

Rubric for Tier Determination and Inclusion of Data in the CMC Database

“Dichotomous keys”

Introduction:

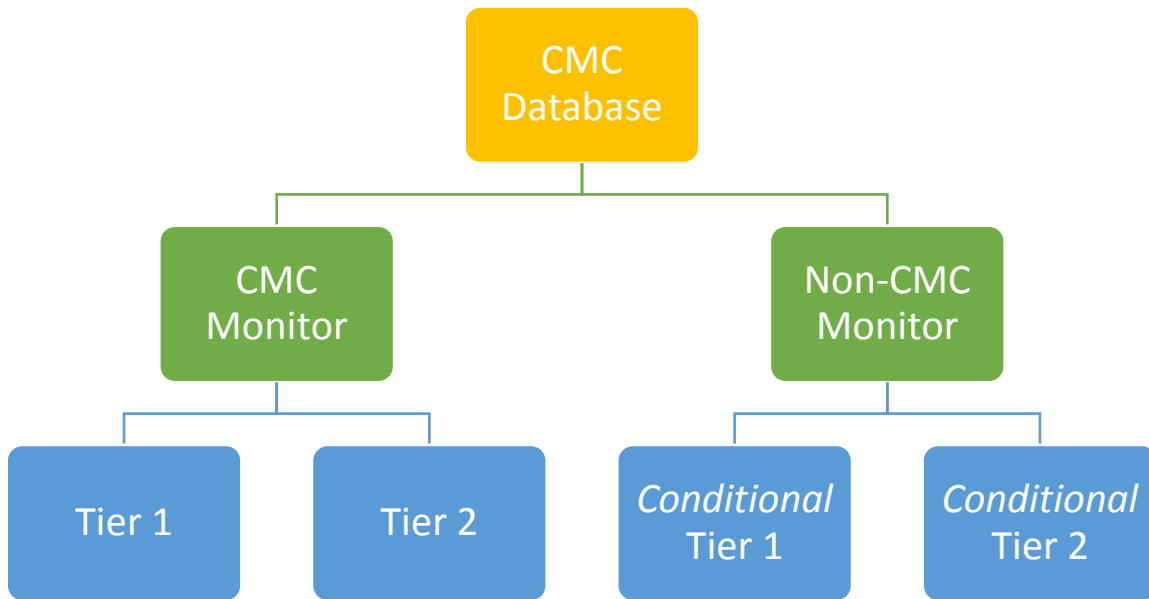
The Alliance for the Chesapeake Bay (Alliance), Izaak Walton League of America (League), Dickinson College's Alliance for Aquatic Resource Monitoring (ALLARM), and the University of Maryland Center for Environmental Science Integration and Application Network (UMCES IAN) (referred to as the Chesapeake Monitoring Cooperative (CMC) in this document) are partnering to provide technical, logistical, and outreach support for the integration of citizen-based and non-traditional (i.e., non-agency) monitoring data into the Chesapeake Bay Program (CBP) partnership. The integration of these data into the CBP monitoring networks will provide additional cost-effective data and information that supports shared decision-making and adaptive management by the CBP partners focused on restoration of the Chesapeake Bay and its watershed.

CMC is developing a database to house the non-traditional data engaged in this project. In the database, data sets will be classified to help inform potential data uses of non-traditional data. These data classifications stem from a tiered framework CMC developed to provide suggestions on potential uses of the data.

TIERS	Intended Data Use
TIER 1	Education, Environmental Health Screening
TIER 2	Environmental Health Report Cards, Environmental Health Screening, Targeting of Management Actions
TIER 3	Chesapeake Bay Watershed trends and assessments to help inform policy and management decisions

There are very diverse monitoring practices throughout the Chesapeake Bay watershed as a result, the Chesapeake Monitoring Cooperative (CMC) requires a process to examine datasets and determine what metadata is needed to facilitate data input into the database. The Rubric is a data classification tool to help CMC to review the monitoring techniques, quality assurance measures, and metadata of non-traditional data that will be integrated in the database. Tier 3 data have separate data requirements that CMC is working with the CBP's Data Integrity Workgroup to define, as a result the Rubric focuses on Tier 1 and Tier 2 data. The Rubric, and corresponding tools such as checklists, will help to inform conversations that CMC will have with potential data contributors about data requirements. Finally, the Rubric will facilitate a process that CMC will use to ensure that there is enough information corresponding with CMC datasets for data users to make informed choices.

This rubric outlines four categories for classifying data:



The quality of the data for Tier 1 and *Conditional* Tier 1/Tier 2 and *Conditional* Tier 2 are comparable, but not exact. The data user determines if the data are useable for a given project based on the metadata submitted along with the data.

The Rubric serves two needs:

1. Determine if the data collected are suitable to be included in the CMC database (minimum requirements)
2. Classify the data into tiers (specific requirements)

Once the Rubric is completed, a checklist of requirements and options should be generated for:

1. CMC monitors and trainers to review
2. Non-CMC monitors to fill out when applying to use the database
3. Data users to have as a summary of how the data were collected

For CMC participants who fall under the Quality Assurance Project Plans (QAPPs) developed for macroinvertebrate, non-tidal, and tidal monitoring will be subject to diverse quality control measures. If a participant is unable to meet the quality control requirements their data will be classified as Tier 1.

Water Quality Monitoring in Non-Tidal Streams (CMC Monitors)

Monitors participating in the CMC program follow the CMC QAPP and CMC methods manual. The following procedures, as outlined in those documents, are the minimum requirements which must be followed for the data collected to be included in the CMC database and assigned a designation of tier 1 or tier 2:

1. Program requirements
 - a. Have an approved, written study design
 - b. Site location(s) in latitude, longitude coordinates and are verified by CMC partner
2. Sampling methods
 - a. Use chemical-grade bottle
 - b. Rinse bottle and cap three times
 - c. Sample from middle of stream
 - d. Swipe bottle vertically through water column
 - e. Follow sample preservation techniques required for each parameter
 - f. Test sample within maximum holding time limitations for each parameter
 - g. Use monitoring equipment recommended by CMC (page 10)
3. Equipment maintenance
 - a. Inspect equipment and materials each time before use
 - b. Do not use expired or otherwise degraded reagents
 - c. Clean equipment and materials appropriately for each parameter
 - d. Store equipment appropriately
4. Monitor requirements
 - a. Attend a CMC training
 - b. Fill out field data sheets completely

In addition to the minimum requirements, specific criteria are used to determine the tier designation:

1. Monitor becomes certified and maintains biennial certification
 - a. No Tier 1 (stop).
 - b. Yes *Potential* Tier 2, go to 2.
2. Monitor collects a water sample to send to certified laboratory for analysis
 - a. No Tier 1 or 2, go to 3.
 - b. Yes *Potential* Tier 2, go to 4.
3. Monitor measures each parameter twice at every sampling event (duplicate/replicate)
 - a. No Tier 1 (stop).
 - b. Yes *Potential* Tier 2, go to 6.
4. Monitor sends field blanks (deionized or distilled water) to the lab for analysis
 - a. < 10% Tier 1 (stop).
 - b. ≥ 10% *Potential* Tier 2, go to 5.
5. Monitor collects two water samples (duplicates) to send to the lab for analysis
 - a. < 10% Tier 1 (stop).
 - b. ≥ 10% *Potential* Tier 2, go to 6.
6. The final tier determination depends on the method/equipment used – see page 10.

Water Quality Monitoring in Non-Tidal Streams (Non-CMC Monitors)

Monitors not participating in the CMC program follow a variety of standard operating procedures and may or may not follow an approved QAPP to collect water quality data. Due to the diversity of methods and procedures used, data collected by monitors not participating in the CMC are given a *conditional* tier level and are designated as such in the database.

Data users need to examine the study design, QAPP (if available), standard operating procedures, and equipment specs to determine whether the data collected are suitable for the desired end use.

The following minimum requirements must be met for Non-CMC monitors to contribute data to the CMC database:

1. Program documentation; Non- CMC monitors must submit the following:
 - a. Written study design
 - b. Methods manual
 - c. Coordinates and description of monitoring site(s)
2. Sampling methods
 - a. Use chemical-grade bottles
 - b. Sample from middle of stream
 - c. Follow sample preservation techniques required for each parameter
 - d. Test sample within maximum holding time limitations for each parameter
3. Equipment maintenance
 - a. Inspect equipment and materials each time before use
 - b. Calibrate all equipment that can be calibrated
 - c. Do not use expired or otherwise degraded reagents
 - d. Clean equipment and materials appropriately for each parameter
 - e. Store equipment appropriately
4. Monitor requirements
 - a. Fill out field data sheets completely

In addition to the minimum requirements, specific criteria are used to determine the tier designation:

1. Monitor follows an approved QAPP
 - a. No *Conditional Tier 1 (stop).*
 - b. Yes *Potential Conditional Tier 2, go to 2.*
2. Monitor collects a water sample to send to certified laboratory for analysis
 - a. No *Conditional Tier 1 or 2, go to 3.*
 - b. Yes *Potential Conditional Tier 2, go to 4.*
3. Monitor measures each parameter twice at every sampling event (duplicate/replicate)
 - a. No *Conditional Tier 1 (stop).*
 - b. Yes *Potential Conditional Tier 2, go to 6.*
4. Monitor sends field blanks (deionized or distilled water) to the lab for analysis
 - a. < 10% *Conditional Tier 1 (stop).*
 - b. ≥ 10% *Potential Conditional Tier 2, go to 5.*
5. Monitor collects two water samples (duplicates) to send to the lab for analysis

- a. < 10%
- b. ≥ 10%

Conditional Tier 1 (stop).

Potential Conditional Tier 2, go to 6.

- 6. The final tier determination depends on the method/equipment used – see page 10. If equipment used are not included in the table, the equipment specs will need to be researched by the data user or Data Integrity workgroup to determine which tier the data should be designated – *Conditional Tier 1* or *Conditional Tier 2*.

Water Quality Monitoring in Tidal Streams (CMC Monitors)

Monitors participating in the CMC program follow the CMC QAPP and CMC methods manual. The following procedures, as outlined in those documents, are the minimum requirements which must be followed for the data collected to be included in the CMC database and assigned a designation of tier 1 or tier 2.

1. Program requirements
 - a. Have an approved, written study design
 - b. Site location(s) in latitude, longitude coordinates and are verified by CMC partner
2. Sampling methods
 - a. Use chemical-grade bottles
 - b. Rinse bottle and cap three times
 - c. Sample at defined depth(s)
 - d. Follow sample preservation techniques required for each parameter
 - e. Test sample within maximum holding time limitations for each parameter
 - a. Use monitoring equipment recommended by CMC (page 10)
3. Equipment maintenance
 - a. Inspect equipment and materials each time before use
 - b. Do not use expired or otherwise degraded reagents
 - c. Clean equipment and materials appropriately for each parameter
 - d. Store equipment appropriately
4. Monitor requirements
 - a. Attend a CMC training
 - b. Fill out field data sheets completely

In addition to the minimum requirements, specific criteria are used to determine the tier designation:

1. Monitor becomes certified and maintains biennial certification
 - a. No Tier 1 (stop).
 - b. Yes *Potential Tier 2, go to 2.*
2. Monitor collects a water sample to send to certified laboratory for analysis
 - a. No Tier 1 or 2, go to 3.
 - b. Yes *Potential Tier 2, go to 4.*
3. Monitor measures each parameter twice (duplicate/replicate)
 - a. < 10% Tier 1 (stop).
 - b. ≥ 10% *Potential Tier 2, go to 6.*
4. Monitor sends field blanks (deionized or distilled water) to the lab for analysis
 - a. < 10% Tier 1 (stop).
 - b. ≥ 10% *Potential Tier 2, go to 5.*
5. Monitor collects two water samples (duplicates) to send to the lab for analysis
 - a. < 10% Tier 1 (stop).
 - b. ≥ 10% *Potential Tier 2, go to 6.*
6. The final tier determination depends on the method/equipment used – see page 10.

Water Quality Monitoring in Tidal Streams (Non-CMC Monitors)

Monitors not participating in the CMC program follow a variety of standard operating procedures and may or may not follow an approved QAPP to collect water quality data. Due to the diversity of methods and procedures used, data collected by monitors not participating in the CMC are given a *conditional* tier level and are designated as such in the database.

Data users need to examine the study design, QAPP (if available), standard operating procedures, and equipment specs to determine whether the data collected are suitable for the desired end use.

The following minimum requirements must be met for Non-CMC monitors to contribute data to the CMC database:

1. Program documentation; Non-CMC monitors must submit the following:
 - a. Written study design
 - b. Methods manual
 - c. Coordinates and description of monitoring site(s)
2. Sampling methods
 - a. Use chemical-grade bottles
 - b. Follow sample preservation techniques required for each parameter
 - c. Test sample within maximum holding time limitations for each parameter
3. Equipment maintenance
 - a. Inspect equipment and materials each time before use
 - b. Calibrate all equipment that can be calibrated
 - c. Do not use expired or otherwise degraded reagents
 - d. Clean equipment and materials appropriately for each parameter
 - e. Store equipment appropriately
4. Monitor requirements
 - a. Fill out field data sheets completely

In addition to the minimum requirements, specific criteria are used to determine the tier designation:

1. Monitor follows an approved QAPP
 - a. No *Conditional Tier 1 (stop).*
 - b. Yes *Potential Conditional Tier 2, go to 2.*
2. Monitor collects a water sample to send to certified laboratory for analysis
 - a. No *Conditional Tier 1 or 2, go to 3.*
 - b. Yes *Potential Conditional Tier 2, go to 4.*
3. Monitor measures each parameter twice (duplicate/replicate)
 - a. < 10% *Conditional Tier 1 (stop).*
 - b. ≥ 10% *Potential Conditional Tier 2, go to 6.*
4. Monitor sends field blanks (deionized or distilled water) to the lab for analysis
 - a. < 10% *Conditional Tier 1 (stop).*
 - b. ≥ 10% *Potential Conditional Tier 2, go to 5.*
5. Monitor collects two water samples (duplicates) to send to the lab for analysis
 - a. < 10% *Conditional Tier 1 (stop).*

b. $\geq 10\%$

Potential Conditional Tier 2, go to 6.

6. If equipment used are not included in the table, the equipment specs will need to be researched by the data user or the Data Integrity workgroup to determine which tier the data should be designated – *Conditional Tier 1* or *Conditional Tier 2*.

Water quality monitoring equipment recommended by CMC

Parameter	Tier 1	Tier 2
Alkalinity		Digital checker (colorimetric): <ul style="list-style-type: none"> Hanna HI 775 (standardized) Kit (titration): <ul style="list-style-type: none"> LaMotte (various)
Ammonia-nitrogen		Lab analysis
Bacteria (E. coli)	Kit: <ul style="list-style-type: none"> Coliscan Easygel 	Lab analysis
Chlorophyll		Lab analysis
Conductivity	Meter (not calibrated)	Meter (calibrated): <ul style="list-style-type: none"> LaMotte 1749
Dissolved oxygen	Winkler titration (not standardized) <ul style="list-style-type: none"> LaMotte 5860 	Meter (calibrated): <ul style="list-style-type: none"> LaMotte 1761 Kit (Winkler titration; standardized): <ul style="list-style-type: none"> LaMotte 5860
Nitrate-nitrogen	Kit (colorimetric): <ul style="list-style-type: none"> Hach NI-14 1416100 LaMotte 3110 LaMotte 3354 	Lab analysis
Nitrite-nitrate		Lab analysis
Orthophosphate	Digital checker (ascorbic acid method): <ul style="list-style-type: none"> Hanna HI 713 (not standardized or glassware not acid-washed) Kit (colorimetric; ascorbic acid): <ul style="list-style-type: none"> Hach PO-19 224800 Hanna HI 38061 	Digital checker (ascorbic acid method): <ul style="list-style-type: none"> Hanna HI 713 (standardized, acid-washed glassware) Lab analysis
pH	Kit (colorimetric): <ul style="list-style-type: none"> LaMotte (wide range) Hach (wide range) Meter (not calibrated) Strips: <ul style="list-style-type: none"> ColorpHast (2-9) 	Kit (colorimetric): <ul style="list-style-type: none"> LaMotte (narrow range) Hach (narrow range) Meter (calibrated): <ul style="list-style-type: none"> Extech Hanna LaMotte Oakton
Phaeophytin		Lab analysis
Salinity	Meter (not calibrated) Refractometer	Meter (calibrated)
Silicate		Lab analysis
Total dissolved solids	Meter: <ul style="list-style-type: none"> LaMotte 1749 	
Total nitrogen		Lab analysis
Total phosphorus		Lab analysis
Turbidity	Kit: <ul style="list-style-type: none"> LaMotte 7519 	
Water clarity	Secchi disk <ul style="list-style-type: none"> Ben Meadows 224217 Transparency tube <ul style="list-style-type: none"> Ben Meadows 111360 	
Water temperature	Thermometer (unverified)	Thermometer (verified): <ul style="list-style-type: none"> LaMotte 1066 Hanna 98509 Thermister/thermometer part of meter (verified): <ul style="list-style-type: none"> LaMotte 1761

Non-Tidal Benthic Macroinvertebrate Monitoring in Wadeable Streams (CMC Monitors)

Monitors participating in the CMC program follow the CMC QAPP and CMC standard operating procedures. The following procedures, as outlined in those documents, are the minimum requirements which must be followed for the data collected to be included in the CMC database and assigned a designation of tier 1 or tier 2.

1. Program requirements
 - a. Have an approved, written study design
Site location(s) in latitude, longitude coordinates and are verified by CMC partner
2. Sampling methods
 - a. Sample during baseflow conditions
 - b. Collect side by side samples (replicates); 10% of sampling events
 - c. Use appropriate sampling method for stream type (rocky vs. muddy bottom) and follow procedures exactly
 - i. Choose area with appropriate (if applicable)
 1. hydrology – water depth and flow
 2. substrate type and size
 3. habitat type
 - ii. Equipment type and specification
 - iii. Collection time
 - iv. Number of samples and/or organisms collected
 - d. Photograph and/or preserve unknown sample for identification by Project Partner
3. Equipment maintenance
 - a. Inspect equipment and materials each time before use
 - b. Clean equipment and materials appropriately
 - c. Store equipment appropriately
4. Monitor requirements
 - a. Attend a CMC training
 - b. Become certified and maintain biennial certification OR collect and identify macroinvertebrates under the supervision of a certified monitor or CMC partner staff
 - c. Fill out field data sheets completely

In addition to the minimum requirements, specific criteria are used to determine the tier designation:

1. Monitor identifies macroinvertebrates to the taxonomic level of
 - a. Order Tier 1 (stop).
 - b. Family *Potential Tier 2, go to 2.*
2. Monitor is certified (and maintains biennial certification)
 - a. No Tier 1 (stop).
 - b. Yes *Potential Tier 2, go to 3.*
3. Monitor preserves and sends an unknown specimen to a state or Society for Freshwater Science-certified taxonomist for identification
 - a. No Tier 1 (stop).
 - b. Yes *Potential Tier 2, go to 4.*
4. Monitor preserves and sends an entire sample to a state or Society for Freshwater Science-certified taxonomist for verification

- a. < 10% of sampling events
- b. ≥ 10% of sampling events

Tier 1 (stop).
Tier 2 (stop).

Non-Tidal Benthic Macroinvertebrate Monitoring in Wadeable Streams (Non-CMC Monitors)

Monitors not participating in the CMC program follow a variety of standard operating procedures and may or may not follow an approved QAPP to collect benthic macroinvertebrates. Due to the diversity of methods and procedures used, data collected by monitors not participating in the CMC are given a *conditional* tier level and are designated as such in the database.

Data users need to examine the study design, QAPP (if available), standard operating procedures, and protocol specs to determine whether the data collected are suitable for the desired end use.

The following minimum requirements must be met for Non-CMC monitors to contribute data to the CMC database:

1. Program documentation; Non-CMC monitors must submit the following:
 - a. Written study design
 - b. Methods manual
 - c. Coordinates and description of monitoring site(s)
2. Sampling methods
 - a. Sample during baseflow conditions
 - b. Collect side by side samples (replicates); 10% of sampling events
 - c. Use appropriate sampling method for stream type and follow procedures exactly
 - i. Choose area with appropriate (if applicable)
 1. hydrology – water depth and flow
 2. substrate type and size
 3. habitat type
 - ii. Equipment type and specification
 - iii. Collection time
 - iv. Number of samples and/or organisms collected
 - d. Photograph and/or preserve unknown sample for identification by Project Partner
3. Equipment maintenance
 - a. Inspect equipment and materials each time before use
 - b. Clean equipment and materials appropriately
 - c. Store equipment appropriately
4. Monitor requirements
 - a. Fill out field data sheets completely

In addition to the minimum requirements, specific criteria are used to determine the tier designation:

1. Monitor follows an approved QAPP
 - a. No *Conditional Tier 1 (stop).*
 - b. Yes *Potential Conditional Tier 2, go to 2.*
2. Monitor identifies macroinvertebrates to the taxonomic level of
 - a. Order *Conditional Tier 1 (stop).*
 - b. Family *Potential Conditional Tier 2, go to 3.*
3. Monitor preserves and sends an unknown specimen to a state or Society for Freshwater Science-certified taxonomist for identification

- a. No
- b. Yes

Conditional Tier 1 (stop).
Potential Conditional Tier 2, go to 4.

4. Monitor preserves and sends an entire sample to a state or Society for Freshwater Science-certified taxonomist for verification

- a. < 10% of sampling events
- b. ≥ 10% of sampling events (stop).

Conditional Tier 1 (stop).
Potential Conditional Tier 2