# Maryland Shallow Water Monitoring Program – 2021 DATAFLOW

## Metadata:

*Identification_Information:*
*Citation:*
*Citation_Information:*
*Originator:* Maryland Department of Natural Resources, Resource Assessment Service (MD DNR RAS)
*Publication_Date:* 20220301
*Title:* MD DNR Water Quality Mapping Project 2021
*Geospatial_Data_Presentation_Form:* Spatial dataset

*Description:*
*Abstract:*
This record describes one year of an on-going water quality monitoring project. Mapping surveys were performed monthly from April through October 2021.

A total of twenty mapping cruises were conducted on the Chesapeake Bay. The spatial extent of water quality was measured on waters of Chesapeake Bay TANMH Tangier Sound segment.

Monthly TANMH Segment Tangier Sound North, South, and Western survey data were aggregated to map Chesapeake Bay TANMH Segment water quality. All surveys were conducted using shallow-draft small boats. The monthly surveys for each area occurred within the same day for June through October. However, due to weather and logistical issues, the western location was not sampled during the April survey, and during the May survey the western area was sampled a day later than the northern and southern portions of Tangier Sound.

Small boat water quality mapping was conducted using DATAFLOW, a compact, self-contained surface water quality mapping system. The small boats operated at planing speeds of up to 45 km/hr (24.3 kts). Measurements were made approximately every four seconds, or 50 meters (164 feet). Seven water quality parameters were measured: water temperature, salinity (calculated from conductivity), conductivity, dissolved oxygen, turbidity, fluorescence, and pH.

Additional water quality measurements were made at twelve calibration stations and included: Secchi disk depth, photosynthetic active radiation, and HydroLab water temperature, pH, dissolved oxygen, specific conductance, and salinity. Measurements were made at five Northern Tangier Sound sites, five Southern Tangier Sound sites, and at two Western sites.

Water quality calibration chlorophyll a and total suspended solids "grab" water samples were also collected at the calibration stations during each monthly mapping small-boat survey.

The "grab" samples were collected, after stopping the boat, at 0.5 m depth and filtered, when possible, on site.

Laboratory analyses were performed on calibration "grab" sample water. Concentrations of chlorophyll a and total suspended solids were determined for all stations.

*Purpose:*

The Maryland Department of Natural Resources Shallow Water Monitoring program is part of a cooperative effort between the Federal government and State and local governments in the Chesapeake Bay watershed to assess the ambient water quality criteria for dissolved oxygen, chlorophyll and water clarity in shallow water habitats.

Water quality mapping provides data on variability and patchiness that are valuable in assessing water quality criteria, and in determining attainment of those criteria. For example, spatial information on turbidity can be correlated to the spatial coverage of living resources such as Submerged Aquatic Vegetation (SAV). This information can be used to determine and assess water clarity criteria necessary to support SAV growth, address the progress of meeting SAV restoration goals, and better target specific locations for future SAV restoration.

Spatially-intensive data can also help pinpoint localized areas of water quality concern, such as areas of low dissolved oxygen that can cause fish kills, and their possible links to nearby land uses or point sources.

Water quality maps can capture localized areas of algae blooms, high turbidity, or low dissolved oxygen that may adversely affect living resources in shallow water habitats and spawning areas.

Spatial data can also be aggregated across watershed units to aid in the evaluation of entire systems. Water quality mapping data are integrated with data from other Bay water quality stations and living resources monitoring projects and used to understand linkages, temporal variation and long-term trends.

Water quality data are used to refine, calibrate and validate Chesapeake Bay ecological models. The models are used to develop and assess water quality criteria with the goal of removing the Chesapeake Bay and its tidal rivers from the list of impaired waters.

*Supplemental_Information:*

The target audiences for these data include resource managers, technical/scientific users, government, educators, students and general public.

Data users who desire very detailed information about Water Quality Monitoring data definition, sampling procedures and data processing are encouraged to refer to documents listed below.

Guide to Using Chesapeake Bay Program Water Quality Monitoring Data, EPA 903-R-12-001, February 2012, CBP/TRS 304-12 [http://www.chesapeakebay.net/documents/3676/wq_data_userguide_10feb12_mod.pdf].

Methods and Quality Assurance for Chesapeake Bay Water Quality Monitoring Programs. Chesapeake Bay Program, May 2017, CBP/TRS-319-17 [https://www.chesapeakebay.net/documents/CBPMethodsManualMay2017.pdf].

Quality Assurance Project Plan for the Maryland Department of Natural Resources Chesapeake Bay Shallow Water Quality Monitoring Program for the period July 1, 2020 - June 30, 2021 [https://eyesonthebay.dnr.maryland.gov/eyesonthebay/documents/SWM_QAPP_2020_2021_Draft_v9.pdf].

Water Quality Database - Database Design and Data Dictionary, Prepared For: U.S. Environmental Protection Agency, Region III, Chesapeake Bay Program Office, January 2004. [http://archive.chesapeakebay.net/pubs/cbwqdb2004_RB.PDF]. An updated version of the data dictionary is a Chesapeake Bay Program work in progress.

*Time_Period_of_Content:*
*Time_Period_Information:*
*Range_of_Dates/Times:*
*Beginning_Date:* 20210419
*Ending_Date:* 20211028
*Currentness_Reference:* Ground condition
*Status:*
*Progress:* Complete
*Maintenance_and_Update_Frequency*: As needed
*Spatial_Domain:*
*Bounding_Coordinates:*
*West_Bounding_Coordinate:* -79.4938
*East_Bounding_Coordinate:* -75.0405
*North_Bounding_Coordinate:* 39.7425
*South_Bounding_Coordinate:* 37.8713
*Keywords:*
*Theme:*
*Theme_Keyword_Thesaurus:* Global Change Master Directory (GCMD). 2021. GCMD Keywords, Version 13.2 Greenbelt, MD: Earth Science Data and Information System, Earth Science Projects Division, Goddard Space Flight Center (GSFC) National Aeronautics and Space Administration (NASA). URL (GCMD Keyword Forum Page): [https://wiki.earthdata.nasa.gov/pages/viewpage.action?pageId=242224934]
*Theme_Keyword:* EARTH SCIENCE > BIOSPHERE > ECOLOGICAL DYNAMICS > ECOSYSTEM FUNCTIONS > NUTRIENT CYCLING
*Theme_Keyword:* EARTH SCIENCE > BIOSPHERE > ECOLOGICAL DYNAMICS > ECOSYSTEM FUNCTIONS > PRIMARY PRODUCTION
*Theme_Keyword:* EARTH SCIENCE>OCEANS>SALINITY/DENSITY>PYCNOCLINE
*Theme_Keyword:* EARTH SCIENCE>TERRESTRIAL HYDROSPHERE>SURFACE WATER>SURFACE WATER PROCESSES/MEASUREMENTS>WATER DEPTH

*Theme_Keyword:* EARTH SCIENCE>TERRESTRIAL HYDROSPHERE>WATER QUALITY/WATER CHEMISTRY>WATER CHARACTERISTICS>CHLOROPHYLL CONCENTRATIONS
*Theme_Keyword:* EARTH SCIENCE>TERRESTRIAL HYDROSPHERE>WATER QUALITY/WATER CHEMISTRY>WATER CHARACTERISTICS>CONDUCTIVITY
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*Theme_Keyword:* EARTH SCIENCE>TERRESTRIAL HYDROSPHERE>WATER QUALITY/WATER CHEMISTRY>SOLIDS>SUSPENDED SOLIDS
*Theme_Keyword:* EARTH SCIENCE>TERRESTRIAL HYDROSPHERE>WATER QUALITY/WATER CHEMISTRY>WATER CHARACTERISTICS>TURBIDITY
*Theme_Keyword:* EARTH SCIENCE>TERRESTRIAL HYDROSPHERE>WATER QUALITY/WATER CHEMISTRY>WATER CHARACTERISTICS>WATER TEMPERATURE

*Place:*
*Place_Keyword_Thesaurus:* Common geographic areas
*Place_Keyword:* United States
*Place_Keyword:* Maryland
*Place_Keyword:* Dorchester County
*Place_Keyword:* Lower Chesapeake Bay
*Place_Keyword:* Wicomico County
*Place_Keyword:* Somerset County
*Temporal:*
*Temporal_Keyword_Thesaurus:* USGS Thesaurus
*Temporal_Keyword:* summer
*Temporal_Keyword:* spring (season)
*Temporal_Keyword:* autumn
*Access_Constraints:* None
*Use_Constraints:* Acknowledgement of the MD Department of Natural Resources, Resource Assessment Service as a data source would be appreciated in products developed from these data. Please use the following citation: Maryland Department of Natural Resources, Resource Assessment Service. Eyes on the Bay. URL: [http://www.eyesonthebay.net].
*Point_of_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Mark Trice

*Contact_Position:* Program Chief, Water Quality Informatics, Tidewater Ecosystem Assessment
*Contact_Address:*
*Address_Type:* Mailing and Physical Address
*Address:* Tawes State Office Building, 580 Taylor Avenue, D2
*City:* Annapolis
*State_or_Province:* MD
*Postal_Code:* 21401
*Country:* USA
*Contact_Voice_Telephone:* 410.260.8630
*Contact_Electronic_Mail_Address:* mark.trice_nospam_@maryland.gov[Remove _nospam_ for valid email address]

*Browse_Graphic:*
*Browse_Graphic_File_Name:* MDDNR Water Quality Mapping Monitoring Project 2021 Station Map [https://eyesonthebay.dnr.maryland.gov/eyesonthebay/documents/metadata/MdDNR_DFlowStns 2021.pdf].
*Browse_Graphic_File_Description:* Overview map of twelve 2021 DATAFLOW calibration station sites located in Chesapeake Bay TANMH Tangier Sound Segment.
*Browse_Graphic_File_Type:* PDF
*Data_Set_Credit:*
Survey and calibration data were collected by MD DNR Resource Assessment Service (RAS) Annapolis Field Office staff.

The Nutrient Analytical Services Laboratory (NASL) at the Chesapeake Biological Laboratory (University of Maryland) analyzed chlorophyll and suspended solids samples.

The project was made possible with funding provided by the State of Maryland and the United States Environmental Protection Agency Chesapeake Bay Program.

*Data_Quality_Information:*
*Attribute_Accuracy:*
*Attribute_Accuracy_Report:*
QUALITY ASSURANCE/QUALITY CONTROL
Maryland Department of Natural Resources followed specific procedures to ensure that the DATAFLOW component of the Shallow Water Quality Monitoring Program project design was properly implemented and managed with sufficient accuracy, precision and detection limits. Accuracy (closeness to the true value) of collected data was controlled and assured by the proper use, calibration and maintenance of both field and laboratory equipment used for the measurement of physical and chemical parameters.

YSI 6600 V2 sondes were configured with the following probes: 6025 (chlorophyll); 6136 (turbidity); 6560 (spCond & temperature); 6561(pH); and 6150ROX (dissolved oxygen) during 2021. Resolution, range and accuracy specifications for the sonde and probes may be obtained from the manufacturer [https://www.ysi.com/search?k=6600+AND+probes].

Procedures used to control and assure the accuracy of field measurements included: calibration of field instruments, verification of calibration results, equipment maintenance, and collection of filter blanks. Most of the details of how data acquired with YSI sondes were quality assured and quality controlled are described in process description elements in the Lineage portion of this metadata record. Water quality calibration-station laboratory analytical results were used to crosscheck sonde data for accuracy.

PAR sensors were returned to LI-COR prior to the field season for factory calibration.

Daily quality control checks (including the running of blanks and standards) were used to control and assure laboratory analytical accuracy.

Accuracy of Chesapeake Biological Laboratory, Nutrient Analytical Services Laboratory (CBL NASL) results was also assessed through DNR's participation in the Chesapeake Bay Coordinated Split Sample Program (CSSP), a split sampling program in which five laboratories involved in Chesapeake Bay monitoring analyze the coordinated split samples. CSSP was established in June 1989 to establish a measure of comparability between sampling and analytical operations for water quality monitoring throughout the Chesapeake Bay and its tributaries. DNR followed the protocols in the Chesapeake Bay Coordinated Split Sample Program Implementation Guidelines (EPA 1991) and its revisions. Split samples were collected quarterly. Analytical results were compared using appropriate statistical tests to determine if results differed significantly among labs. If a difference occurred, discussions began regarding techniques and potential methods changes to resolve discrepancies.

OTHER ATTRIBUTE ACCURACY INFORMATION

April 2021: Water quality Mapping surveys were initially attempted on April 19, but could not be completed due to unsafe weather conditions, and only a portion of Tangier Sound South was recorded. Sampling was attempted again on April 27 and was successful for Tangier Sound North and South, however due to high seas Tangier Sound West could not be sampled.

June 2021: During the Tangier Sound North survey eight records were censored due to a clogged intake, resulting in a no-flow event.

July 2021: The Tangier Sound South crew reported the pump being clogged with submerged aquatic vegetation (SAV) between 10:05:18 and 10:06:42; all data were censored. On the Tangier Sound North survey, high dissolved oxygen readings correspond with high chlorophyll values, suggesting the likelihood of an algal bloom being present.

August 2021: The presence of high chlorophyll values, coupled with high dissolved oxygen and pH readings during the Tangier Sound North and South surveys, suggests the presence of algal blooms. Notes recorded during the Tangier Sound West survey also report widespread algal blooms, along with high chlorophyll and dissolved oxygen values.

September 2021: Notes recorded during the Tangier Sound West survey report widespread algal blooms.

October 2021: Tangier Sound West was sampled during the Tangier Sound North and South surveys due to multiple logistical and equipment issues.

There were no known attribute accuracy issues during sampling conducted in May 2021.

*Logical_Consistency_Report:*

April 2021: Due to unsafe weather conditions the attempted April 19 2021 cruise track had to be altered, and ultimately cut short, for Tangier Sound South; Tangier Sound West and North could not be sampled on April 19 2021. A replacement cruise was rescheduled for April 27 2021, and on this date the Tangier Sound South cruise was attempted but the cruise track had to be altered due to high seas, and was also cut short due to dangerous weather conditions. Tangier Sound West could not be sampled on this second April cruise date.

May 2021: The cruise track for the Tangier Sound South survey was altered in order to meet up with the Tangier Sound North crew to transfer equipment.

June 2021: During the Tangier Sound North survey connection to the GPS was briefly severed between the times 10:53 to 11:08. During the Tangier Sound West survey the cruise track was altered to visit station XCI0132 (part of Tangier Sound North) in order to expedite sampling.

October 2021: Tangier Sound West was sampled during the Tangier Sound North and South surveys due to multiple logistical and equipment issues. During Tangier Sound South survey the laptop failed just before the last station, however station XAI8482 was sampled regardless.

There were no known logical consistency issues during TANMH sampling conducted in July, August, or September 2021.

*Completeness_Report:*

The DATAFLOW project dataset includes mapping and calibration data acquired during monthly sampling runs, between April and October.

Sampling event, water quality calibration, pigment and suspended solids data from twelve stations are included in the dataset. Calibration samples were collected at five stations on the Tangier Sound North run, at five stations one the Tangier Sound South run, and at two stations on the Tangier Sound West run.

Collection of a full suite of nutrient samples ceased on most Water Quality Mapping surveys in 2010. Nutrient sampling on Corsica River surveys continued through 2016 and were discontinued in 2017.

Contour maps based on 2021 dissolved oxygen, salinity, turbidity, temperature and chlorophyll data acquired during DATAFLOW monthly mapping cruises are available on-line. [https://eyesonthebay.dnr.maryland.gov/sim/Dataflow.cfm].

Data users may discover a few interruptions in sonde datasets. These were related to short-term problems with flow, power or sonde operation.

Turbidity data were censored in cases where bottom sediment disturbances were determined to be caused by the sampling vessel or other vessels.

April 2021: During the original April cruise attempt on April 19, only Tangier Sound South could be partially sampled due to unsafe weather conditions. The rescheduled cruise date on April 27 also had high seas and winds, and Tangier Sound West could not be sampled. Due to rough seas LI-COR was unable to be collected at stations XBI5751 in Tangier Sound North, and XAI6645 in Tangier Sound South. Stations EE3.2, XBI3751 and XBI1219 were not able to be sampled at all, due to high seas and winds.

May 2021: Due to shallow depths, LI-COR was unable to be collected at Tangier Sound North station XCH3277. LI-COR was not recorded at any station in Tangier Sound South due to equipment malfunction.

June 2021: During the Tangier Sound North survey, connection to the GPS was briefly severed between the times 10:53 to 11:08.

September 2021: Due to rough seas LI-COR was unable to be collected at stations EE3.1, XBI6201, and XBI5751 in Tangier Sound North, or at station XAI6645 in Tangier Sound South.

October 2021: Tangier Sound West was sampled during the Tangier Sound North and South surveys due to multiple logistical and equipment issues. During Tangier Sound South survey the laptop failed just before the last station, however station XAI8482 was sampled regardless.

There were no known completeness issues during 2021 TANMH July and August September surveys.

*Lineage:*

*Process_Step:*

*Process_Description:*

WATER QUALITY CALIBRATION SAMPLES:

At each calibration station, "grab" water quality samples were collected from the outflow of the DATAFLOW unit.

"Grab" samples were collected at the same time as the Hydrolab surface sample was recorded. Numbered two quart bottles were triple-rinsed and filled with water for chlorophyll and total suspended solids samples.

Chlorophyll and suspended solid water samples were filtered on station or shortly thereafter. Sample waters and filters were placed on ice immediately after filtration.

HYDROLAB PROFILE:

The first reading of the Hydrolab water-column profile at each calibration station was recorded at the same time the water quality bottle sample was collected. The first Hydrolab record logged was for the 0.5 m depth. The sonde was then lowered to the bottom. A reading was taken at 0.3 m above the bottom. The sonde was raised and measurements were recorded at 0.5 m or 1.0 m increments until it reached the surface. (In cases where station depth was greater than 3 m, the sonde was raised in 1 m increments).

SECCHI DEPTH:

Secchi disk depth was measured at each calibration station. Readings with the Secchi disk were made in situ without the aid of sunglasses. The Secchi disk was lowered into the water, on the shady side of the boat, and the depth at which it was no longer visible was recorded. The Secchi depth reading was taken near the stern of the vessel, and the time at which the reading was taken was noted (to the second) from the Global Positioning System. This facilitated later matching of Secchi depth readings with turbidity probe data.

PAR MEASUREMENT:

Underwater Photosynthetically Active Radiation (PAR, 400-700nm)

At each calibration station, down-welling light penetrating the water column (PAR) was measured underwater at several depths to calculate the light attenuation coefficient, Kd. Simultaneous deck and submersed PAR intensity measurements were taken to account for variability in incident surface irradiance due to changes in cloud cover. Data collected using this procedure were used to estimate the depth of the photic zone.

The equipment used was manufactured by LI-COR, Inc. and consisted of a LI-192SA, flat cosine Underwater Quantum Sensor, a LI-190SA air (deck) reference sensor and a Data Logger (LI-1000 or LI-1400).

Deck and underwater readings were recorded simultaneously. Readings were allowed to stabilize before being recorded. If the station depth was less than 3 meters, readings were taken at 0.1 meter and at 0.25 m intervals until 10% of the 0.1 m reading was reached. If the station depth was greater than 3 m, a reading was taken at 0.1 m and at 0.5 m intervals until 10% of the 0.1 m reading was reached.

SONDE PROBES:

YSI 6600 data sondes equipped with a 6560 conductivity/temperature probe, a 6136 turbidity probe, a 6025 chlorophyll probe, a 6561 pH probe and a 6150ROX (Optical) dissolved oxygen probe were maintained and calibrated before and after each deployment in accordance with YSI recommendations [http://www.ysi.com/resource-library.php].

SMALL BOAT SURVEYS:

DATAFLOW is a compact, self-contained surface water quality mapping system, suitable for use in a small boat operating at planing speeds of about 25 knots. The system collects water through a pipe ("ram") deployed on the transom of the vessel, pumps it through an array of water quality sensors, and then discharges the water overboard. Orientation of the sonde vertically, with probes upward, ensures that no air bubbles are conveyed to the sensors, preventing errors that might be caused by such bubbles.

Water quality instrumentation consisted of a YSI 6600 Sonde equipped with a flow-through chamber. The system was configured with conductivity/temperature, turbidity, chlorophyll, pH and dissolved oxygen probes.

Positioning and depth instrumentation consisted of a Raymarine A70D Chartplotter/Sounder. The data logger matched the position data with water quality sensor data for each observation. The Raymarine A70D GPS transmitted NMEA data to a Panasonic ToughBook(tm) or Dell Latitude Rugged Extreme. A DATAFLOW/LabVIEW program was used to merge position and depth data with data collected by the logger and create an output file.

The system was equipped with an inline flow meter. Although the flow rate did not affect sensor readings, decreased flow was an indication of either a partial blockage or an interruption of water flow to the instrument. Flow data were used in the field as a diagnostic tool to ensure that the system was working properly and, later, as a quality assurance tool to verify that water flow was uninterrupted. A boat horn was wired to the flow meter. If the flow-rate fell below 3.0 L/s, the horn sounded and warned operators that a problem needed to be corrected.

Cruise tracks varied depending on the water body being mapped. In general, a square-wave pattern was followed by alternately sampling shallow shoreline areas, and open, deeper waters while traveling up and down river. Alternative cruise paths were followed if water body size, shape impediments, or obstructions dictated otherwise. Cruise patterns were selected to obtain representative coverage of shallow water habitats and open waters so that segment-wide criteria could be assessed as accurately as possible. Navigational issues and placement of representative calibration sites also determined ultimate cruise tracks.

*Process_Date:* Unknown
*Process_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Kristen Heyer
*Contact_Position:* Manager, Water Quality Monitoring
*Contact_Address:*
*Address_Type:* mailing and physical
*Address:* 1919 Lincoln Drive
*City:* Annapolis
*State_or_Province:* Maryland
*Postal_Code:* 21401
*Country:* USA
*Contact_Voice_Telephone:* 410.990.4600
*Contact_Electronic_Mail_Address:* kristen.heyer_nospam_@maryland.gov[Remove _nospam_ for valid email address]

*Process_Step:*
*Process_Description:*

SONDE FILE AND NAVIGATION FILE MERGE:

The output of the DATAFLOW/LabVIEW system used on small boat surveys contains merged time, coordinate and sonde results.

DATAFLOW FILE POST-PROCESSING:

Each file was opened in Microsoft Excel(tm) and renamed using a survey-date naming convention. Rows of data acquired before and after mapping were deleted. Records (if any) were also deleted if they did not have associated GPS values. A macro was executed that rearranged columns and inserted error-tracking columns and headings. Next, negative values were flagged, and values outside each parameter's normal range were highlighted. The macro also returned a form summarizing exceedances. Finally, mapping cruise event and instrument information were appended to each record.

Flagged values were evaluated for common anomalies, including spikes in fluorescence and turbidity, dips in specific conductance, and unusually high dissolved oxygen readings. Instrument post-calibration results, in situ comparisons with HydroLab, LI-COR readings, historical data from nearby locations, and survey crew remarks were used to determine whether sensor values were acceptable.

In cases where data were determined to be unreliable, the reason(s) values were determined to be erroneous were documented with error codes and comments. Unreliable data were masked. No data were discarded. All DATAFLOW data for each mapping cruise, both valid and erroneous, were retained in an archival file. Only data considered reliable were published in reports.

VERIFICATION AND DATA MANAGEMENT:

At the end of the monitoring season, DNR Tawes Office and Field Office personnel conducted additional data QA/QC procedures. All of the water quality calibration "grab" sample data were plotted, and outliers and anomalous values were thoroughly researched. Staff compared unusual values to historic values from the site and values from nearby sites in the Bay. Weather events were considered, event logs were reviewed and field staff members were consulted regarding possible legitimate causes for outlying values. In cases where values were not considered to be legitimate, they were masked from the published dataset with the approval of the field staff and the Quality Assurance Officer.

*Process_Date:* Unknown
*Process_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Mark Trice
*Contact_Position:* Program Chief, Water Quality Informatics, Tidewater Ecosystem Assessment
*Contact_Address:*
*Address_Type:* Mailing and Physical Address
*Address:* Tawes State Office Building, 580 Taylor Avenue, D2
*City:* Annapolis
*State_or_Province:* MD

*Postal_Code:* 21401
*Country:* USA
*Contact_Voice_Telephone:* 410.260.8630
*Contact_Electronic_Mail_Address:* mark.trice_nospam_@maryland.gov[Remove _nospam_ for valid email address]

*Process_Step:*
*Process_Description:*
LABORATORY ANALYSIS - CBL
University of Maryland's Chesapeake Biological Laboratory (CBL), Nutrient Analytical Services Laboratory (NASL) analyzed chlorophyll, phaeophytin and total suspended solids.

Further information about laboratory analytical procedures may be obtained from the "Process_Contact".
*Process_Date:* Unknown
*Process_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Jerry Frank
*Contact_Position:* Manager of Analytical Services
*Contact_Address:*
*Address_Type:* mailing and physical
*Address:* Chesapeake Biological Laboratory, Center for Environmental and Estuarine Studies, The University of Maryland System, 146 Williams St; P.O. Box 38
*City:* Solomons
*State_or_Province:* Maryland
*Postal_Code:* 20688
*Country:* USA
*Contact_Voice_Telephone:* 410.326.7252
*Contact_Electronic_Mail_Address:* frank_nospam_@umces.edu[Remove _nospam_ for valid email address]

*Spatial_Data_Organization_Information:*
*Indirect_Spatial_Reference:* TANMH Segment, Tangier Sound, Maryland, USA.
*Direct_Spatial_Reference_Method:* Point

*Spatial_Reference_Information:*
*Horizontal_Coordinate_System_Definition:*
*Geographic:*
*Latitude_Resolution:* 0.0001
*Longitude_Resolution:* 0.0001
*Geographic_Coordinate_Units:* Decimal degrees
*Geodetic_Model:*
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*Ellipsoid_Name:* Geodetic Reference System 80
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*Denominator_of_Flattening_Ratio:* 298.257

*Entity_and_Attribute_Information:*
*Overview_Description:*
*Entity_and_Attribute_Overview:*

This metadata record describes water quality data collected during a water-quality mapping project. Project data are an aggregation of data collected during twenty 2021 DATAFLOW mapping cruises.

The data are contained in six related entities (tables): Light_Attenuation_Data, Monitoring_Event_Data, Optical_Density_Data, Station_Information, and Water_Quality_Data. Each table contains attributes (fields).

The entity Light_Attenuation_Data is comprised of the attributes: MonitoringStation, HUC8, HUC12, FIPS, CBSeg2003, SegmentShed2009, EventID, Cruise, Program, Project, Agency, Source, Station, SampleDate, SampleTime, TotalDepth, UpperPycnocline, LowerPycnocline, Depth, Layer, SampleType, SampleReplicateType, Parameter, Qualifier, MeasureValue, Unit, Method, Lab, Problem, PrecisionPC, BiasPC, Details, Latitude, Longitude, and TierLevel.

The entity Monitoring_Event_Data is comprised of the attributes: MonitoringStation, HUC8, HUC12, FIPS, CBSeg2003, SegmentShed2009, EventID, Cruise, Program, Project, Agency, Source, Station, SampleDate, SampleTime, TotalDepth, UpperPycnocline, LowerPycnocline, FieldActivityEventType, FieldActivityRemark, WindSpeed, WindDirection, PrecipType, tideStage, WaveHeight, CloudCover, Pressure, GaugeHeight, FlowStage, Details, Latitude, Longitude, and TierLevel.

The entity Optical Density is comprised of the attributes: MonitoringStation, HUC8, HUC12, FIPS, CBSeg2003, SegmentShed2009, EventID, Cruise, Program, Project, Agency, Source, Station, SampleDate, SampleTime, TotalDepth, UpperPycnocline, LowerPycnocline, Depth, Layer, SampleType, SampleReplicateType, Parameter, Qualifier, MeasureValue, Unit, Method, Lab, Problem, PrecisionPC, BiasPC, Details, Latitude, Longitude, and TierLevel.

The entity Sonde_Data is comprised of the attributes: StationDesc, Sample_Date, Sample_Time, Depth_m, Latitude, Longitude, Salinity_ppt, Temp_C, DO_mg/L, DO_%Sat, pH, Turbidity_NTU, Fluor, and Chl_ug/L.

The entity Station_Information is comprised of the attributes: CBSeg2003, CBSeg2003Description, CBSegmentShed2009, CBSegmentShed2009Description, CountyCity, FallLine, FIPS, HUC12, HUC8, Latitude, LLDatum, Longitude, State, Station, StationDescription, USGSGage, UTMX, and UTMY.

The entity Water_Quality_Data is comprised of the attributes: MonitoringStation, HUC8, HUC12, FIPS, CBSeg2003, SegmentShed2009, EventID, Cruise, Program, Project, Agency, Source, Station, SampleDate, SampleTime, TotalDepth, UpperPycnocline, LowerPycnocline, Depth, Layer, SampleType, SampleReplicateType, Parameter, Qualifier, MeasureValue, Unit, Method, Lab, Problem, PrecisionPC, BiasPC, Details, Latitude, Longitude, and TierLevel.

Maps created by interpolating the dissolved oxygen, turbidity, chlorophyll a, salinity and temperature data acquired during monthly mapping cruises show spatial distribution of water quality parameter values on the day of the survey. The maps may be viewed and downloaded from [https://eyesonthebay.dnr.maryland.gov/sim/Dataflow.cfm].

*Entity_and_Attribute_Detail_Citation:*
Guide to Using Chesapeake Bay Program Water Quality Monitoring Data, EPA 903-R-12-001, February 2012, CBP/TRS 304-12 [https://www.chesapeakebay.net/documents/3676/wq_data_userguide_10feb12_mod.pdf].

Methods and Quality Assurance for Chesapeake Bay Water Quality Monitoring Programs. Chesapeake Bay Program, May 2017, CBP/TRS-319-17 [https://www.chesapeakebay.net/documents/CBPMethodsManualMay2017.pdf].

Quality Assurance Project Plan for the Maryland Department of Natural Resources Chesapeake Bay Shallow Water Quality Monitoring Program for the period July 1, 2021 - June 30, 2022 [https://eyesonthebay.dnr.maryland.gov/eyesonthebay/documents/SWM_QAPP_2021_2022_Draft_v6.pdf].

Water Quality Database - Database Design and Data Dictionary, Prepared For: U.S. Environmental Protection Agency, Region III, Chesapeake Bay Program Office, January 2004. [https://www.chesapeakebay.net/documents/3676/cbwqdb2004_rb.pdf].

*Distribution_Information:*
*Distributor:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Mike Mallonee
*Contact_Position:* Water Quality Data Manager
*Contact_Address:*
*Address_Type:* Mailing and Physical
*Address:* 1750 Forest Drive, Suite 130
*City:* Annapolis
*State_or_Province:* Maryland
*Postal_Code:* 21401
*Country:* USA
*Contact_Voice_Telephone:* 410.267.5785
*Contact_Electronic_Mail_Address:* mmallone@_no_spam_chesapeakebay.net[Remove _nospam_ for valid email address]
*Resource_Description:* Downloadable data
*Distribution_Liability:* None of the Chesapeake Bay Program partners nor any of their employees, contractors, or subcontractors make any warranty, expressed or implied, nor assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information or data contained within the web site. Reference to any specific commercial

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*Access_Instructions:* Data are available via the Chesapeake Bay Programs CIMS data hub. Select Water Quality Database (1984-Present). Access the data by following web site (see Network Resource Name) instructions.

*Fees:* None
*Distribution_Information:*
*Distributor:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Mark Trice
*Contact_Position:* Program Chief, Water Quality Informatics, Tidewater Ecosystem Assessment
*Contact_Address:*
*Address_Type:* Mailing and Physical Address
*Address:* Tawes State Office Building, 580 Taylor Avenue, D2
*City:* Annapolis
*State_or_Province:* MD
*Postal_Code:* 21401
*Country:* USA
*Contact_Voice_Telephone:* 410.260.8630
*Contact_Electronic_Mail_Address:* mark.trice_nospam_@maryland.gov[Remove _nospam_ for valid email address]

*Resource_Description:* Downloadable data
*Distribution_Liability:* None of the Maryland Department of Natural Resources partners, nor any of their employees, contractors, or subcontractors, make any warranty, expressed or implied, nor assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information or data contained within the web site. Reference to any specific commercial products, processes, or services or the use of any trade, firm, or corporation name is for the

information and convenience of the public and does not constitute endorsement, recommendation or favoring by the Maryland Department of Natural Resources.

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Water quality sonde data have been collected during surveys of tributaries to the Maryland portion of the Chesapeake Bay or Segments of the Chesapeake Bay mainstem.

Select a sampling location (Tributary/Waterbody), then choose sampling date(s). Please wait for sampling dates to load after highlighting a waterbody.

*Fees:* NONE
*Metadata_Reference_Information:*
*Metadata_Date:* 20220623
*Metadata_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Rebecca Burrell
*Contact_Address:*
*Address_Type:* Mailing and physical address
*Address:* Maryland Department of Natural Resources, D-2 580 Taylor Avenue
*City:* Annapolis
*State_or_Province:* MD
*Postal_Code:* 21401
*Contact_Voice_Telephone:* (410) 260-8630
*Contact_Electronic_Mail_Address:* rebecca.burrell_nospam_@maryland.gov[Remove _nospam_ for valid email address]
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