# Maryland Shallow Water Monitoring Program – 2014 DATAFLOW

## Metadata:

*Identification_Information:*
*Citation:*
*Citation_Information:*
*Originator:* Maryland Department of Natural Resources, Resource Assessment Service (MD DNR RAS)
*Publication_Date:* 20150301
*Title:* MD DNR Water Quality Mapping Project 2014
*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 2014.

A total of forty-two mapping cruises were conducted on Maryland water bodies. The spatial extent of water quality was measured on the following rivers: Back, Corsica, Nanticoke and Pocomoke.

Two surveys were required to map the Nanticoke and Pocomoke Rivers. Data collected during Upper and Lower Nanticoke River surveys were combined. Similarly, data collected during the Upper and Lower Pocomoke River surveys were combined. Normally, upper and lower surveys were conducted on the same day. The upper and lower legs of the June Pocomoke survey occurred one day apart due to weather conditions.

Water quality mapping was conducted using DATAFLOW, a compact, self-contained surface water quality mapping system deployed in a small boat operating at planing speeds of up to 45 km/hr (24.3 kts). Measurements were made approximately every four seconds, or 30 meters (100 feet). Seven water quality parameters were measured: water temperature, salinity, conductivity, dissolved oxygen, turbidity, fluorescence and pH. The April, August and October Corsica River surveys were conducted using a second sonde equipped with blue-green algal (phycoerythrin) sensors used to measure blue green algal cells/ml and Relative Fluorescence Units (RFUs). Water depth was also measured. The DATAFLOW system sampled water at approximately 0.5-m depths below the surface.

Additional water-quality measurements were made at thirty calibration stations. Secchi disk depth, HydroLab (water temperature, pH, dissolved oxygen, specific conductance, and salinity) and photosynthetic active radiation measurements were made at five stations during each survey.

Water-quality calibration chlorophyll and total suspended solids "grab" water samples were collected at five stations during each monthly mapping survey. The "grab" samples were collected, after stopping the boat, at 0.5-m depth and filtered, when possible, on site.

A suite of nutrient "grab" water samples were also collected monthly at Corsica River stations: COR0056, XHH3851, XHH4528, XHH4916 and XHH4931. The Corsica survey was the only water quality mapping survey on which nutrient samples were collected.

Laboratory analyses were performed on calibration "grab" sample water. Concentrations of chlorophyll a and total suspended solids were determined for all stations. Corsica River stations were also analyzed for total dissolved nitrogen, particulate nitrogen, nitrite, nitrite + nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, particulate inorganic phosphorus, orthophosphate, particulate carbon and volatile suspended solids.

*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 target specific locations for 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.

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

Quality Assurance Project Plan for the Maryland Department of Natural Resources, Chesapeake Bay Shallow Water Quality Monitoring Program, for the period July 1, 2014 - June 30, 2015.
[http://mddnr.chesapeakebay.net/eyesonthebay/documents/SWM_QAPP_2014_2015_Draft_v3.pdf]

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]

*Time_Period_of_Content:*
*Time_Period_Information:*
*Range_of_Dates/Times:*
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*Ending_Date:* 20141028
*Currentness_Reference:* Ground condition
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Olsen, L.M., G. Major, K. Shein, J. Scialdone, S. Ritz, T. Stevens, M. Morahan, A. Aleman, R. Vogel, S. Leicester, H. Weir, M. Meaux, S. Grebas, C.Solomon, M. Holland, T. Northcutt, R. A. Restrepo, R. Bilodeau, 2013. NASA/Global Change Master Directory (GCMD) Earth Science Keywords. Version 8.0.0.0.0

NASA/Global Change Master Directory (GCMD) Earth Science Keywords. Version 8.0.0.0.0 [online: http://gcmd.gsfc.nasa.gov/learn/keywords.html]
*Theme_Keyword:* BIOSPHERE > AQUATIC ECOSYSTEMS > ESTUARINE HABITAT

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*Temporal:*
*Temporal_Keyword_Thesaurus:* Global Change Master Directory Science Keywords
*Temporal_Keyword:* 2014
*Access_Constraints:* None
*Use_Constraints:* None
*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
*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:* [http://mddnr.chesapeakebay.net/eyesonthebay/documents/metadata/MdDNR_DFloStns2014.pdf]
*Browse_Graphic_File_Description:* Overview map of thirty 2014 DATAFLOW calibration station sites located on Maryland Chesapeake Bay tributaries.
*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, nutrient and suspended solids samples.

The project was made possible with funding provided by the State of Maryland, the United States Environmental Protection Agency Chesapeake Bay Program, and the National Atmospheric and Oceanic Administration Chesapeake Bay Program Office.

*Data_Quality_Information:*
*Attribute_Accuracy:*
*Attribute_Accuracy_Report:*
QUALITY ASSURANCE/QUALITY CONTROL

MD DNR 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 2014. A second sonde configured with 6132 (blue-green phycoerythrin) probe was also used (April, August and October Corsica River surveys only). Resolution, range and accuracy specifications for the sonde and probes may be obtained from the manufacturer [http://www.ysi.com/accessories.php] - Sensors&Probes - 6-Series.

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 LICOR, Inc. 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 2014: An algal sample was collected when elevated fluorescence readings were observed during the Corsica River survey.

May 2014: A phytoplankton bloom was noted at Corsica River station XHH4528.

June 2014: Field sheet comments for Upper Nanticoke River stations XCI6253,

XCI5934, XDI1487 and XCI9167, stated that thunderstorms had occurred the night be for the stations were sampled.

July 2014: A phytoplankton bloom was noted at Back River station XHH4528. All Back River and Corsica River water quality calibration stations had comments related to thunderstorms that occurred the night before the stations were sampled. A heavy Scrippsiella precaria bloom extended over half of the Corsica River. Elevated Upper Nanticoke River turbidity readings measured off Penknife Point and Point No Point were evaluated and were attributed to high current conditions.

August 2014: A phytoplankton bloom was noted at Back River station WT4.1. Two Back River algal sample cell counts were consistent with elevated fluorescence readings. A Back River field sheet comment for station XIF4935 stated that the bottom had been disturbed. A phytoplankton sample was collected at Corsica River station XHH3851.

October 2014: A count of over 54 million cells per liter was estimated in a Corsica River survey algal sample.

There were no known attribute accuracy issues during September 2014.

*Logical_Consistency_Report:*

April 2014: The April Back River survey was the first water quality mapping project survey of the river. Subsequent monthly cruise tracks extended further upriver. Efforts to document station WT4.1 coordinates resulted in cruise track variations. Progress, during the Upper Pocomoke survey, was interrupted due to time required to open and close a bridge.

June 2014: Due to survey vessel issues, the Lower Pocomoke survey was conducted one day after the Upper Pocomoke survey was conducted.

There were no other known logical consistency issues during sampling conducted during May, July, August, September and October 2014.

*Completeness_Report:*

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 thirty stations are included in the dataset. Five calibration samples were collected during each of the following monthly sampling runs: Back, Corsica, Lower Nanticoke, Lower Pocomoke, Upper Nanticoke, and Upper Pocomoke.

Beginning in January 2010, a full suite of nutrient samples was no longer collected during most Water Quality Mapping Surveys. The exception was the Corsica River surveys, where, during 2014, full nutrient suites continued to be collected at stations: COR0056, XHH3851, XHH4528, XHH4916 and XHH4931.

Samples from the five calibration stations on the Corsica River were collected and analyzed for the same suite of nutrients as those measured for the Chesapeake Bay Mainstem Program (chlorophyll a, pheophytin, total dissolved nitrogen, particulate nitrogen, nitrite, nitrite + nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, orthophosphate, particulate carbon, total suspended solids and volatile suspended solids) plus particulate inorganic phosphorus.

Contour maps based on 2014 Dissolved Oxygen, Salinity, Turbidity, Temperature and Chlorophyll data acquired during DATAFLOW monthly mapping cruises are available on-line. [http://mddnr.chesapeakebay.net/sim/dataflow_data.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 2014: Depth values were not recorded during the April Corsica River survey due to software configuration issues. The upper Nanticoke cruise track did not go south of station XDI4990 due to engine over-heating concerns. The course alteration resulted in the loss of approximately ten percent of the Southern part of the upper Nanticoke cruise track.

May 2014: The Corsica River survey was interrupted for half an hour due to power supply concerns.

June 2014: LICOR sampling was not possible at Corsica River stations XHH4931, XHH4916 and XHH4528 due to equipment issues. Due to dangerous sea conditions, LICOR readings were not taken at Back River stations XIF4750 and WT4.1.

July 2014: Depth values were not recorded during the Lower Nanticoke River survey due to unknown issues.

August 2014: A computer issue resulted in a data gap between 08:36 and 08:45 on the Corsica River survey. The data sonde intake was clogged with debris resulting in a five minute data gap. The Upper Nanticoke survey was shortened due to concerns about the vessel fuel level.

September 2014: Software failures resulted in termination of data logging on two occasions during the Upper Nanticoke survey.

October 2014: Battery failure terminated data logging 820 meters before the vessel reached the dock at the end of the Lower Nanticoke survey.

*Lineage:*
*Process_Step:*
*Process_Description:*

SONDE CALIBRATION and POST-CALIBRATION:

YSI 6600 data sondes equipped with a 6560 conductivity/temperature probe, a 6136 turbidity probe, a 6025 chlorophyll probe, a 6561 pH probe, a 6150ROX (Optical) Dissolved Oxygen probe and in one case, a 6132 (blue-green phycoerythrin) probe, were maintained and calibrated before and after each deployment in accordance with YSI recommendations. [http://www.ysi.com/resource-library.php]

CONTINUOUS SURFACE WATER QUALITY MAPPING:

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. A second sonde, configured with a phycoerythrin probe, was deployed on some Corsica River surveys. The sonde transmitted data sensor measurements to a YSI 650 data logger.

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 small form factor computer. 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.

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 and, on the Corsica River survey, "whole" and "filtered" nutrient samples.

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

Particulate samples included: Chlorophyll, Phaeophytin, Particulate Carbon, Particulate Nitrogen, Particulate Phosphorus (PP), Particulate Inorganic Phosphorous (PIP), Total Suspended Solids (TSS) and Volatile Suspended Solids (VSS).

Filtrate collected from TSS/VSS or PP/PIP filtrations was used for dissolved nutrient samples. Nitrate, Nitrite, Ammonia, Orthophosphate, Total Dissolved Nitrogen and Total Dissolved Phosphorus samples were collected.

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-meter depth. The sonde was then lowered to the bottom. A reading was taken at 0.3-meters above the bottom. The sonde was raised and measurements were recorded at 0.5-meter or 1.0-meter increments until it reached the surface. (In cases where station depth was greater than 3-meters, the sonde was raised in 1-meter 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-meter intervals until 10% of the 0.1-meter reading was reached. If the station depth was greater than 3 meters, a reading was taken at 0.1-meter and at 0.5-meter intervals until 10% of the 0.1-meter reading was reached.

*Process_Date:* Unknown
*Process_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Sally Bowen
*Contact_Position:* Project Chief, Monitoring Field Office, DNR
*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:* 410 263-3369
*Contact_Electronic_Mail_Address:* sally.bowen_nospam_@maryland.gov[Remove _nospam_ for valid email address]

*Process_Step:*
*Process_Description:*
DATAFLOW FILE POST-PROCESSING:

Each raw .txt file, created by DATAFLOW/LabVIEW during 2014 mapping cruises on all water bodies was post-processed in the following manner.

Each file was opened in Microsoft Excel(tm) and renamed. 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 extremely 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 "bad" were documented with error codes and comments. Unreliable data were masked. No data were discarded. All DATAFLOW data for each mapping cruise, both "good" and "bad", were retained in an archival file. Only data considered reliable were published in reports.

MERGING PRIMARY AND SECONDARY SONDE DATA

When a second data sonde was used on a survey, it was necessary to generate time adjustment values because the clocks in the two sondes were not synchronized. Secondary sonde adjusted times made it possible to merge secondary sonde data with data from the primary sonde. Adjustment values for 7,280 records were derived using expressions which shifted the time. The mean time adjustment was 1.27 seconds. One three second adjustment was needed.

*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:* Tawes State Office Building, 580 Taylor Avenue, D2
*City:* Annapolis
*State_or_Province:* Maryland
*Postal_Code:* 21401
*Country:* United States
*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, total dissolved nitrogen, particulate nitrogen, nitrite, nitrite + nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, particulate inorganic phosphorus, orthophosphate, particulate carbon, total suspended solids, and volatile 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 Nutrient Analytical Services Laboratory

*Contact_Address:*

*Address_Type:* mailing and physical

*Address:* Chesapeake Biological Laboratory, Center for Environmental and Estuarine Studies, The University of Maryland System, P.O. BOX 38, SOLOMONS, MD 20688

*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]

*Process_Step:*

*Process_Description:*

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. 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:* Tawes State Office Building, 580 Taylor Avenue, D2

*City:* Annapolis

*State_or_Province:* Maryland

*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]

*Spatial_Data_Organization_Information:*
*Indirect_Spatial_Reference:* Back River, Corsica River, Nanticoke River, Pocomoke River, Maryland, USA.
*Direct_Spatial_Reference_Method:* Point
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*Semi-major_Axis:* 6378137
*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 2014 data collected during forty-two DATAFLOW mapping cruises.

The data are contained in six related entities (tables): Station_Information, Monitoring_Event_Data, Water_Quality_Data, Light_Attenuation_Data, SONDE_DATA and BGA_DATA. Each table contains attributes (fields). NOTE: SONDE_DATA and BGA_DATA were not served by the Chesapeake Bay Program at the time this metadata record was developed.

The entity Station_Information is comprised of the attributes: STATION, DESCRIPTION, WATER_BODY, CBP_BASIN, TS_BASIN, BASIN, CBSEG_2003, CBSEG_2003_DESCRIPTION, HUC8, CATALOGING_UNIT_DESCRIPTION, HUC11, WATERSHED, FIPS, STATE, COUNTY/CITY, FALL_LINE, LATITUDE, LONGITUDE, LL_DATUM, UTM_X and UTM_Y.

The entity Monitoring_Event_Data is comprised of the attributes: EVENT_ID, SOURCE, AGENCY, PROGRAM, PROJECT, STATION, EVENT_START_DATE, EVENT_START_TIME, CRUISE, TOTAL_DEPTH, UPPER_PYCNOCLINE, LOWER_PYCNOCLINE, AIR_TEMP, WIND_SPEED, WIND_DIRECTION, PRECIP_TYPE, TIDE_STAGE, WAVE_HEIGHT, CLOUD_COVER, GAGE_HEIGHT, PRESSURE, FLOW_STAGE, DETAILS and WATER_BODY.

The entity Water_Quality_Data is comprised of the attributes: EVENT_ID, SOURCE, PROJECT, STATION, SAMPLE_DATE, SAMPLE_TIME, DEPTH, LAYER, SAMPLE_TYPE, SAMPLE_ID, PARAMETER, QUALIFIER, VALUE, UNIT, METHOD, LAB, PROBLEM, DETAILS, TOTAL_DEPTH, UPPER_PYCNOCLINE, LOWER_PYCNOCLINE, LAT, and LONG.

The entity Light_Attenuation_Data is comprised of the attributes: EVENT_ID, SOURCE, PROJECT, STATION, SAMPLE_DATE, SAMPLE_TIME, SAMPLE_REPLICATE_TYPE, DEPTH, EPAR_S, EPARU_Z, EPARD_Z, UNIT, METHOD, DETAILS, WATER_BODY, TOTAL_DEPTH, UPPER_PYCNOCLINE, and LOWER_PYCNOCLINE.

The entity SONDE_DATA is comprised of the attributes: SAMPLE_DATE, SAMPLE_TIME, WATER_BODY, SECTION, PRI_SEG, SONDE, LATITUDE, LONGITUDE, TOTAL_DEPTH, BOAT_SPEED, BATT, WTEMP, SPCOND, SALINITY, DO_SAT, DO, PH, TURB_NTU, FLUOR, TCHL_PRE_CAL and COMMENTS.

Cyanobacteria are commonly referred to as Blue Green algae (BGA). YSI 6600 sondes are not configured with enough sensor ports to measure water quality and Cyanobacteria with a single instrument so two sondes are used. Cyanobacteria sonde data merged with primary sonde data by matching record timestamps as closely as possible.

The entity BGA_DATA is comprised of the attributes: bgaTemp, bgaSpCond, BGA_PE_Conc, BGA_PE_RFU, bgaDate, bgaTime, bgaTimeAdjusted, SAMPLE_DATE, SAMPLE_TIME, WATER_BODY, SECTION, PRI_SEG, SONDE, LATITUDE, LONGITUDE, TOTAL_DEPTH, BOAT_SPEED, BATT, WTEMP, SPCOND, SALINITY, DO_SAT, DO, PH, TURB_NTU, FLUOR, TCHL_PRE_CAL and COMMENTS.

Maps created by interpolating the Dissolved Oxygen, Turbidity, Chlorophyll a, Salinity and Temperature data acquired during mapping cruises may be viewed and downloaded from [http://mddnr.chesapeakebay.net/sim/dataflow_data.cfm].

*Entity_and_Attribute_Detail_Citation:*

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

Quality Assurance Project Plan for the Maryland Department of Natural Resources, Chesapeake Bay Shallow Water Quality Monitoring Program, for the period July 1, 2014 - June 30, 2015.
[http://mddnr.chesapeakebay.net/eyesonthebay/documents/SWM_QAPP_2014_2015_Draft_v3.pdf]

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]

*Distribution_Information:*
*Distributor:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Michael Mallonee
*Contact_Position:* Water Quality Data Manager
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*Address_Type:* mailing
*Address:* 410 Severn Avenue
*City:* Annapolis
*State_or_Province:* Maryland
*Postal_Code:* 71403
*Contact_Voice_Telephone:* 800 968-5785
*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 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 Chesapeake Bay Program partners.

*Standard_Order_Process:*
*Digital_Form:*
*Digital_Transfer_Information:*
*Format_Name:* ASCII file, formatted for text attributes, declared format
*Format_Information_Content:* Station Information, Monitoring Event data, Light Attenuation data and Water Quality data.
*File_Decompression_Technique:* No compression applied
*Transfer_Size:* 1.2
*Digital_Transfer_Option:*
*Online_Option:*
*Computer_Contact_Information:*
*Network_Address:*
*Network_Resource_Name:*
[http://www.chesapeakebay.net/data/downloads/cbp_water_quality_database_1984_present]
*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.

*Digital_Form:*
*Digital_Transfer_Information:*
*Format_Name:* ASCII (ASCII file, formatted for text attributes, declared "ASCII" format)
*Format_Information_Content:* Water quality mapping sonde data

*File_Decompression_Technique:* No compression applied
*Transfer_Size:* 15.2
*Digital_Transfer_Option:*
*Online_Option:*
*Computer_Contact_Information:*
*Network_Address:*
*Network_Resource_Name:*
[http://www.chesapeakebay.net/data/downloads/cbp_water_quality_database_1984_present]
*Access_Instructions:* UNKNOWN +++++++++++++ TO BE DETERMINED when data are served by CBP.

*Digital_Form:*
*Digital_Transfer_Information:*
*Format_Name:* XLS (Microsoft Excel)
*Format_Information_Content:* Cyanobacteria sonde data merged with primary sonde data.
*File_Decompression_Technique:* Unzip
*Transfer_Size:* 1.2
*Digital_Transfer_Option:*
*Online_Option:*
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*Network_Address:*
*Network_Resource_Name:*
[http://www.chesapeakebay.net/data/downloads/cbp_water_quality_database_1984_present]
*Access_Instructions:* UNKNOWN +++++++++++++ TO BE DETERMINED when data are served by CBP.
*Fees:* None

*Metadata_Reference_Information:*
*Metadata_Date:* 20150303
*Metadata_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Ben Cole
*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:* benjamin.cole_nospam_@maryland.gov[Remove _nospam_ for valid email address]
*Metadata_Standard_Name:* FGDC Content Standards for Digital Geospatial Metadata
*Metadata_Standard_Version:* FGDC-STD-001-1998