**Chesapeake Monitoring Cooperative**

**Program Manual**

***[GROUP NAME]***

***[Date]***

***Title and Approval Page***

**Program Name:**

**Monitoring Group:**

**Date:**

***[name]*** Date

Certified Trainer/QA Officer

***[Group Name]***

Liz Chudoba Date

CMC Service Provider

Alliance for the Chesapeake Bay

Stephanie Letourneau Date

CMC Service Provider

Alliance for Aquatic Resource Monitoring

Section A: Roles and Responsibilities

**[*INSERT Org Chart/Flow Chart and details about personnel at the organization involved in the monitoring program and their roles. Can include more positions than what is listed in Table 1, but at a minimum needs to include someone in charge of ensuring data is collected properly (either by volunteers or paid staff), someone in charge of managing the data and quality assurance measures to ensure data quality, and a certified monitor/trainer. Those roles can be filled by one person or multiple people. Additional roles can be included as needed for specific programs, for example, boat captains, laboratory analyses, etc.]***

*Table A1: Personnel involved in the monitoring program and their designated roles.*

|  |  |  |
| --- | --- | --- |
| **Role** | **Description** | **Individuals Involved** |
| Program Coordinator | Manages and administers the monitoring program to ensure all volunteer monitors follow proper sampling procedures. |  |
| QA Officer | Performs all quality assurance measures outlined in this manual, including calibration checks, replicate/duplicate checks, spot checks and QA on data. Uploads and publishes data in the Chesapeake Data Explorer. |  |
| Certified Trainer | Performs new and recertification trainings for monitors within the associated monitoring group. |  |
| CMC Service Provider | Conducts the initial certification training with the program coordinator and annual recertification trainings. Conducts annual thermometer checks. Assists with data integration into the Data Explorer. | Liz Chudoba (ACB)  Caroline Donovan (UMCES)  Stephanie Letourneau (ALLARM) |

Section B: Program Summary

***Background***

***[Add in background info as needed for specific monitoring program. Can include watershed context, TMDL’s or watershed impairments, past monitoring that has occurred or current monitoring that is occurring by other organizations, etc.]***

***Goals and Objectives***

***[Identify the goals and objectives of the monitoring program. What are the questions you are trying to answer? Examples include but are not limited to:***

* **Determine the status and trends for water quality conditions on and around Blackwater NWR, capturing spatial and temporal variability, and sufficient to guide habitat management, enhancement and restoration activities. (Credit: Blackwater National Wildlife Refuge)**
* **Characterize the present state of the Nanticoke River by establishing baseline data, including spatial and seasonal variation, using key water quality indicators. (Credit: Nanticoke Watershed Alliance)**
* **Determine long‑term trends or changes in key water quality indicators in relation to pollution control programs. (Credit: Nanticoke Watershed Alliance)**
* **Identify areas for management and restoration efforts. (Credit: Nanticoke Watershed Alliance)]**

***Data Use (Tier Level)***

***[Identify specific data uses and audiences for the data collected through this program. Examples include but are not limited to:***

* ***SRA uses the water quality data to explain changing conditions in our river, such as the permanent dead zone, why we’ve lost habitat for Yellow Perch, what caused the decline of underwater grasses, what killed off our oyster reefs, why there were no pickerel in the river last winter, and what can we do to save habitat for what remains: turtles, beaver, river otters, waterfowl, horseshoe crabs, rockfish, blue crabs etc. (Credit: Severn River Association)***
* ***We’ll use GIS story maps, press releases, social media campaigns, monthly educational meetings, e-mail campaigns, report cards, annual reports, SRA’s monthly newsletter, brochures and websites. (Credit: Severn River Association)***
* ***Produce a report card for the Antietam Creek watershed's health by subwatersheds for various chemical, physical, and biological parameters which could be distributed to County residents. (Credit: Antietam-Conococheague Watershed Alliance)]***

Data collected through this project are classified as Tier X, Tier X and Tier X in the CMC’s Chesapeake Data Explorer, based on equipment used and QA procedures established in this Program Manual. See Table B1 for the intended data uses for those tier levels.

For use in the Integrated Report of Surface Water Quality, Maryland Department of the Environment (MDE) solicits data from the Data Explorer biannually.  Each Integrated Report cycle typically includes a five-year data window and all data published by February 1st of the odd numbered calendar year will be used in the next even numbered calendar year's Integrated Report.  For example, for the 2024 IR, all data from 2018-2022 should be published by February 1, 2023 to be included in the 2024 Integrated Report.  Any data published after February 1, 2023 will be used for the next cycle (2026) of the Integrated Report. Specific data used are determined based on [MDE’s Tiered Framework](https://mde.maryland.gov/programs/water/TMDL/Integrated303dReports/Pages/Data-Solicitation.aspx).

The purpose of the Integrated Report is to identify and list waters not meeting water quality standards.  The most frequently assessed non-tidal parameters for the Integrated Report include pH, dissolved oxygen (DO), turbidity (in NTU), biology, and bacteria.  Maryland does not have water quality criteria for some commonly monitored nontidal parameters such as nutrients, suspended solids, or water clarity (Secchi depth) for nontidal waters.  All tidal data should go through the Chesapeake Data Explorer to be included in the Chesapeake Bay Program's Interpolator Assessments that are used in the Integrated Report.

For use by the Chesapeake Bay Program partnership, data is also uploaded to the Chesapeake Bay Program’s DUET/CEDR database annually by the CMC team.

*Table B1: The CMC’s Tiered Framework and intended data uses. Tiers are determined for individual parameters not entire programs and are based off of monitoring protocols, sampling frequency, equipment and quality assurance protocols.*

|  |  |  |
| --- | --- | --- |
| **Tier** | **Intended Data Use** | **Summary of Data Requirements** |
| Provisional | Track groups collecting water quality monitoring data across the watershed. | Program does not meet minimum requirements for Tier 1. |
| Provisional Tier 1 | Education, environmental health screening | * Historic dataset that is categorized as Tier 1 * Current dataset that is categorized as Tier 1 but the group does not attend a CMC certification training workshop. |
| Tier 1 | Education, environmental health screening, targeting of management actions, baseline stream health assessment. | * Written study design (preferred) * Documented monitoring methodology and field data sheet * Documented site location(s) (with coordinates) * Collect samples at a specified sampling rate with an 80% completion rate. |
| Provisional Tier 2 | Environmental health screening, environmental health report cards, targeting of management actions | * Historic dataset that is categorized as Tier 2 * Current dataset that is categorized as Tier 2 but the group does not attend a CMC certification training workshop. |
| Tier 2 | Education, environmental health screening, targeting of management actions, baseline stream health assessment, and CMC Report Cards. | * Same at Tier 1 * Meets the Tier 2 quality assurance standards for specific equipment and parameters. * Acquires and maintains CMC Tier II certification. |
| Tier 3 | Tier 1 and 2 uses and Chesapeake Bay Watershed trends and assessments to help inform policy and management decisions. | * Maintain QAPP and field/lab standard operating procedures approved by CBP. * Participation in CBP DIWG field and lab audits. |

***Timeline***

***[Specify the program sampling timeline, frequency, and schedule. Additional information to include if possible are contingencies if the sampling cannot occur on the same schedule.***

***Examples:***

***Alliance for the Chesapeake Bay:***

***Samples are collected once a month, year-round. Individual monitors/monitoring groups select a sampling day that works for them, but is consistent each month (ie. The first Tuesday of each month). If there is a conflict with the regularly scheduled sampling day (due to inclement weather, etc), the sample is collected on a different day within 2 days of the original sampling day.***

***Severn River Association:***

***Samples are collected weekly from May-October, weather permitting, and monthly from November – April. There are three vessels in the SRA fleet, 4 volunteer boat captains who rotate their services on the WQ tours. SRA recruits volunteers to help out with the Wednesday and Thursday WQ Tours. SRA’s Tom Guay and the CCC Intern lead these tours.***

***To cover the entire river, SRA monitors the Anne Arundel County portions of the Severn River. We are also working with partners, Operation Clearwater and the Spa Creek Conservancy who monitor Spa and Back Creeks in the city of Annapolis.***

***The breakdown is as follows:***

1. ***Upper River (Clements Creek To Indian Landing). Weekly monitoring on Wednesdays by SRA.***
2. ***Mid-River (Asquith Creek To USNA Bridge). Weekly monitoring on Thursdays by SRA.***
3. ***Lower River (Lake Ogleton To Whitehall Creeks). Weekly monitoring on Thursdays or Fridays by SRA.***
4. ***Spa Creek (Wednesday): Weekly monitoring by Spa Creek Conservancy in conjunction with Operation Clearwater, and***
5. ***Back Creek (Thursday): Weekly monitoring Back Creek Conservancy in conjunction with Operation Clearwater.***

***Blackwater National Wildlife Refuge:***

***Trained volunteers collect data once per month, year around. Testing is intended to be conducted on the second Tuesday of each month, between 8 am and noon. Occasionally, severe ice conditions may prevent sampling at some locations. If weather conditions or volunteer availability require rescheduling to a different day, it should be rescheduled to be as close to the original day as possible.]***

*Table B2: Project Timeline*

|  |  |
| --- | --- |
| **Task** | **Timeline** |
| Program Start Date |  |
| Sampling frequency (eq. monthly, bimonthly, weekly) |  |
| Sampling timeframe (eg. Year round, months) |  |
| Data upload to the Chesapeake Data Explorer |  |
| Volunteer monitor recruitment/training |  |
| Recertification for Monitors | Annually |
| Recertification for Coordinators | Annually |

***Site Selection***

***[Document site location selection process/how the sites were selected and how many sites. Fill in Table B3 with the actual site locations, using the latitude and longitude coordinates in decimal degrees (4 decimal places) with the North American 1983 Datum (NAD83). Monitors sampling from a boat are required to document the latitude and longitude coordinates using GPS or mobile device with the North American 1983 Datum (NAD83) to ensure that they are located with 10 meters of the original site location.***

***Blackwater National Wildlife Refuge Example:***

***Sampling locations were selected to adequately capture spatial variability across the project area and characterize key hydrologic units. The exact locations were selected for convenience purposes (bridges for sites F, G, and H, allowing midstream sampling; a boat launch with bulkhead for site I). Site F characterizes the upper Blackwater River and the Buttons Creek tributary as it flows downstream towards Fishing Bay. Site G characterizes the water quality at the mouth of the Little Blackwater River as it flows into the Blackwater River, approximately seven miles downstream from the Nanticoke Watershed Alliance’s Little Blackwater 4 sampling point. Site H characterizes water quality as the Blackwater River narrows and eventually flows into Fishing Bay. Site I characterizes the quality of the Transquaking River, approximately 11.2 miles downstream from Nanticoke Watershed Alliance’s TRAN2 station on Drawbridge Road, as it approaches Fishing Bay. A final advantage of using these sites is that they were used in the past, allowing a direct comparison with historical data.]***

*Figure 1: Sampling site locations for this project.*

***[INSERT site map]***

*Table B3: List of Monitoring Sites for the project.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Site ID** | **Sample Method** | **Description** | **Latitude** | **Longitude** |
| ***EX. ACB1*** | ***Wade in mid-channel with a bucket.*** | ***Located in Richmond, VA on Reedy Creek off of the hiking trail through the park.*** | ***38.9876*** | ***-76.8976*** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

\*Latitude and Longitude coordinates must be in decimal degrees with 4 decimal places.

***Water Quality Parameters***

This program will use ***[insert specific equipment (ex. YSI Pro DSS)]*** to measure ***[insert specific parameters with units (ex. Dissolved oxygen (mg/L and % saturation), water temperature (degrees Celsius)]*** *in situ*. The parameters to be analyzed in the field and the equipment to be used are found in Table B4. All samples will be collected following the detailed methodology found in Appendix A.

The program will collect samples from a ***[insert how the samples are taken – boat, dock, bridge, wade-in. Specify whether surface samples or depth profiles will be measured and if samples are taken with a bucket.]***

***[Standard language to include if doing depth profile samples]*** Depth profile readings must be taken mid-channel by boat. Channel depth should be measured with the depth finder on the boat or by using the Secchi line/measuring tape. In the main stem of the river (or if the depth is >3 m deep) take a bottom measurement at 1.0 m above the bottom, go to the next whole number and take a reading, then proceed in 1.0 m increments until you reach 0.5 m below the surface (Example: At a 3.4 m deep site, measure at 2.4, 2.0, 1.0 m and 0.5 m). In the creeks (or if the depth is ≤3 m) measure 1.0 m above the bottom and then again at 0.5 m below the surface. At each iteration allow the probe to stabilize before recording your reading at the corresponding depth.

*Table B4: Field Parameters Monitored*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Analytical Method** | **Equipment** | **Units** | **Tier Designation** |
| Air and Water Temperature | USEPA 170.1 | ***[insert specific probe/meter]*** | Celsius | Tier 2 |
| Dissolved Oxygen | USEPA 360.1 | ***[insert specific probe/meter]*** | mg/L and % sat | Tier 2 |
| pH | USEPA 150.1 | ***[insert specific probe/meter]*** | SU | Tier 2 |
| Water Clarity | Secchi Depth | Secchi Disk | Meters | Tier 1 |
| Total Depth | N/A | ***[insert specific equipment]*** | Meters | Tier 1 |

This program will use ***[insert specific lab with address and any contact info (ex. Horn Point Laboratories, address, point of contact) ]*** to analyze ***[insert specific parameters with units (ex. Total Nitrogen (mg/L)]***.

*Table B5: Lab Parameters Monitored*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Lab** | **Parameter and Units** | **Analytical Method** | **MDL (Detection Limit)** | **Holding Time and Condition** |
| ***EX. Horn Point*** | ***Total Nitrogen (mg/L as N)*** | ***EPA Method 353.2*** | ***0.006 mg/L*** | ***28 days in -20 oC freezer*** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

***Data Management***

All data collected (observations and water quality results) will be recorded on field data sheets provided by the program coordinator. Following data collection, data will be entered into the Chesapeake Data Explorer by the monitor or program coordinator either from the field datasheet or via bulk upload. The data is then checked by the QA Officer and published on the [Chesapeake Data Explorer](https://cmc.vims.edu) according to the quality assurance procedures in section AXX. Lab data sheets or excel files will be uploaded to the Chesapeake Data Explorer as received.

All data published on the Chesapeake Data Explorer are publicly available for federal, state, and other entities to use. A subset of this data are uploaded to the Chesapeake Bay Program’s DUET system and EPA’s Water Quality Exchange (WQX) by the CMC team on an annual basis. Refer to the Chesapeake Data Explorer User Manual for more detailed information.

*Table A6.4: Chesapeake Data Explorer Roles and Responsibilities:*

|  |  |  |
| --- | --- | --- |
| **Role** | **Personnel** | **Responsibility** |
| Monitor | Certified Monitors | Have access to upload data to sites registered under their group and to edit and review data points they upload into the Data Explorer until it is published by the program coordinator. |
| Coordinator | Program Coordinator/  QA Officer | Have access to edit, review and publish data for all sites and monitors assigned to their monitoring group. Have access to add or remove stations, monitors or parameters from their monitoring program. |
| Member | CMC Service Provider | Upload all published data to the Chesapeake Bay Program annually. |

Section C: Quality Assurance

***Training***

***[Insert overall details of how trainings will occur annually. Some options include:***

* ***CMC service provider trains the program coordinator annually to be a certified trainer, who then trains the monitors to go out on their own to collect the data.***
* ***CMC service provider trains the program coordinator annually to be a certified monitor, who collects the data with or without the help of volunteers.***
* ***CMC service provider trains the program coordinator and volunteers to be certified monitors.***

***Fill out the Certified Monitor/Certified Coordinator sections as needed based on the set up of the program.]***

**Certified Monitor**

***[This section can be edited to fit the nature of your program and training, but at a minimum should have these elements…]***

Each person who wishes to collect Tier II data for this project will be required to attend a certification workshop hosted by either the CMC Service Provider or Certified Trainer and take a certification test to demonstrate their ability to follow standard operating procedures and understand QA/QC procedures. The certification workshop covers the following items:

1. Goals and objectives of the monitoring program and the CMC
2. Information about the Chesapeake Bay Watershed health and water quality impacts
3. Water quality parameters measured
4. Safety when monitoring
5. Data upload to the Data Explorer (if applicable)
6. Sampling methods:
   1. Clean, calibrate, use, store and maintain all equipment used
   2. Collect, store and transport water samples for analysis (if applicable)
   3. Analyze water samples (if applicable)

The certification test must be taken by the monitor at least one day after their training event and within 90 days to ensure that they have retained the information. Monitors must pass the certification test with an 80% or greater. Monitors that are unable to pass the test will be retrained on their deficiencies and allowed to retake the test. Monitors will be allowed to start collecting water quality samples once they have become certified.

Certified Monitors that are collecting Tier 2 data and wish to maintain their certification must attend a re-certification session hosted by the CMC Service Provider or Certified Trainer annually. During the re-certification monitors are checked to assure that: they remain proficient in methodology and understanding of basic water quality parameters; their equipment is operational and properly calibrated/verified; and, they have an adequate supply of viable chemicals, procedures, equipment verification/check, and updated information about monitoring.

Each sampling event/monitoring group collecting Tier 2 data must have at least one certified monitor responsible for data collection.

**Certified Trainer**

***[This section can be edited to fit the nature of your program and training, but at a minimum should have these elements…]***

The CMC Service Provider will host a Certified Trainer workshop with the program coordinator if they wish to train volunteers. The workshop will cover the goals of the project, information on how to conduct Water Quality Monitoring and Certification Workshops, how to manage the project documentation, how to perform QA/QC checks appropriately, and upload data to the Data Explorer. In order to become certified, trainers must demonstrate a thorough understanding of water quality monitoring methods and QA/QC procedures implemented by the program. This can be achieved through prior knowledge and experience (as deemed appropriate by the CMC Service Provider) or by being a Certified Monitor for at least one year. Once a trainer becomes certified they may train and re-certify volunteer monitors under their program, quality assure data, and publish data in the Chesapeake Data Explorer.

In order to stay certified, trainers will need to attend annual recertification workshops either one on one or regionally with the CMC project team member in person or by video to retain their certification. Trainers may be asked to perform a “mock” training if deemed necessary.

***Field Parameters***

**Spot-checking data sheets**

***[Choose from the three basic options below, can also be tailored based on your specific program so long as 10% of the datasheets are checked for accuracy…]***

For programs that allow monitors to upload data to the Data Explorer and send in their field datasheets to the regional Coordinator for review.

* Check all datasheets have an entry in the database and all data entries have datasheets.
  + If a datasheet is not entered, enter the data and wait one day to conduct the spot check or have someone else complete the following tasks.
  + If datasheets are missing, contact the monitor.
* Complete a 10% spot check of data sheets per site.
  + Spot check every datasheet for new monitors for the first year of monitoring to ensure they are following directions and entering data properly.
  + Spot check every datasheet for certain monitors that have frequent issues.
  + If an error is found that is the fault of the monitor, all their recent data sheets from the previous 6 months are to be checked.
  + Errors will be corrected by the project coordinator.
  + See the CMC QAPP for more specific instructions on spot-checking.
* Scan and file datasheets, keep hard copies for 7 years.

For programs that send the datasheets to a centralized coordinator or QA officer for data upload via the data upload form.

* Enter data from the field datasheets into the Chesapeake Data Explorer online form or onto an excel spreadsheet. Either have a second person or wait one day to complete a 10% spot check of data sheets (ex. Pick one datasheet per sampling day at random). Check to ensure the data was transferred accurately.
  + If an error is found in data entry, check all of the other datasheets for that day or month.

For programs that collect the data on an excel spreadsheet (or some other database) and upload data via the bulk upload process:

**Equipment maintenance**

* Precision Thermometers (used to do field thermometer checks):
  + Verified annually against a NIST master thermometer in cold (0-4oC), room temperature (18-22oC) and hot (30-35oC) water. Each field thermometer needs to be within 0.2oC of the master thermometer and results are recorded in a calibration log.
* Field Thermometers:
  + Verified annually against a NIST master thermometer in cold (0-4oC), room temperature (18-22oC) and hot (30-35oC) water. Each field thermometer needs to be within 0.5oC of the master thermometer and results are recorded in a calibration log.
  + Check for signs of damage before each sampling event.
  + Properly clean after each sampling event.
* Probes:
  + Calibrated to manufacturer’s instructions within 24 hours before sampling and post-sample checks completed within 24 hours after sampling. Calibrations and post-sample checks are tracked on the field data sheets or calibration logs. Calibration ranges:
    - pH: 2-point calibration using buffer 7 and either 10 or 4, bracketing the typical field reading.
    - Conductivity: 1-point calibration using a standard solution within the range of a typical field reading.
    - Dissolved oxygen: 1-point calibration in 100% saturation.
    - Turbidity: 1-point calibration using DI water
  + Stored in a cool dry place according to manufacturer’s instructions.
  + Check for damage before each sampling event.
  + Properly clean after each sampling event.
* Kits:
  + Standardized using the appropriate standard solution within 24 hours before sampling.
  + Store in a cool dry place according to the manufacturer’s instructions.
  + Check chemical expiration dates and glassware before each sampling event.
  + Properly clean all glassware after each sampling event.

**Quality Control Checks**

All probes must be calibrated within 24 hours of sampling and post-sample checked within 24 hours after sampling using standard solutions following the manufacturer’s instructions and Table C1. All calibrations must be recorded on the field datasheet or a calibration log.

If any of the calibrations or standardizations fail (ie. Do not fall within the acceptable range in Table C1), measurements for that parameter should not be taken until the issue is resolved and the calibration is successful.

If any of the post-sample checks fail, flag data with the appropriate problem code listed in Table C4.

*Table C1: Quality Control requirements for Tier 2 field equipment.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Equipment** | **Calibration standard** | **Acceptable Calibration Range** |
| Conductivity (TDS/salinity) | Meter or Probe | It is preferred to do a two-point calibration bracketing the average conductivity field value range. | +/- 5% of the standard |
| Dissolved Oxygen | Meter or Probe | 100% saturation | +/- 0.3 mg/L  95% - 105% |
| Dissolved Oxygen | Winkler Titration | Sodium thiosulfate check – if first check is not within acceptable range, conduct a second check. If the second check is not within range, do not run samples during that sampling event. If the second check is within range, conduct a third check and report the closest two. | 9.4 – 10.0 mg/L |
| pH | Meter or Probe | It is preferred to do a two-point calibration bracketing the pH field value, always using pH 7 buffer (either 7 and 10 OR 7 and 4). If the pH field value is outside of the calibration bracket, the post-sample check should be completed with the third buffer solution. | +/-0.20 of standard |

Other field measurements are checked annually to verify accuracy of the reading as identified in Table C2.

*Table C2: Annual verification requirements for Tier 2 field equipment.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Equipment** | **Verification** | **Acceptable Calibration Range** |
| Air and Water Temperature | Armored glass thermometer, digital thermometer or thermistor | Checked annually against a NIST traceable thermometer. | +/- 0.2oC |
| Secchi Depth | Secchi Disk | Line measured annually to verify accurate readings | None, markings adjusted as needed |

**Field Replicates and Duplicates**

*In Situ* probe measurements in tidal waters are recommended but not required to do ≥10% field replicates due to changing conditions.

*In Situ* probe measurements in non-tidal waters are required to do ≥10% field replicates in order for data to be classified as Tier 2. This includes placing the probe into the sample water and recording the sample value. Then removing the probe and replacing it in the sample water to take a second reading.

All Kit measurements (ie. The Winkler Titration for dissolved oxygen) in tidal or non-tidal waters are required to do 100% field replicates for data to be classified as Tier 2. This includes collecting the sample water in two separate bottles or containers for analysis. All field replicates and duplicate readings should fall within the acceptable ranges identified in Table C3.

*Table C3: Acceptable replicate and duplicate ranges for field parameters.*

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Equipment** | **Field Replicate/Duplicate Acceptable Range** |
| Conductivity (TDS/salinity) | Meter or Probe | 2% FS |
| Dissolved Oxygen | Meter or Probe | +/- 0.3 mg/L |
| Dissolved Oxygen | Winkler Titration | +/- 0.6 mg/L |
| pH | Meter or Probe | +/- 0.2 SU |
| pH | Colorimetric Kits | +/- 0.5 SU |
| pH | Test Strips | +/- 1 SU |
| Water Clarity | Turbidimeter | +/- 5 JTU |
| Air and Water Temperature | Armored glass thermometer | +/- 1.0oC |
| Air and Water Temperature | Digital thermometer or thermistor | +/- 0.5oC |
| Nitrate | Colorimetric Kit | Low range (0–1 mg/L) = +/- 0.1 mg/L  Mid range (1–10 mg/L) = +/- 1 mg/L |
| Phosphate | Colorimetric Kit | +/- 0.04 mg/L |

If any of the QA checks fail the data should be flagged by marking the specific data point with the problem code in Table C4 in the Chesapeake Data Explorer.

*Table C4: Problem codes used to flag field data in the Chesapeake Data Explorer.*

|  |  |
| --- | --- |
| CBP Problem Code | QA Issue |
| (C) Instrument Failure (during sampling that may have effected results) | pH/DO/conductivity post-sample check failure, if values appear inaccurate |
| (F) post-calibration failure (likely due to equipment damage after sampling; data appear normal) | pH/DO/conductivity post-sample check failure, if values appear accurate |
| (V) Sample results rejected due to QC Criteria | pH/DO/conductivity calibration failed – data is questionable |
| (HI) | Duplicates are not within accepted range |

***Lab Analysis***

This program will use the follow lab/s for data analysis:

Lab Name:

Address:

Contact Information:

Parameters Analyzed:

Link to lab website/methodologies:

State, Federal or NELAP Certification – Y/N

CBP Data Integrity Workgroup Approval – Y/N

The EPA QA Officer will review SOPs, QAPPs, and results to verify lab data as Tier III. Data reported to the Project Team by a lab must be accompanied by a Method Detection Limit (MDL) for each parameter as established by the laboratory.

Labs that do not maintain a certification or are not approved by the CBP will be considered for inclusion on a case by case basis, and all data will be marked as provisional Tier II until recognized by the CBP or CMC team.

*Table C5: Parameters analyzed and holding times for lab analyzed samples.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Approved Procedure** | **Equipment** | **Holding Time** |
| Chlorophyll a | USEPA Method 445.0 | Flourometry | 30 days |
| Chlorophyll a, b, c | CBP IV-12.0 | Spectrophotometry | 30 days |
| Enterococcus | ASTM Method (#D6503-99) | IDEXX Enterolert | 6 hours |
| Ecoli | SM 9223B | IDEXX Colilert | 6 hours |
| Total Phosphorus | USEPA Method 365.4 | Specific to Individual Lab | 28 days |
| Nitrate-Nitrogen | USEPA Method 352.1 | Specific to Individual Lab | 28 days |
| Nitrite-Nitrogen | USEPA Method 353.4 | Specific to Individual Lab | 28 days |
| Ammonia | USEPA Method 349.0 | Specific to Individual Lab | 28 days |
| Total Kjeldahl Nitrogen | USEPA Method 351.1 | Specific to Individual Lab | 28 days |
| Total Nitrogen | USEPA Method 351.2 | Specific to Individual Lab | 28 days |

*Table C6: Problem codes used to flag lab data in the Chesapeake Data Explorer.*

|  |  |
| --- | --- |
| CBP Problem Code | QA Issue |
| (E) Sample received after holding time | The sample was delivered to the lab after the holding time. |
| (GG) Sample analyzed after holding time | The sample was delivered to the lab within the proper holding time, but the lab analyzed the sample after the holding time. |
| (V) Sample results rejected due to QC Criteria | Data is questionable |

**Blanks/Duplicates**

Monitors collecting samples for Tier 2 laboratory analysis will collect duplicate and blank samples at least 10% of the time. To collect duplicate samples, monitors will collect a sample in a second bottle and perform all field procedures. This bottle should be labelled as a duplicate, and sent to the lab for analysis with the first sample. To collect blank samples, monitors will perform all field procedures including preserving the samples as required using deionized water supplied by the lab instead of sample water. Results from field blanks will be recorded and appropriately marked during data entry in the Chesapeake Data Explorer.

*Table C7: Acceptable replicate and duplicate ranges for lab parameters.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Approved Procedure** | **Duplicate Range** | **Blank Range** |
| Chlorophyll a | USEPA Method 445.0 |  |  |
| Chlorophyll a, b, c | CBP IV-12.0 |  |  |
| Enterococcus | ASTM Method (#D6503-99) |  |  |
| Ecoli | SM 9223B |  | >1 MPN/100mL |
| Total Phosphorus | USEPA Method 365.4 |  |  |
| Nitrate-Nitrogen | USEPA Method 352.1 |  |  |
| Nitrite-Nitrogen | USEPA Method 353.4 |  |  |
| Ammonia | USEPA Method 349.0 |  |  |
| Total Kjeldahl Nitrogen | USEPA Method 351.1 |  |  |
| Total Nitrogen | USEPA Method 351.2 |  |  |

**Documentation**

Sample custody procedures are an integral part of the laboratory and field operations.

***Documentation and Records***

During every sampling occasion, the monitor will fill out and complete a prescribed and standardized field data sheet. On the data sheet, monitors record essential metadata including their name, date, time, and sample site location/station ID. They may also record weather conditions, whether they calibrated their equipment, and time spent monitoring. The data values are entered into the appropriate place on the data sheet, including values for replicates. These data sheets are either passed on to the monitoring group leader for data entry or the monitor may enter the data directly into the Chesapeake Data Explorer upon returning from the field. In either case, the original data sheets are archived with the Certified Trainer or regional Project Team member for seven years after submission to the project. In addition, the project maintains electronic (digital) records of the data within the database.

*Table C8: Document and record holding times.*

|  |  |  |
| --- | --- | --- |
| **Document** | **Storage Location** | **Storage Time** |
| Monitoring QAPP/SOP | XXXX | Permanently |
| Monitoring Field Datasheets and Calibration records | XXXX | Hard copy 7 years, electronic copy permanently |
| List of active certified monitors | XXXX | Permanently, updated and submitted to the CMC Service Provider at least annually |
| Thermometer Verification Logs | Alliance for the Chesapeake Bay’s Richmond Office | Permanently, updated at least annually |

**Appendix A: Sampling Methods**

**Appendix B: Field Datasheet**

**Appendix C: Lab Analytical Methods**

**Appendix D: Lab Chain of Custody**