 8.04" N, 70° 31' 17.76" W*
Tidal range *(meters)*	~ 0.90 m (based on 2014-2016 data)
Salinity range *(psu)*	13.7 – 32.1 (based on 2014 data)
Type and amount of freshwater input	
Water depth (*meters, MLW*)	2.0 (estimated)
Sonde distance from bottom (*meters*)	~ 0.5 m

Bottom habitat or type	Soft organic rich anoxic mud overlain by thick algal (Cladophora) mats
Pollutants in area	
Description of watershed	This site is located in the main basin of Waquoit Bay, and was selected to be within or near the outer regions of the gyre (described above), and more or less represents "typical" water mass conditions and residence times for the bay. The station is approximately a half mile from shore, well flushed and mixed by tides, and is exposed to strong fetch from the south. Because of this, it has been observed that under sustained southerly winds (over 20 kts), this site experiences elevated turbidity due to sediment suspension.

Site name	Menauhant Yacht Club (MH)
Latitude and longitude	*41° 33' 9.36" N, 70° 32' 54.60" W*
Tidal range *(meters)*	1.55 (based on 2014 – 2016 data)
Salinity range *(psu)*	23.3 – 32.5 (based on 2022 data)
Type and amount of freshwater input	
Water depth (*meters, MLW*)	1.1 (estimated)
Sonde distance from bottom (*meters*)	0.5
Bottom habitat or type	Sands and gravels
Pollutants in area	
Description of watershed	The Menauhant station, installed at a dock piling in March 2001, is located within the Eel Pond Inlet at the Menauhant Yacht Club docl. Eel Pond Inlet is the westernmost of the two main tidal inlets into the Waquoit bay system. Entering waters represent the marine endmember while the outflows represent the final product of estuarine water mass modification and export to shelf waters. Due to turbulent tidal flow within the inlet, conditions are vertically well-mixed, and the site can be maintained year-round even through ice-over conditions affecting the rest of the bay. Strong south to southeast (onshore) winds tend to product turbidity events at this site from wave-induced suspension of fine sediments and organic material in the upstream near-shore zone. While these types of turbidity events are localized to windward near-shore areas in the bay, the transport of sediments at inlet mouths during such wind events seems to be a common, and perhaps dominant sedimentation process in the whole estuarine system.

Site name	Child's River (CR)
Latitude and longitude	41° 34' 48.47" N, 70° 31' 49.87" W
Tidal range *(meters)*	1.3 (based on 2014 – 2016 data)
Salinity range *(psu)*	14.8 – 30.6 (based on 2014 data)
Type and amount of freshwater input	
Water depth (meters, MLW)	1.2 (estimated)
Sonde distance from bottom (meters)	0.5
Bottom habitat or type	Fine, organic-rich muds
Pollutants in area	
Description of watershed	The Childs' River station (installed in May 2002), is located on a dock piling at East Falmouth Marina near the upper tidal reaches of the Child's River – one of the two main surface fresh water sources to Waquoit Bay (see general description of Waquoit Bay above). This location is very strongly stratified, characterized by a salt wedge with fresher river water overlying saline ocean water. Vertical salinity ranges can vary from 0-10 ppm at the surface to more than 30 ppm just 1m below. The sonde sensors are usually well-within the salt wedge portion of the water column. Nonetheless, this location is also our freshwater SWMP site. Child's River also represents the most terrigenous and anthropogenically-impacted SWMP site. Monthly water quality samples collected near this location for over a decade show very high chlorophyll concentrations during the warmer months and more recent dissolved nutrient records show very high nutrient loads. Boat traffic at the marina likely leads to increased turbidity during the boating season as well due to propwash disturbing the bottom sediments. During the winter (mid-December through March), marina staff install aerators at the end of each pier to prevent ice damage and restrict access to the site, so we do not deploy sondes or collect samples during these months.

Site name	Sage Lot (SL)
Latitude and longitude	41° 33'15.12" N, 70° 30'30.20" W
Tidal range *(meters)*	0.99 (based on 2014 – 2016 data)
Salinity range *(psu)*	24.22 – 32.28 (based on 2014 data)
Type and amount of freshwater input	
Water depth (*meters, MLW*)	1.15 (estimated)

Sonde distance from bottom (*meters*)	0.5
Bottom habitat or type	Fine organic-rich muds
Pollutants in area	
Description of watershed	The Sage Lot station was installed in May 2002 in a deep portion of Sage Lot Pond, a small sub-estuary of Waquoit Bay surrounded by salt marsh and the back side of a barrier beach. Its small watershed is the least developed of all of Waquoit Bay's sub-watersheds, making it theoretically the least impacted sub-estuary. Until the early 2020s, Sage Lot Pond possessed one of the few remaining eelgrass beds in the Waquoit Bay system. The site is considered to represent the opposite endmember of nutrient loading and human impacts in contrast to the Child's River site. However, Sage Lot Pond is hydrologically connected to an upstream brackish source – Flast Pond – via a series of tidal creeks, drainage ditches, and culverts. Flat Pond itself borders a country club and golf course, so it is possible that Sage Lot Pond would also be impacted. The marshes around Sage Lot pond are also bisected by a paved road and a walking trail, both of which see heavy volumes of vehicle and foot traffic during summer months.

Station code	SWMP status	Station name	Location	Active dates	Reason decommissioned	Notes
wqbcrwq	P	Child's River	41° 34' 48.47" N, 70° 31' 49.87" W	05/01/2002 00:00 -	NA	NA
wqbslwq	P	Sage Lot	41° 33' 15.12 N, 70° 30' 30.20 W	05/01/2002 00:00 -	NA	NA
wqbmhwq	P	Menauhant	41° 33' 9.36 N, 70° 32' 54.60 W	03/01/2001 00:00 -	NA	NA
wqbmpwq	P	Metoxit Point	41° 34' 8.04 N, 70° 31' 17.76 W	11/01/1998 00:00 -	NA	NA
wqbcbwq	P	Central Basin	41° 33' 55.80 N, 70° 31' 15.96 W	10/01/1995 00:00 - 12/01/1998 00:00	MP was considered more representative of the average water quality dynamics in Waquoit Bay. The MP site is located outside an anti-clockwise gyre, where water exchange is reduced.	
wqbctwq	P	Adjacent to Central Basin	41° 33' 55.80 N, 70° 31' 15.96 W	09/01/1998 00:00 - 10/01/1998 00:00	Considered a "rover" site. Never designed to be long-term	

wqbnbwq	P	North Basin	41° 34' 43.68 N, 70° 31' 25.32 W	10/01/1995 00:00 - 12/01/1997 00:00	Considered a "rover" site. Never designed to be long-term	
wqbnswq	P	North Basin Surface	41° 34' 43.68 N, 70° 31' 25.32 W	07/01/1997 00:00 - 12/01/1997 00:00	Considered a "rover" site. Never designed to be long-term	

6) Data collection period –

SWMP water quality monitoring in Waquoit Bay was initiated in 1995. Several different pilot sites (i.e., North Basin and Central Basin) were occupied for varying durations before settling on our first permanent long term site at Metoxit Point in summer 1998. The Menauhant site was our second permanent station and began operation in March 2001. Sage Lot and Childs River sites began operation in May 2002.

In 2021, year-round data were collected at the Childs River and the Menauhant station. Due to interference from an aerator system at the marina on Childs River, the winter data are marked as suspect. Due to icy conditions during the winter months, the Metoxit Point and Sage Lot stations were not occupied from mid-December 2020 through the last week in March 2021. In preparation for the winter (before the boats are pulled), the Metoxit Point and Sage Lot stations were removed on 12/10/2020 and 12/11/2020, respectively. The deployment dates and times for 2021 are indicated below: The staff at the Childs River marina planned a large construction project for October 2021. All docks and piers were removed while new bulkheads and other structures were built. We removed the Childs River sonde on October 4, 2021, the portion of the dock connecting it to the main walkway had already been removed. We surveyed the cross bar that holds the sonde at the bottom of the pipe and some construction marks on the remaining section of the dock. We are attempting to find out the elevations of the construction marks so that we can calculate the sonde's elevation in its original configuration.

Menauhant

Deploy Date	Deploy Time	Retrieve Date	Retrieve Time
1/09/2024	10:45	02/01/2024	12:30
02/01/2024	12:45	2/20/2024	11:30
2/20/2024	11:45	02/26/2024	14:45
02/26/2024	15:00	03/18/2024	14:45
03/18/2024	15:00	04/09/2024	10:30
04/09/2024	10:45	05/06/2024	15:15
05/06/2024	15:30	06/05/2024	11:45
06/05/2024	12:00	07/15/2024	11:45
07/15/2024	12:00	08/19/2024	15:15
08/19/2024	15:30	09/18/2024	14:00
09/18/2024	14:15	10/23/2024	12:30
10/23/2024	12:45	11/20/2024	13:00
11/20/2024	13:15	12/11/2024	09:30
12/11/2024	09:45	01/02/2025	11:30

Metoxit Point

Deploy Date	Deploy Time	Retrieve Date	Retrieve Time

07/07/2024	15:15	06/04/2024	11:00
06/04/2024	11:15	07/16/2024	08:15
07/16/2024	08:30	08/20/2024	12:30
08/20/2024	13:30	09/18/2024	13:00
09/18/2024	13:15	10/24/2024	09:45
10/24/2024	10:00	12/04/2024	09:45

Child's River

Deploy Date	Deploy Time	Retrieve Date	Retrieve Time
05/17/2024	15:30	06/20/2024	12:15
06/20/2024	12:30	07/25/2024	07:45
07/25/2024	08:00	09/03/2024	15:30
09/03/2024	14:45	10/08/2024	09:16
10/08/2024	09:16	11/06/2024	14:00
**11/06/2024	14:15	12/02/2024	14:15

** A sonde was deployed, but the data returned was unusable and is not included here.

Sage Lot

Deploy Date	Deploy Time	Retrieve Date	Retrieve Time
05/02/2024	14:15	06/04/2024	08:30
06/04/2024	08:45	07/08/2024	10:15
07/08/2024	10:30	08/12/2024	14:40
08/12/2024	14:45	9/17/2024	08:15
09/17/2024	08:30	10/25/2024	08:58
10/25/2024	09:05	12/02/2024	13:45
12/02/2024	13:45	01/06/2025	15:15

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 processed 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 2024.

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. Data are available in comma delimited format.

8) Associated researchers and projects –

As part of the SWMP long-term monitoring program, XXX NERR also collects 15-minute meteorological data and monthly grab and diel samples for nutrient/pigment data which may be correlated with this water quality dataset. These data are available at www.nerrsdata.org.

Waquoit BayWatchers:

The Reserve has carried out a volunteer-based water quality monitoring program since 1993 called *BayWatchers*. Water quality measurements are carried out at 9 sites within Waquoit Bay estuary for the purposes of 1) constructing a long time series of water quality information to determine trends, as well as 2) providing a sentinel role to detect unusual changes and events. Monthly (October-May) and Bi-weekly (June-September) measurements are made year-round on a set schedule. Chl-*a* samples are processed and analyzed using Turner 10AU fluorometer at WBNERR. Dissolved inorganic nutrient samples are currently analyzed by the Provincetown Center for Coastal Studies (pre-2015 data was analyzed at the Woods Hole Oceanographic Institute). All data is processed and archived at WBNERR and is publicly available upon request.

A new field procedure was initiated in July 2007 and a ninth site was added at the south basin of Waquoit Bay at the first inlet buoy in the main channel. A change at this time was made from previous wet chemical measurements to utilizing hand-held YSI 85 meters to measure water temperature, salinity, and dissolved oxygen (% and mg/L). Each meter is calibrated each sampling period for dissolved oxygen. Measurements are taken at the surface (0.25m) and the bottom at each site. The bottom depth is recorded. Additionally, due to shallow depths at most sites, water clarity measurements with Secchi discs have been discarded for turbidity measurements.

Two bottles of water are now collected at each site for nutrients analysis, at approximately 0.25m below the surface, by locking the bottles into a hand-held apparatus. This new sampling procedure has helped in standardizing the depth sampled for all sites in our chemical analysis. The bottles are mounted to a pole and capped with rubber stoppers attached to a rope. When the bottles are lowered to a marked level (0.25m) on the apparatus, the rope is pulled and water enters the bottle. The cap is placed on the bottles and returned back to the lab for turbidity, chlorophyll, and nutrient analysis. Physical characterization of the site and sampling period are recorded each sampling date (time of sampling, weather conditions-sun/clouds/rain/fog, name of team members, etc) and any other observations are recorded

II. Physical Structure Descriptors

9) Sensor specifications –

YSI EXO Sonde:

Parameter: Temperature
Units: Celsius (C)
Sensor Type: Wiped probe; Thermistor
Model#: 599827
Range: -5 to 50 C
Accuracy: ±0.2 C
Resolution: 0.001 C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: Wiped probe; 4-electrode cell with autoranging

Model#: 599827
Range: 0 to 100 mS/cm
Accuracy: ±1% of the reading or 0.002 mS/cm, whichever is greater
Resolution: 0.0001 to 0.01 mS/cm (range dependent)

Parameter: Salinity
Units: practical salinity units (psu)/parts per thousand (ppt)
Model#: 599827
Sensor Type: Wiped probe; Calculated from conductivity and temperature
Range: 0 to 70 ppt
Accuracy: ±2% of the reading or 0.2 ppt, whichever is greater
Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 599100-01
Range: 0 to 500% air saturation
Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 5% or reading
Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)
Units: milligrams/Liter (mg/L)
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 599100-01
Range: 0 to 50 mg/L
Accuracy: 0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater
20 to 50 mg/L: +/- 5% of the reading
Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)
Units: feet or meters (ft or m)
Sensor Type: Stainless steel strain gauge
Range: 0 to 33 ft (10 m)
Accuracy: +/- 0.013 ft (0.004 m)
Resolution: 0.001 ft (0.001 m)

Parameter: pH
Units: pH units
Sensor Type: Glass combination electrode
Model#: 599701(guarded) or 599702(wiped)
Range: 0 to 14 units
Accuracy: +/- 0.1 units within +/- 10° of calibration temperature, +/- 0.2 units for entire temperature range
Resolution: 0.01 units

Parameter: Turbidity
Units: formazin nephelometric units (FNU)
Sensor Type: Optical, 90 degree scatter
Model#: 599101-01
Range: 0 to 4000 FNU
Accuracy: 0 to 999 FNU: 0.3 FNU or +/-2% of reading (whichever is greater); 1000 to 4000 FNU +/-5% of reading
Resolution: 0 to 999 FNU: 0.01 FNU, 1000 to 4000 FNU: 0.1 FNU

Parameter: Chlorophyll
Units: micrograms/Liter
Sensor Type: Optical probe
Model#: 599102-01
Range: 0 to 400 ug/Liter
Accuracy: Dependent on methodology
Resolution: 0.01 ug/L chl a, 0.1% FS

Depth Qualifier:
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:
Metoxit Point	MP	wqbmpwq
Menauhant	MH	wqbmhwq
Child's River	CR	wqbcrwq
Sage Lot Pond	SL	wqbslwq

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 datasonde, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an * below) can be applied to the entire record in the F_Record column.

General Errors

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

GSM	See metadata

Corrected Depth/Level Data Codes

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

Sensor Errors

SBO	Blocked optic
SCF	Conductivity sensor failure
SCS	Chlorophyll spike
SDF	Depth port frozen
SDG	Suspect due to sensor diagnostics
SDO	DO suspect
SDP	DO membrane puncture
SIC	Incorrect calibration / contaminated standard
SNV	Negative value
SOW	Sensor out of water
SPC	Post calibration out of range
SQR	Data rejected due to QAQC checks
SSD	Sensor drift
SSM	Sensor malfunction
SSR	Sensor removed / not deployed
STF	Catastrophic temperature sensor failure
STS	Turbidity spike
SWM	Wiper malfunction / loss

Comments

CAB*	Algal bloom
CAF	Acceptable calibration/accuracy error of sensor
CAP	Depth sensor in water, affected by atmospheric pressure
CBF	Biofouling
CCU	Cause unknown
CDA*	DO hypoxia (<3 mg/L)
CDB*	Disturbed bottom
CDF	Data appear to fit conditions
CFK*	Fish kill
CIP*	Surface ice present at sample station
CLT*	Low tide
CMC*	In field maintenance/cleaning
CMD*	Mud in probe guard
CND	New deployment begins
CRE*	Significant rain event
CSM*	See metadata
CTS	Turbidity spike
CVT*	Possible vandalism/tampering
CWD*	Data collected at wrong depth
CWE*	Significant weather event

13) Post deployment information –

Menauhant *(EXO2 deployed at this site)*

Date Checked	DO	Baro.	Depth	Depth	SpCond	pH 7	pH 10	Turb	Turb	Chl 0	Chl	Rhodamine
	100%	Pres.		Offset	50.00	7.00	10.00	DI	124.0	DI	Rhodamine	Std value
dd/mm/yyyy	%	mmHg	m	m	mS/cm			FNU	FNU	µg/L	µg/L	µg/L
01/09/2024	101.6	769.62	0.148	0.131	50.165	6.98	9.95	0.33	124.81	0.55	72.84	69.4
02/01/2024	100.5/100.4	760.48	0.012	0.007	49.92	6.96	9.93	0.34	123.6	0.02	75.35	69.9
02/20/2024	103.4/103.3	773.94	0.193	0.19	41.38	6.95	9.81	0.04	122.86	0.07	73.85	69.9
02/26/2024	NO POST-DEPLOYMENT DATA TAKEN. PROBE MALFUNCTION DURING DEPLOYMENT											
03/19/2024	100.2/100.2	752.35	-0.096	-0.104	49.82	7.00	9.95	0.32	124.79	0.00	64.12	71.1
04/09/2024	100.9/100.9	763.52	-0.162	0.048	49.87	6.85	9.88	0.00	123.9	0.25	71.19	69.5
05/07/2024	102.5/102.5	753.64	-0.083	-0.086	50.045	7.03	9.99	0.2	123.86	0.06	70.62	69.1
06/05/2024	99.8/99.8	758.45	-0.027	-0.021	49.80	7.12	10.13	-0.02	126.20	0.07	69.48	67.5
07/16/2024	100.0/99.9	757.17	-0.034	-0.038	49.94	6.99	10.07	0.52	123.42	0.12	68.05	65.0
08/20/2024	99.1/99.2	756.92	-0.056	-0.042	49.778	7.04	10.04	-0.45	118.0	0.51	65.64	63.9
09/19/2024	99.3/99.4	757.35	-0.03	-0.036	49.812	7.03	10.07	0.0	124.31	0.31	66.55	66.0
10/23/2024	99.6/99.5	761.46	0.022	0.02	50.149	7.09	10.05	0.05	123.83	0.05	66.3	68.5
11/20/2024	99.0/99.0	755.97	-0.161	-0.055	49.90	6.95	9.96	0.54	123.94	0.18	72.05	69
12/11/2024	99.6/99.6	752.15	-0.160	-0.107	49.998	6.99	9.97	0.08	124.4	0.03	62.05	68.9
01/02/2025	99.2/99.5	753.53	-0.09	-0.088	50.135	6.93	9.95	-0.27	123.35	0.04	71.09	69.2

Childs River *(EXO2 deployed at this site)*

Date Checked	DO	Baro.	Depth	Depth	SpCond	pH 7	pH 10	Turb	Turb	Chl 0	Chl	Rhodamine
	100%	Pres.		Offset	50.00	7.00	10.00	DI	124.0	DI	Rhodamine	Std value
dd/mm/yyyy	%	mmHg	m	m	mS/cm			FNU	FNU	µg/L	µg/L	µg/L
06/20/2024	87.0/90.1	768.35	0.114	0.114	47.25	7.08	10.07	0.08	124.54	0.25	65.4	66.7
07/25/2024	98.2/97.9	760.98	-0.121	0.013	50.015	7.10	10.11	0.07	14.51	0.1	70.66	67.8
09/03/2024	103.1/03.2	773.18	0.18	0.179	49.73	7.06	10.09	-0.6	115.0	0.05	66.0	67.0
10/08/2024	99.5/99.5	757.0	-0.029	-0.041	49.98	7.06	10.09	1.0	132.24	0.17	72.33	68.6
11/06/2024	97.6/97.9	758.36	0.007	-0.022	49.737	7.13	10.08	0.07	124.24	0.17	65.93	68.4
12/02/2024	33.7/33.7	764.94	0.12	0.067	49.715	7.03	9.97	0.46	124.68	-0.05	71.74	69.1

Metoxit Point *(EXO2 deployed at this site)*

Date Checked	DO	Baro.	Depth	Depth	SpCond	pH 7	pH 10	Turb	Turb	Chl 0	Chl	Rhodamine
	100%	Pres.		Offset	50.00	7.00	10.00	DI	124.0	DI	Rhodamine	Std value
dd/mm/yyyy	%	mmHg	m	m	mS/cm			FNU	FNU	µg/L	µg/L	µg/L
06/04/2024	-	763.53	-0.031	0.048	49.71	6.83	10.08	0.03	126.48	0.48	68.67	68.1
07/16/2024	104.4/104.5	757.17	-0.034	-0.038	49.992	6.95	10.12	1.18	123.55	0.85	68.54	64.9
08/20/2024	99.1/99.2	757.17	-0.03	-0.038	49.212	7.18	10.12	0.42	114.88	0.3	62.01	63.7
09/19/2024	99.6/99.6	757.64	-0.021	-0.032	49.955	7.01	10.01	-1.58	112.08	-0.16	66.68	66.2
10/24/2024	99.8/99.7	756.78	-0.038	-0.044	49.13	7.09	10.04	1.01	125.28	1.28	58.86	94.8
12/04/2024	99.9/99.8	764.64	0.158	0.063	49.95	7.02	10.01	-1.18	125.07	0.01	73.53	70

Sage Lot *(EXO2 deployed at this site)*

Date Checked	DO	Baro.	Depth	Depth	SpCond	pH 7	pH 10	Turb	Turb	Chl 0	Chl	Rhodamine
	100%	Pres.		Offset	50.00	7.00	10.00	DI	124.0	DI	Rhodamine	Std value
dd/mm/yyyy	%	mmHg	m	m	mS/cm			FNU	FNU	µg/L	µg/L	µg/L
06/04/2024	100.3/100.3	764.04	0.045	0.055	49.567	7.02	10.04	0.07	125.20	0.0	62.12	68.3
07/09/2024	104.5/104.5	761.24	0.023	0.017		7.06	10.03	0.07	124.01	0.04	62.2	65.3
08/13/2024	98.5/98.1	760.73	0.014	0.01	44.99	7.05	10.07	0.88	104.50	0.67	48.6	64.7
9/17/2024	102.2/102.2	766.78	0.109	0.092	50.043	7.08	10.10	0.6	123.29	-0.08	70.9	67.4
10/25/2024	99.3/99.3	762.22	-	0.03	49.19	7.08	10.03	0.57	128.55	0.33	67.45	68.8
12/02/2024	98.5/98.8	762.44	0.091	0.033	48.67	7.06	9.99	-0.28	124.05	0.44	79.33	69.2
01/07/2025	100.4/100.4	750.26	-0.103	-0.132	50.525	6.71	9.69	-0.33	123.41	-0.23	71.35	70.6

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.

NOTE 1: SMALL NEGATIVE TURBIDITY ANOMALIES:

Slight negative turbidity values sometimes occur because of small calibration offsets. Often these turbidity minimum values are between 0 and -2 NTU. All these small negative turbidity values (the minimum for a given deployment) should be considered to be within 2 NTU of the true datum for correction purposes. This data has been given a Flag Code of <1> and retained.

NOTE 2: BIOLOGICAL-RELATED TURBIDITY ANOMALIES:

This type of anomaly includes turbidity readings that are either outside of the normal range or spikes way above background and unrelated to increased sediment suspension or decreased water column clarity. We believe these records are real (and not sensor malfunction), although not reflective of actual water column turbidity. These extreme values are likely due to biological factors (such as small fish, crabs, or other marine organisms). Our criteria for flagging these data are single spikes (above rather constant background) over 50 NTU that are more than 10 times surrounding values. These readings were rejected <-3>[SQR].

NOTE 3: SUSPENSION EVENT RELATED TURBIDITY ANOMALIES:

This type of anomaly includes turbidity readings that were either outside the normal range, or spikes way above background that are related to elevated turbidity levels indicative of wind wave-induced suspension (at the Menauhant site typically where vegetation often re-circulates due to wind and tidal currents or gets caught on the sonde guard) or prop wash-related suspension events (at the Childs River site typically). We believe these are real (and not sensor malfunction), though not reflective of actual water column turbidity. These extreme values are likely due to large floating particles (i.e., seaweeds, detritus, etc.) suspended in the water column during storm events usually from strong southerly winds in the Waquoit Bay area (see end of section 5 for more detail on these events at this site). Our criteria for flagging these data are values over 100 NTU that are more than 5 times the magnitude of surrounding values and linked to high winds. These readings were rejected <-3> (CDB).

NOTE 4: SMALL NEGATIVE DEPTH ANOMALIES:

This type of anomaly occurs due to barometric pressure differences between time of calibration and the reading and ice conditions. In all such cases, barometric pressure differences are checked as well as comparison with other parameters for indications of aerial exposure to verify that all data are valid submerged readings.

NOTE 5: 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.

NOTE 6: ELEVATED CHLOROPHYLL FLUORESCENCE ANOMALIES

Due to interference from biofouling or floating detritus, the chlorophyll fluorescence optic sensors will record values which are above the normal environmental range. Sporadic values which only occur for one or two 15-minute readings, exceed 25 ug/L, and/or go over five times the magnitude of surrounding values are flagged as suspect <1> and given the code [SCS] indicating a chlorophyll spike. Sporadic values which only occur for one or two 15-minute readings, exceed 40 ug/L, and/or go over ten times the magnitude of surrounding values are flagged as rejected <-3> and given the code [SCS] indicating a chlorophyll spike.

Additionally, values > 100µg/L should be given special consideration when analyzing chlorophyll fluorescence data. Extremely high and sustained chlorophyll fluorescence data impacted by detritus, biofouling, and/or dissolved forms of fluorescent interference (e.g., colored dissolved organic matter) are rejected and flagged as <-3>[SQR].

NOTE 7: HYPOXIC EVENTS AND SMALL NEGATIVE D.O VALUES

Many prolonged periods of hypoxia and even anoxia occurred at the Sage Lot and Metoxit Point stations during the summer months (particularly July and August, but also into September). These hypoxic events often began in the evening (usually around or after 1800, but occasionally earlier), and would last into the morning (as late as 1000), sometimes with a prolonged period of small negative D.O values sandwiched in between during the night hours. This pattern occurred most notably at Metoxit Point, with similar events at Sage Lot not lasting quite as long, not occurring quite as often, and mostly missing the small negative values. Since these events formed a consistent pattern and schedule throughout the summer, the data was flagged as <0> (CDA). Small negative D.O values are automatically flagged as suspect, but since they are thought to represent valid anoxic events and not an issue with the sensor, they are coded with comments as <1> [SNV] (CDA).

FIELD and "CSM" NOTES:

All times reported in Eastern Standard Time (EST).

Childs River (CR)

General (CR)

- 07/25/2024 08:00 <-3>[GQR](CND) – Instrument took its first readings as it was being deployed (deployment time was around 0759 – 0800). All data is rejected because of it.
- 09/10/2024 09:45 – 10:15 <-2> Brief instrument malfunction where three 15-minute periods were affected, and data from all parameters were lost.
- 11/06/2024 14:15 – 12/02/2024 – This deployment is missing because the data recovered from the sonde was non-sensical and unable to be submitted to the CDMO. There was likely some catastrophic error in the sonde's hardware which caused the deployment settings to shut down.

Chlorophyll (CR)

- 07/10/2024 19:45 <-3>[SQR] – This value was high enough to be automatically flagged as beyond the sensor's reliable range. Many other values were similarly flagged during this deployment.
- 07/11/2024 03:00 <1>[SCS] – This value meets the criteria in Note 6 for being flagged as suspect. Several other readings are similarly flagged in this deployment.

- 07/13/2024 19:15 <-3>[SCS] – This value meets the criteria in Note 6 for being rejected. Several other readings are similarly flagged in this deployment.
- 07/26/2024 10:15 – 11:45 <-3>[SCS] – These values meet the criteria in Note 6 for being rejected. Several other readings are similarly flagged in this deployment.
- 07/27/2024 16:16 – 21:00 <-3>[SQR] – These values meet the criteria in Note 6 for being rejected. Several other readings are similarly flagged in this deployment.
- 08/04/2024 19:15 – 20:15 <-3>[SQR] – Meets the criteria in Note 6 for being rejected. Throughout the deployment period, a pattern emerged of high chlorophyll spikes at night that decreased during the day. Many other values were similarly flagged during this deployment.
- 08/06/2024 19:15 <1> [SCS] – Meets criteria in Note 6 for labeling suspect. Several other readings are similarly flagged in this deployment.
- 09/15/2024 21:45 – 09/16/2024 01:00 <-3>[SQR] – These values meet the criteria in Note 6 for being rejected.

Turbidity (CR)

- 05/26/2024 11:45, <-3> [SQR] – Meets criteria in Note 2 to be rejected. Many other similar instances occur in this deployment, including:
    - 05/26/2024 21:15, 22:15
    - 05/27/2024 00:45, 07:15, 08:30
    - 06/04/2024 07:15
- 06/09/2024 04:00 – 06/20/2024 12:15, <1>[SSD](CSM) – The wiper was found in the bottom of the bronze casing when the sonde was retrieved. It was unknown when the wiper fell off, so an estimate was made as to when algal buildup would have started affecting the sensors. Turbidity data seems to hint that this sensor drift began around this time, until the end of the deployment.
- 06/20/2024 12:30 – 07/25/25 07:45, <-3> [SQR] – These values are disjunct from the surrounding deployments. Additionally, the sensor's post-deployment reading of the turbidity standard solution was significantly off.
- 08/27/2024 05:45 – 09/03/2024 14:30 <1> [SSD] – The last week of deployment showed consistently low readings (multiple 2/3 NTU readings for hours at a time), and the new deployment values were greater and more varied, indicating sensor drift. Post-deployment also indicated sensor drift.
- 09/06/2024 06:45 <-3> [SQR] – This reading meets the criteria set in Note 2 to be rejected. Several other readings are similarly flagged in this deployment.
- 09/10/2024 12:30 – 13:00 <-3> [SQR] – These readings meet the criteria set in Note 2 to be rejected. Several other readings are similarly flagged in this deployment.
- 10/05/2024 11:00 <-3> [SQR] – This reading meets the criteria set in Note 2 to be rejected. Several other readings are similarly flagged in this deployment.
- 10/13/2024 11:00 – 15:15 <-3>[STS](CCU) – A turbidity spike for some unknown reason.
- 10/19/2024 15:30 – 22:45 <-3>[STS](CCU) – Another turbidity spike for some unknown reason.

pH (CR)

- 06/20/2024 12:30 – 07/25/25 07:45, <1> [SPC] – The sensor's post-deployment reading for both the 7 and 10 standard solutions were off. Unknown if the data are significantly affected, hence considering the data suspect and not rejected.

Specific Conductivity and Salinity (CR)

- 6/11/2024 11:15 – 6/20/2024 12:15, <1> [SSD](CSM) – The SpCond and Sal data seems to start drifting in this time period and lasts through the end of the deployment (and is disjunct to the beginning of the next deployment). The post-deployment sensor readings are low but not totally out of range.

Dissolved Oxygen (% Sat and mg/L) (CR)

- 05/17/2024 16:30 – 06/20/2024 12:30 <0> (CDA) – Many time periods (short and long) are seen in this deployment with small DO concentration values that are automatically flagged by the system. These seem to be valid hypoxic or anoxic events, though some last well into the daytime. Examples include:
    - 06/06/2024 06:45 – 08:00, 08:30 – 10:45, 11:00 – 15:30, 16:15 – 18:15, 18:45, 21:30 – 23:00, 23:30 – 23:45
    - 06/09/2024 02:00 – 02:15, 02:45 – 12:30
    - 06/09/2024 13:00 – 06/10/2024 11:15
    - Many others.
- 05/17/2024 16:30 – 06/20/2024 12:30 <1> [SNV](CDA) – Several short time periods in this deployment are flagged like this, having small negative concentration values. They occur among likely valid anoxic or hypoxic events, hence not being rejected, only labeled as suspect.
- 07/15/2024 00:15 – 01:00 <1>[SNV](CDA) – Many time periods (short and long) are seen in this deployment with small negative DO concentration values. These are all valid anoxic events occurring, usually in the nights and sometimes lasting into the late morning.
- 07/25/2024 08:15 – 09:00 <0> (CDA) – Many time periods (short and long) are seen in this deployment with small DO concentration values that are automatically flagged by the system. These are all valid anoxic events occurring, usually in the nights and sometimes lasting into the late morning.
- 07/25/2024 09:15 – 15:30 <1>[SNV](CDA) – Many time periods (short and long) are seen in this deployment with small negative DO concentration values. These are all valid anoxic events occurring, usually in the nights and sometimes lasting into the late morning.
- 08/16/2024 06:00 – 07:30 <1>[SNV](CDA) – Many time periods (short and long) are seen in this deployment with small negative DO concentration values. These are all valid anoxic events occurring, usually in the nights and sometimes lasting into the late morning.
- 10/08/2024 02:30 – 05:45 <0> (CDA) – Many time periods (short and long) are seen in this deployment with small DO concentration values that are automatically flagged by the system. These are all valid anoxic events occurring, usually in the nights and sometimes lasting into the late morning.

Depth (CR)

- 06/20/2024 12:30 – 07/25/25 07:45, <-3> [SPC] – These values are disjunct from and shallower than the surrounding deployments by about 0.12-0.13. Additionally, the sensor's post-deployment reading was about 0.13 lower than it should have been.
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Menauhant (MH)

General (MH)

- 02/25/2023 17:30 –02/26/2024 14:45, <-2>[GIM] – A full catastrophic software failure occurred, and the sonde stopped recording entirely. No data from here until the end of the deployment.
- 03/18/2024 14:00 – 14:45, <-2>[GSM] – One of the sondes (unknown which) was recording in local time, not EST.
- 03/18/2024 15:00 – 04/09/2024 10:30 – This deployment used an older sonde with older (and potentially suspect) sensors on them because other sondes were sent in for winter maintenance and another (mentioned above) was sent in for repairs due to a software failure that caused the sonde to stop recording data.
- 05/09/2024 11:00 -11:30 <-3>[SCF] – Abnormally low Specific Conductivity and Salinity values, which requires those values, both D.O. parameters values, and Depth values to be rejected (all of which were significantly lower than the values bracketing this time period). Turbidity and pH values in this time period also seemed to be affected, so they were also rejected.
- 06/06/2024 08:45 – 15:30 <-2> - Battery power failed earlier than expected in the deployment. Another sonde was able to be quickly put in its place at 15:30 that day.

- Between 07/23/2024 – 07/31/2024, a lot of the nights and mornings tend to have some extended period of time with sustained, high chlorophyll measurements. We suspect that this reflects detritus and colored dissolved organic matter (CDOM) more than algae and so those events are rejected as <-3>[SQR].
- 09/18/2024 14:15 – 10/23/2024 12:30, <1>(CWD) – During this whole deployment, the sonde was not sitting fully deployed at the station. It was not resting at the bottom of the PVC tube, but instead only partially down. This made the depth values significantly different, but the other values were not significantly different. As such, other parameters were left alone and not flagged, while depth data was labeled as suspect.
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Chlorophyll (MH)

- 01/10/2024 05:00 <1>[SCS] – Meets criteria for suspect data under Note 6.
- 01/26/2024 05:45 <1>[SCS] – Meets criteria for suspect data under Note 6. Several other similar individual instances occur in this deployment.
- 02/17/2024 12:15, 14:15, 15:45 – Meets criteria for rejection under Note 6. Many other similar instances occur during this deployment.
- 02/27/2024 08:30 – 09:30 <-3>[SCS] and <-1>[SCS] – A time period with elevated chlorophyll values, some of which meet the criteria for suspect data under Note 6, and some of which meet criteria for rejection under Note 6.
- 02/29/2024 10:00, 13:00 <1>[SCS] – Meets criteria for suspect data under Note 6. Several other similar individual instances occur during this deployment.
- 02/27/2024 10:00 – 11:00, <-3>[SQR] – Over 45 consecutive minutes of sustained chlorophyll values well over 100 µg/L and often between 200-700 µg/L. Meets criteria in second part of Note 6 for rejection. Other similar extended time periods occur during this deployment.
- 02/28/2024 01:15, 02:15, 21:30 <-3>[SCS] – Value is over 10x the surrounding values, and over 40 µug/L, meeting criteria for rejection in Note 6. Several other similar examples of this occur in this deployment.
- 02/28/2024 04:00 <1>[SCS] – Meets criteria for suspect data under Note 6. Many other similar instances occur during this deployment.
- 03/07/2024 17:00 – 21:30 <-3>[SQR] – Chlorophyll values generally between 200 – 700 µg/L for several hours, meets criteria for rejection in second part of Note 6. Several other similar periods exist during this deployment, particularly in the evenings.
- 05/06/2024 23:30 <-3>[SCS] – Meets criteria for rejection under Note 6. Other similar instances are found in this deployment.
- 05/06/2024 01:00 – 01:45 <-3> [SQR] – 45 minutes of chlorophyll values >100 µg/L, meeting criteria for rejection in Note 6. Several other examples similar to this occur during this deployment.
- 06/07/2024 12:45 <1>[SCS] – Meets criteria for suspect data under Note 6. Many other similar instances to this are found in this deployment.
- 06/20/2024 16:00 <-3> [SQR] – Over 45 minutes (in fact, 1.25 hours) of chlorophyll values >100 µg/L, meeting criteria for rejection in Note 6. Several other examples similar to this occur during this deployment.
- 07/03/2024 16:15 <-3>[SCS] – Meets criteria for rejection under Note 6. Many other similar instances occur during this deployment.
- Generally, the April and June deployments (using the same sonde, with a chlorophyll-a sensor from 2021) shows much more varying data than the May deployment (using a sonde with a sensor from 2018).
- 07/20/2024 05:15, 06:00, 06:45, <-3>[SCS] – Meets criteria for rejection under Note 6. Several other similar instances occur during this deployment.
- 07/23/2024 21:30 – 07/24/2024 05:15 – Meets criteria for rejection under Note 6, being multiple hours of sustained high chlorophyll values potentially reflecting more detritus or coloured dissolved organic matter than algae.

- 07/24/2024 05:45 – 06:30, and 08:15 – 14:15 – Meets criteria for rejection under Note 6, being multiple hours of sustained high chlorophyll values potentially reflecting more detritus or coloured dissolved organic matter than algae. Similar events occur most nights and mornings between now and 07/31.
- 11/22/2024 13:30 and 14:00 – 14:30 <-3>[SCS] - Meets criteria for rejection under Note 6.
- 11/25/2024 04:15 <-3>[SCS] - Meets criteria for rejection under Note 6.
- 11/27/2024 04:30 <-3>[SCS] - Meets criteria for rejection under Note 6.
- 11/27/2024 04:15 <1>[SCS] - Meets criteria for suspect under Note 6.
- 12/11/2024 16:15 <-3>[SCS] - Meets criteria for rejection under Note 6.
- 12/14/2024 07:00 <-3>[SCS] - Meets criteria for rejection under Note 6.

Turbidity (MH)

- 01/01/2024 00:00 - 01/09/23 10:30 <-3>[SSM] – We suspect that the turbidity sensor (installed and manufactured in 2021) is broken. It was mainly reading single digit values while the other sonde (with a 2023 sensor) showed values which seemed more plausible.
- 01/09/2024 21:45 – 01/12/2024 12:30 <1>[STS](CRE) – A significant winter storm with rain and wind came through starting the evening of 1/09 and lasted all through 1/10 into 1/11. It looks like effects lasted through into 1/12. Similar storm events occurred throughout this deployment (1/13, 1/16, 1/24 – 1/30) where rainfall exceeded 1 in, often in a short time period. Oftentimes in these time periods, winds were highly variable, but with extended periods of moderate to strong winds out of the W, NW, and N.
- 01/16/2024 09:30 – 01/17/2024 17:00 <1>[STS](CRE) – A rain event as well as highly variable winds that then finished up with steady to strong NW winds on 1/17.
- 02/28/2024 02:15 <-3>[SQR] – Meets criteria for rejection under Note 2.
- 03/10/2024 10:45 – 11:00 <-3>[SQR] – Meets criteria for rejection under Note 2. Several other similar instances occur during this deployment.
- 03/18/2024 15:00 – 04/09/2024 10:30 <1>[CSM] – The turbidity sensor used for this deployment is significantly older than other sensors in different sondes, and there is a significant discrepancy between the end of the previous deployment and the beginning of this deployment. We are considering this whole deployment's turbidity data as suspect.
- 06/13/2024 12:30 <-3>[SQR] – Meets criteria for rejection under Note 2. Several other similar instances occur during this deployment.
- 07/06/2024 08:45 – 09:00 <-3>[SQR] – Meets criteria for rejection under Note 2. Several other similar instances occur during this deployment.
- 08/12/2024 00:00 – 08/19/20024 15:15, <1>[SSD] – Turbidity data in next deployment looks a bit mor varied and higher than the near constant 1, 2, or 3 readings often staying at the same value for hours that we see in the last week of this deployment. Algae buildup on Turbidity sensor was noted, so this was noted as sensor drift.
- 08/28/2024 17:15, <-3>[SQR] – Meets criteria for rejection under Note 2. Several other similar instances occur during this deployment (ie: 09/01/2024 16:00, 09/12/2024 10:30, and others).
- 09/23/2024 16:15, <-3>[SQR] – Meets criteria for rejection under Note 2. Several other similar instances occur during this deployment (ie: 10/12/2024 20:15, 10/20/2024 08:00).
- 11/15/2024 23:00 <-3>[SQR] – Meets criteria for rejection under Note 2.
- 11/22/2024 00:15, <-3>[SQR] - Meets criteria for rejection under Note 2. Several other instances of this occur during this deployment, though all of them within the first week of the deployment. Last two instances are on 11/26/2024 at 15:45 and 16:15.
- 11/22/2024 01:00 – 06:30, <1>[CDB] – Even though this doesn't meet flagging criteria set by Note 2, this is flagged as suspect because of elevated (~ 20 mph) winds out of the south during this time period (a relatively unusual wind direction for this time of year), potentially kicking up sediments.

pH (MH)

- 03/18/2024 15:00 – 04/09/2024 10:30 - <-3>[SPC] – Post deployment readings against the standard solutions was not satisfactory, and the while the mV slope looked fine, the data looks suspiciously flat – almost like a sensor drift. Data is rejected.
- 04/09/2024 10:45 – 05/06/2024 08:30 <-3>[CCU] – pH values mostly flatlined for the whole deployment for reasons unknown. All pre and post deployment pH measurements seemed fine.
- 05/06/2024 16:30 – 06/05/2024 12:45 - <1> [SPC] – Post deployment readings against the standard solutions were a bit high. However, the mV slope was within parameters. Considered as suspect.

Specific Conductivity and Salinity (MH)

- 06/11/2024 11:15 <1>[CSM] – Anomalously low Specific Conductivity and Salinity values, but for unknown reasons. Other parameters don't seem to be affected.
- 07/22/2024 20:15 and 08/08/2024 04:45, <1>[CSM] – Anomalously low Specific Conductivity and Salinity values, but for unknown reasons. Other parameters don't seem to be affected.

Dissolved Oxygen (% Sat and mg/L) (MH)

- 02/22/2024 10:00 – 02/25/2024 17:15, <-2>[SSM] and <-3>[SSM] – For the vast majority of this time period, the D.O. sensor stopped recording, and those entries are labeled as <-2>[SSM]. Interspersed in this time period are a few single entries where the sensor randomly recorded a value, which we are rejecting as <-3>[SSM].

Depth (MH)

- 03/18/2024 15:00 – 04/09/2024 10:30 - <1>[SPC] – A significant depth discrepancy exists between the previous deployment and this one, and the post-deployment readings for this sonde were not very close to what the expected value should be.
- For the whole deployment from 09/18/2024 14:15 – 10/23/2024 12:30, the sonde was not sitting fully deployed at the station. It was not resting at the bottom of the PVC tube, but instead only partially down. This made the depth values significantly different, but the other values were not significantly different. As such, other parameters were left alone and not flagged, while depth data was labeled as suspect.

Metoxit Point *(MP)*

General (MP)

- 07/16/2024 08:30, <0>(CND) – Sonde was sitting in the station tube, but not fully inserted as it was taking readings. New deployment, but not necessarily at the correct depth yet.
- 8/20/2024 12:45 – 13:15, <-2>(CSM) – Sonde was retrieved, but then deployment of new sonde took a long time due to low water visibility.
- 09/18/2024 13:15 <-3>(CND) – Sonde took readings while not yet fully deployed (depth, D.O, and SpCond/Sal data are off).
- 10/18/2024 10:00 <1> (CSM) – Some of these parameters look a little off. This was when an anchor dragged over the station and got caught in it. Anchor was retrieved on 10/22/2024 at 10:15 and 10:30. Parameters potentially affect by anchor retrieval are also flagged as <1>(CSM).

Temperature (MP)

Specific Conductivity/Salinity (MP)

- 07/15/2024 04:45 <1>[CSM] – Anomalously low Specific Conductivity and Salinity values, but for unknown reasons. Other parameters don't seem to be affected.

Dissolved Oxygen (MP)

- 05/31/2024 02:00 – 05:15 <0> (CDA) – A low-oxygen event, where D.O. concentration values dip below 3 mg/L. Hypoxic conditions (and occasionally anoxic) conditions are relatively common at this site during the summer (and now late spring too), usually at night and into the early morning.

Depth (MP)

- 07/16/2024 08:30, <1>(CND) – Sonde was sitting in the station tube, but not fully inserted as it was taking readings. New deployment, but not necessarily at the correct depth yet.

Turbidity (MP)

- 06/24/2024 09:45 <-3>[SQR] – Meets criteria for rejection under Note 2. A few other similar instances occur during this deployment.
- 07/09/2024 23:00 <1>[STS] – Doesn't quite meet criteria for rejection under Note 2 (value is not over 50). However, this is still likely not very representative of the actual turbidity of the water at this instance.
- 07/19/2024 09:15, 08/11/2024 16:15 <-3>[SQR] – Meets criteria for rejection under Note 2.
- 10/03/2024 21:00, 10/04/2024 07:45 <-3>[SQR] – Meets criteria for rejection under Note 2.
- The deployments from 07/16 – 08/20 and 08/20 – 09/18 both have low Turbidity readings in post-deployment. This was when we switched to a new Turbidity calibration solution that many other reserves noted also read low on their EXO sondes when initially used.
- 10/24/2024 15:15 <1>[CAF] – Intermittent episodes and instances of slightly negative turbidity values, indicting an error in the sensor accuracy or calibration, but within an acceptable range. Several other similar time periods and individual instances occur:
    - 10/25/2024 09:15, 11:45, 13:15, 15:45, 17:30, 22:45
    - 11/01/2024 09:15, 11:30 – 11:45, 12:15 – 12:30
    - 11/02/2024 12:00 – 12:15, 16:45. 17:30 – 18:45, 19:15, 19:45, 20:30 – 21:00, 21:30, 22:15
    - 11/03/2024 18:15 – 18:45, 19:45
- 10/24/2024 11:15 – 12/04/2024 09:45 <1> [CSM] – Most of the turbidity data in this deployment is constant (often at 0) for long periods of time before jumping to higher levels briefly and then going back to 1 or 0. Considering the whole deployment's turbidity data as suspect.

pH (MP)

- 07/16/2024 08:30 – 08/20/2024 12:30 <1>[SPC] – Post deployment readings for pH were significantly off for both calibration points (7 and 10). The mV slope was still good.
- 10/24/2024 11:15 – 12/04/2024 09:45 <1> [CSM] – During the whole deployment, pH values would stay steady for hours before barely changing and then remaining steady for another long period of time. This is very unusual behavior, so the whole deployment's pH data is being considered as suspect.

Chlorophyll-a (MP)

- 07/18/2024, 03:45 <-3>[SQR] – Meets criteria for rejection under Note 6.
- 12/01/2024 17:00 <-3>[SQR] – Meets criteria for rejection under Note 6.

Sage Lot *(SL)*

General (SL)

- See notes in each section, but the Turbidity and Conductivity/Salinity parameters showed much more variability in the May deployment than in the June deployment. The sondes had sensors of similar age (from 2022 or 2023).
- 08/12/2024 14:45 – 08/29 10:00 <-3> [SQR] – Station had drifted ~10-20 meters East of mooring block after being lifted off of it during deployment. All readings within that time frame were rejected due to this drift and the sonde's resettlement into the mud.
- 08/29/2024 09:30 – 10:00 <-3>[GOW] – Sonde out of water while getting station back in place.
- 12/02/2024 14:00 – 01/06/2025 15:15 – During this deployment, ice was observed several times around the sonde station. Fundamentally, we want to recognize that ice formed around the station at multiple points, and the freezing/thawing process caused some very strange readings that are real, but for various reasons (non-sensical low Dissolved Oxygen, non-sensical high chlorophyll and turbidity) might need to be considered as suspect. The station is not under 24-hr surveillance, so we can't know precisely when ice began to form and when it melted away. However, the <1>(CIP) flag and comment was used at several points:
    - For any automatically flagged data around instances when freezing was actually observed (12/14/2024 between 10:00 – 11:00, 12/23/2024 between 13:00 – 14:00, and 01/06/2025 around 15:00), and reasonable time periods around those instances.
    - For the automatically-flagged negative % saturation Dissolved Oxygen values around times with near or below-freezing air temperatures.
    - For instances with very strange overall data readings (significant and sudden changes in temperature and conductivity and oxygen all at once, or large spikes in turbidity and chlorophyll).

  The <0>(CIP) flag was used to note that there was ice observed (or when it could reasonably be assumed ice was present even if it wasn't observed), but data is not wildly off. Every parameter is flagged as suspect.

  The <1>[SQR](CSM) flag was used around times of significant changes in water temperature or Specific Conductivity/Salinity over short time periods. For these time periods, since either or both of these parameters are being called into questions, all other dependent parameters were flagged as suspect as well.
- 12/02/2024, 13:45 <-2>[GMC] – Deploying the new sonde took a bit of time. The previous sonde was removed before 13:45, but the new one wasn't in place until after 13:45.

Temperature (SL)s

- 12/03/2024 09:15 – 09:45 <1> [SQR](CSM) – A 2.4 degree drop in water temperature over 45 minutes after several hours of supposedly stable readings is suspect. Specific Conductivity and Salinity are also included as suspect since these parameters are part of the same sensor. Other parameters dependent on temp and specific conductivity/salinity like D.O % and concentration and depth are also flagged as suspect. Several other events like this occur over this deployment. They seem to occur around when air temperatures drop to freezing or below.
    - 12/15/2024 08:15 – 09:00: 2.3 degree drop in 15 minutes is suspicious.

Specific Conductivity/Salinity (SL)

- 05/03/2024 23:15, 05/04/2024 00:00 <1>[CSM] – Anomalously low Specific Conductivity and Salinity values, but for unknown reasons. Other parameters don't seem to be affected. Many of these instances occur between this time and 6/02/2024 18:00.

Dissolved Oxygen (SL)

- 06/04/2024 04:45 <0> (CDA) – A very brief low-oxygen event, where D.O. concentration values dip below 3 mg/L. Hypoxic conditions (and occasionally anoxic) conditions are relatively common at this site during the summer (and now late spring too), usually at night and into the early morning.
- 07/22/2024 04:45 <0> (CDA) – A very brief low-oxygen event, where D.O. concentration values dip below 3 mg/L. Hypoxic conditions (and occasionally anoxic) conditions are relatively common at this site during the summer (and now late spring too), usually at night and into the early morning.
- 07/24/2024 05:00 – 07:30 <0> (CDA) – A low-oxygen event lasting two hours where D.O. concentration values dip below 3 mg/L. Hypoxic conditions (and occasionally anoxic) conditions are relatively common at this site during the summer (and now late spring too), usually at night and into the early morning.
- 07/25/2024 04:45 – 08:00 <0> (CDA) – A low-oxygen event lasting two hours where D.O. concentration values dip below 3 mg/L. Hypoxic conditions (and occasionally anoxic) conditions are relatively common at this site during the summer (and now late spring too), usually at night and into the early morning.
- 09/02/2024 09:00 <0> (CDA) – A very brief low-oxygen event.
- 10/03/2024 07:15 <0> (CDA) – Another very brief low-oxygen event.

Depth (SL)

- 09/17/2024 08:30 – 10/25/2024 08:45 <-3>[SIC] – Depth sensor was not calibrated before deployment. Depth sensor did not connect during the post-deployment calibration. With these factors in mind, depth readings for the entire deployment period are rejected.

Turbidity (SL)

- 05/23/2024 19:00 <-3>[SQR] – Meets criteria for rejection under Note 2. A few other similar instances occur during this deployment.
- 07/10/2024 14:15 <-3> [SQR] – Meets criteria for rejection under Note 2. A few other similar instances occur during this deployment.
- 07/23/2024 10:15 <-3> [SQR] – Meets criteria for rejection under Note 2. A few other similar instances occur during this deployment.
- 08/03/2024 16:30 – 18:30 <-3> (CDB) – Meets criteria for rejection under Note 3. A few other similar instances occur during this deployment. This is linked to high winds and wind directions with a more westerly component. Winds with a more southerly or easterly component did not seem to have as much an effect on the site measurements.
- 08/08/2024 07:30 – 09:15 <-3> (CDB) – Meets criteria for rejection under Note 3. A few other similar instances occur during this deployment. This is linked to high winds and wind directions with a more westerly component. Winds with a more southerly or easterly component did not seem to have as much an effect on the site measurements.
- 08/08/2024 09:30 – 08/12/2024 14:30 <1> [SWM] – Wiper fell off during deployment - found in sonde guard. Lack of wiper may have affected the performance of the turbidity sensor.
- 09/07/2024 09:45 – 09/17/2024 08:15 <1> [SWM] – Wiper fell off during deployment - found in sonde guard. Lack of wiper may have affected the performance of the turbidity sensor.
- 09/24/2024 21:00 <-3>[SQR] – Meets criteria for rejection under Note 2. A few other similar instances occur during this deployment.
- 09/25/2024 01:30 <-3>[SQR] – Meets criteria for rejection under Note 2. A few other similar instances occur during this deployment.

- 10/16/2024 02:15 <-3>[SQR] – Meets criteria for rejection under Note 2. A few other similar instances occur during this deployment.
- 10/25/2024 13:45 – 10/26/2024 01:30 <-3>(CCU) – Nearly 12 consecutive hours of turbidity data well over 100 FNU. There were no especially high winds, although there is a pattern of generally southerly and/or westerly winds associated with similar episodes of high turbidity. Other similar episodes occur in this deployment:
    - 10/26/2024 09:45 – 13:00
    - 10/26/2024 15:15 – 10/27/2024 03:15
    - 10/28/2024 02:30 – 17:15
    - Many others
- 11/03/2024 12:15 – 13:15 <-3>[SQR] and 13:30 – 23:30 – The initial turbidity values are just so high that they are automatically rejected. The rest of the time period is only considered suspect because it fits the same description as the high turbidity episodes described previously. It is associated with a period of highly variable but not especially strong winds.
- 11/11/2024 11:30 <-3>[SQR] – Meets criteria for rejection under Note 2. A few other similar instances and time periods occur during this deployment.
    - 11/17/2024 11:15 – 12:45 and 14:00 – 15:45
    -
- 11/14/2024 17:30 – 11/15/2024 01:45 <1>[CAF] – Intermittent episodes and instances of slightly negative turbidity values, indicting an error in the sensor accuracy or calibration, but within an acceptable range. Several other similar time periods and individual instances occur:
    - 11/15/2024 06:45
    - 11/15/2024 11:00 – 13:30
    - 11/15/2024 18:00 – 11/16/2024 04:45
    - 11/16/2024 12:45 – 11/17/2024 02:30
    - 11/17/2024 19:30
    - 11/18/2024 00:30 – 04:15
    -
-

pH (SL)

- 12/02/2024 14:00 – 01/06/2025 15:15 <1>[SPC](CDF) – Post-deployment sensor checks showed pH values reading significantly low. While the data appear to fit conditions fairly well, these values will still be considered suspect.

Chlorophyll-a (SL)

- 06/21/2024 16:45 <-3>[SCS] – Meets criteria for rejection under Note 6.
- 07/12/2024 00:45 <-3> [SCS] – Meets criteria for rejection under Note 6. A few other similar instances occur during this deployment.
- 07/19/2024 15:00 <-3> [SCS] – Meets criteria for rejection under Note 6. A few other similar instances occur during this deployment.
- 07/31/2024 18:30 <-3> [SCS] – Meets criteria for rejection under Note 6. A few other similar instances occur during this deployment.
- 09/25/2024 01:30 <-3> [SQR] – Meets criteria for rejection under Note 6. A few other similar instances occur during this deployment.
- 10/16/2024 02:00 <-3> [SQR] – Meets criteria for rejection under Note 6. A few other similar instances occur during this deployment.
- 10/23/2024 10:30 <-3> [SQR] – Meets criteria for rejection under Note 6. A few other similar instances occur during this deployment.

- 11/24/2024 18:45 <-3> [SCS] – Meets criteria for rejection under Note 6. A few other similar instance occur during this deployment (between 11/24 and 11/27)