

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

“Dichotomous keys”

Introduction:

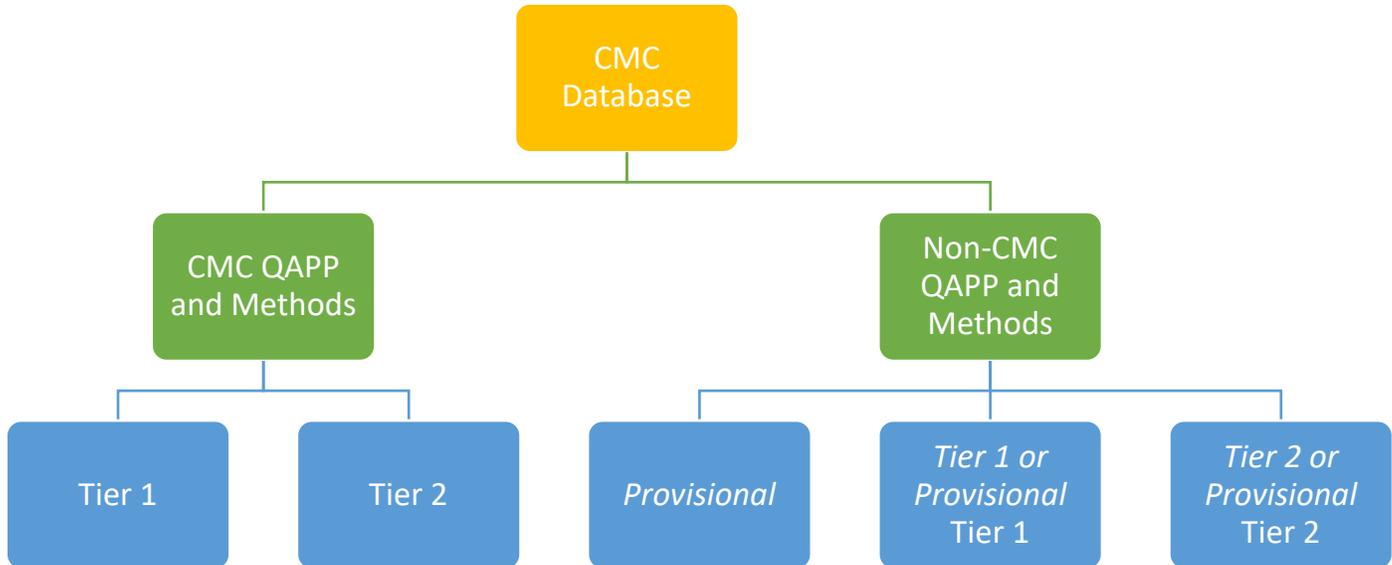
The Alliance for the Chesapeake Bay (Alliance), Izaak Walton League of America (League), Dickinson College's Alliance for Aquatic Resource Monitoring (ALLARM), and the University of Maryland Center for Environmental Science Integration and Application Network (UMCES IAN) (referred to as the Chesapeake 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 *provisional* Tier 1/Tier 2 and *provisional* 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 QAPP and Methods)

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 a written study design (preferred, not required)
 - b. Have a written methods manual (upload to database)
 - c. Have written QAPP or QA/QC procedures (CMC QAPP)
 - d. Site location(s) in latitude, longitude and datum.
2. Quality Control requirements
 - a. Spot check $\geq 10\%$ of a monitor's total number of data sheets and compare the results entered in the database for data entry errors. If a data entry error is found, it will be corrected and the previous six months of data sheets will be checked.
 - b. Field datasheet are kept in a secure location for 7 years by either the monitoring entity designated project coordinator or the CMC Project Team lead.
3. 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
 - b. Yes *Potential Tier 2*
2. Monitor measures each parameter twice at least 10% of the time (duplicate/replicate)
 - a. No Tier 1
 - b. Yes *Potential Tier 2*
3. Monitor collects a water sample to send to certified laboratory for analysis
 - a. No Skip to 6
 - b. Yes *Potential Tier 2*
4. Monitor sends field blanks (deionized or distilled water) to the lab for analysis
 - a. $< 10\%$ Tier 1
 - b. $\geq 10\%$ *Potential Tier 2*
5. Monitor collects two water samples (duplicates) to send to the lab for analysis
 - a. $< 10\%$ Tier 1
 - b. $\geq 10\%$ *Potential Tier 2*
6. The final tier determination depends on the method/equipment used – see page 10. If a group meets all Tier 2 requirements then the final tier designation will correspond to the method/equipment used. If a group does not meet all the Tier 2 requirements, they will be designated Tier 1 for all data regardless of the method used.

Water Quality Monitoring in Non-Tidal Streams (Non-CMC QAPP and Methods)

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
 - a. Written study design (preferred, not required)
 - b. Methods manual (uploaded to database)
 - c. Site location(s) in latitude, longitude and datum.
2. 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. Monitoring group follows a written QAPP or QA procedures
 - a. No *Provisional*
 - b. Yes *Potential Tier 2*
2. Monitor inspects and maintains equipment per manufacturer's instructions
 - a. No *Tier 1, go to 3*
 - b. Yes *Potential Tier 1 or 2*
3. Monitor measures each parameter twice at least 10% of sampling events (duplicate/replicate)
 - a. No *Tier 1*
 - b. Yes *Potential Tier 2*
4. Monitor collects a water sample to send to certified laboratory for analysis
 - a. No *Skip to 7*
 - b. Yes *Potential Tier 2*
5. Monitor sends field blanks (deionized or distilled water) to the lab for analysis
 - a. < 10% *Tier 1*
 - b. ≥ 10% *Potential Tier 2*
6. Monitor collects two water samples (duplicates) to send to the lab for analysis
 - a. < 10% *Tier 1*
 - b. ≥ 10% *Potential Tier 2*
7. 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 – *Provisional Tier 1* or *Provisional Tier 2*.

Water Quality Monitoring in Tidal Streams (CMC QAPP and Methods)

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 a written study design (preferred, not required)
 - b. Have a written methods manual (upload to database)
 - c. Have written QAPP or QA/QC procedures (CMC QAPP)
 - d. Site location(s) in latitude, longitude and datum.
 - e. Sample location within the waterway (shoreline, bridge/dock, mid-channel)

4. Quality Control requirements
 - a. Spot check $\geq 10\%$ of a monitor's total number of data sheets and compare the results entered in the database for data entry errors. If a data entry error is found, it will be corrected and the previous six months of data sheets will be checked.
 - b. Field datasheet are kept in a secure location for 7 years by either the monitoring entity designated project coordinator or the CMC Project Team lead.

2. 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
 - b. Yes *Potential Tier 2*

2. Monitor measures each parameter twice at least 10% of sampling events (duplicate/replicate)
 - a. $< 10\%$ Tier 1
 - b. $\geq 10\%$ *Potential Tier 2*

3. Monitor collects a water sample to send to certified laboratory for analysis
 - a. No Skip to 6
 - b. Yes *Potential Tier 2*

4. Monitor sends field blanks (deionized or distilled water) to the lab for analysis
 - a. $< 10\%$ Tier 1
 - b. $\geq 10\%$ *Potential Tier 2*

5. Monitor collects two water samples (duplicates) to send to the lab for analysis
 - a. $< 10\%$ Tier 1
 - b. $\geq 10\%$ *Potential Tier 2*

6. The final tier determination depends on the method/equipment used – see page 10. If a group meets all Tier 2 requirements then the final tier designation will correspond to the method/equipment used. If a group does not meet all the Tier 2 requirements, they will be designated Tier 1 for all data regardless of the method used.

Water Quality Monitoring in Tidal Streams (Non-CMC QAPP and Methods)

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. Have a written study design (preferred, not required)
 - b. Have a written methods manual (upload to database)
 - c. Site location(s) in latitude, longitude and datum.
 - d. Sample location within the waterway (shoreline, bridge/dock, mid-channel)
2. 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. Monitoring group follows a written QAPP or QA procedures
 - a. No *Provisional*
 - b. Yes *Potential Tier 2*
2. Monitor inspects and maintains equipment per manufacturer's instructions
 - a. No *Tier 1,*
 - b. Yes *Potential Tier 1 or 2*
3. Monitor measures each parameter twice (duplicate/replicate)
 - a. < 10% *Tier 1*
 - b. ≥ 10% *Potential Tier 2*
4. Monitor collects a water sample to send to certified laboratory for analysis
 - a. No *Skip to 7*
 - b. Yes *Potential Tier 2*
5. Monitor sends field blanks (deionized or distilled water) to the lab for analysis
 - a. < 10% *Tier 1*
 - b. ≥ 10% *Potential Tier 2*
6. Monitor collects two water samples (duplicates) to send to the lab for analysis
 - a. < 10% *Tier 1*
 - b. ≥ 10% *Potential Tier 2*
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 the Data Integrity workgroup to determine which tier the data should be designated – *Provisional Tier 1* or *Provisional 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 (not standardized) 	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
Enterococcus		Lab analysis
Chlorophyll		Lab analysis
Conductivity	Meter (not calibrated)	Meter (calibrated): <ul style="list-style-type: none"> LaMotte 1749
Dissolved oxygen	Meter (not calibrated): <ul style="list-style-type: none"> LaMotte 1761 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 	Kit (colorimetric) with acid washed glassware: <ul style="list-style-type: none"> Hach NI-14 1416100, 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) Strips: <ul style="list-style-type: none"> ColorpHast (2-9) Meter (not calibrated)	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 Hydrometer	Meter (calibrated)
Silicate		Lab analysis
Total dissolved solids	Meter: <ul style="list-style-type: none"> LaMotte 1749 	
Total suspended solids		Lab analysis
Total nitrogen		Lab analysis
Total phosphorus		Lab analysis
Turbidity	Kit: <ul style="list-style-type: none"> LaMotte 7519 	Turbidimeter <ul style="list-style-type: none"> Hach 2100P
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

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 a written study design (preferred, not required)
 - b. Site location(s) 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. Monitoring Methodology Requirements
 - a. Groups collecting Tier I data are required to sample each site at least one time per year.
5. 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 samples two times a year, once in the spring (March- June) and once in the fall (August-October)
 - a. No Tier 1, go to 4.
 - b. Yes *Potential* Tier 2, go to 4.
4. 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 5.

5. Monitor preserves and sends an entire sample to a state or Society for Freshwater Science-certified taxonomist for verification
 - a. < 10% of sampling events Tier 1 (stop).
 - b. ≥ 10% of sampling events Tier 2 (stop).

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. Have a written study design (preferred, not required)
 - b. Have a written 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 *Provisional* (stop).
 - b. Yes *Potential* Tier 1 or Tier 2, go to 2.
2. Monitor identifies macroinvertebrates to the taxonomic level of
 - a. Order Tier 1 (stop).
 - b. Family *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 Tier 1 (stop).
 - b. ≥ 10% of sampling events *Potential* Tier 2 (stop).