

Volunteer Water Quality Monitoring

Instructions for use of the Control Charting Software

Programmer Information

The code for the program was written by one of our Waccamaw River water quality monitoring volunteers, Dr. Forrest Meiere, who saw the need to reduce the work load on our volunteer monitoring coordinator and taught himself php to help us! Dr. Meiere also wrote the php code for a control charting module which is used by the volunteer monitoring coordinator to review the meter replicates.

We are much indebted to his efforts on our behalf!

The purpose of this program

This program is designed for volunteer water quality monitors to enter their biweekly data. The data are then available to the volunteer monitoring coordinator to verify for completeness and accuracy before transfer to an online database. The public has access to the latter. By having the volunteers post their data online, a more rapid review of the data is accomplished. This provides more timely access to the public and to the project managers and funding partners who are alerted to all contraventions of water quality standards. See the project Quality Assurance Project Plan (<http://www.coastal.edu/www/vm/qapp.html>) for a complete description of data management and use.

Instructions for Using Volunteer Water Quality Monitoring Control Charting Software

1. Go to: <http://bcmw.coastal.edu/volunteermonitoring/wr/index.php>.
2. Click on "QA" on the top of the page.
3. Use the drop down menus to pick: Project and Parameter to chart. If you saved a cookie during your last session, you can resume at the sample that you left off by checking the "Resume Session" box and click on "Begin Charting". Other options are to: (1) Enter the starting ID, or (2) just click on "Begin Charting". The latter will take you to the first ID. Other things you can do from this screen are: "See tagged and removed tables" and "See corrected database tables". These options can be used to print or obtain .csv files of tagged or removed data from either the Waccamaw River or Murrells Landing projects.
4. Fill out the required information in Part IV of the Control Chart Log for the Date range, ID range, Reviewer and Review Date. Also record the raw mean SD and observe whether it is above or below the DQO specified in the red box at the lower left of the screen and in Part IV of the Control Chart Log.
5. Use the following steps to perform the quality control review of the data if at least one data point lies above the Upper Control Limit (UCL) and the raw mean SD is greater than the DQO.
 - a. For all data above the Upper Control Limit, inspect the flagged data listed at the bottom of the screen. Decide on which of any replicates you wish to retain. Under the "action" column, select Remove or Tag or No action. Note that the default setting is "remove" for data above the UCL and "tag" for data above the UWL. If you tag or remove any data, type in a comment. Some of the outliers could be typos, so perform this step of the data review while concurrently reviewing the field datasheets submitted by the

volunteers. Check that the calibration and LCS checks were in control. (If **no action** is going to be taken, print the screen image – this is the “**Raw Control Chart**”.)

- b. Click “**submit**”
 - c. This produces a list at the bottom of the screen of data records that have been updated as a result of your selections under the “action” column. Use this information to fill out Part V in the Control Chart Log. The data table to the left of the graph is not updated, nor is the graph. In Part IV of the Control Chart Log, record the raw mean SD. If data have been flagged or removed, print this screen image – this is the “**Raw Control Chart**”.
 - d. Click [Save Session](#) to store information on **your** computer as a cookie that will enable you to begin a new control chart session where you ended your last control chart session. After you click on “Save Session”, you will get a report that the session was saved. Click on “Exit” to close the window
 - e. Click “**submit**” to move to the next set of data to review. This is the last step of the data review. *Or if you want to stop work, you can “Save” the session. This will create a cookie that will enable you to resume the session.
 - f. You can opt to “[See tagged and removed tables](#)” and “[See corrected database tables](#)” at any time.
 - g. To view the updated data table and graph, enter the starting ID and click on “Begin Charting”. Record the revised mean SD. Note whether this SD is within the DQO specified in the red box at the lower left of the screen and in the Control Chart Log. Print the screen image – this is the “**Revised Control Chart**”.
- NOTE: If the Revised Mean SD is above the DQO, another iteration of data removal can be undertaken. If the second iteration generates a Mean SD that is still above the DQO, consult the QA Officer as this indicates a serious systems failure.**
- h. On Part IV of the Control Chart Log, check off that the raw and revised control charts have been printed and attached to the log. Include any notes to be considered by the QA officer.
 - i. To end your session, click on the “log out” button at the top right of the screen.
 - j. Paginate the Control Chart Log and submit to the QA Officer for review. The QA Officer will sign and date Part V and add notes as needed.
6. If at least one data point lies above the Upper Control Limit (UCL) and the raw mean SD is less than the DQO, follow the steps in #5 above, but instead of removing the data, simply flag it.
NOTE: Use your judgment as to whether to remove a measurement.
 7. If no points are above the upper warning or control limits and the raw mean SD is below the DQO, no data flagging or removal is needed. To record this, write NA in the “Revised Mean SD” column of Part IV in the Control Chart Log and under “Note”, write: “All in control”
 8. If no points are above the upper warning or control limits and the raw mean SD is above the DQO, consult the QA Officer as this indicates a serious systems failure.
 9. If at least one point lies above the Upper Warning Limit, but below the Upper Control Limit, follow the procedure outlined below.
 - a. If the raw Mean SD is greater than the DQO, follow the steps in #5 above. If the Revised Mean SD is above the DQO, another iteration of data removal can be undertaken. If the second iteration generates a Mean SD that is still above the DQO, consult the QA Officer as this indicates a serious systems failure.
 - b. If the raw Mean SD is less than the DQO, follow the steps in #5 above, but instead of removing the data, simply flag it. **NOTE: Use your judgment as to whether to remove a measurement.**

NOTE: For conductivity, the data table column labeled "group stdev" is actually the %RSD. The DQO is 5%. For saline samples in which specific conductivity >25 mS/cm, the DQO is ± 0.4 psu. This is equivalent to a 540 $\mu\text{S}/\text{cm}$ difference in specific conductivity between replicates. This is roughly equivalent to a %RSD of 0.5% for specific conductivity.

Waccamaw River VM QAPP Revisions (Draft 2/20/09)

The Data and QC review form (xx-xxxx) will be used to document the following four activities:

1 - The volunteer monitoring coordinator (aka the Project Officer) has verified receipt of all data and calibration information for a given sampling period. Notes are to be included to describe what's missing and likely causes. The Quality Assurance (QA) Officer reviews and verifies.

2 - The volunteer monitoring coordinator lists any follow ups on missing information and their final status, such as "permanently missing". In the case of the latter, this will be recorded in the database as "ND" for "Not Determined". This status needs to be displayed on the time trend graphs to distinguish it from measurements of "0". The number of ND values will be evident in the statistic summary tables as these tables already contain a sample count for each site for each parameter. The QA officer signs off on this information.

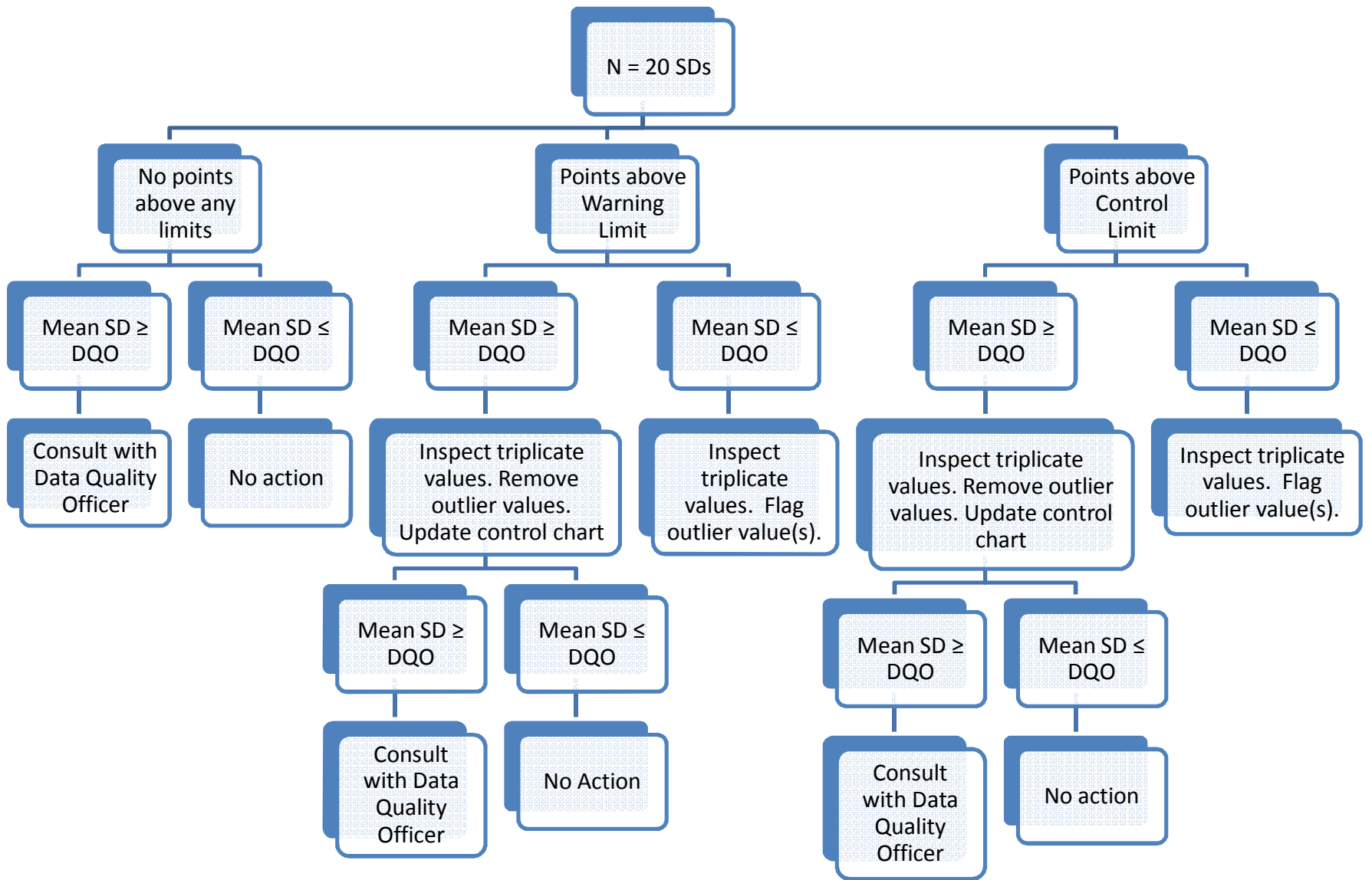
3 - The volunteer monitoring coordinator has reviewed control charts for the triplicate meter readings (temp, DO, %DO, pH, conductivity, and salinity). The control charts will be generated from the last 20 samples whose data has been submitted using an online database. SDs that exceed the warning limits are flagged and values above the control limits are removed for the purposes of statistical analyses and plotting. A more detailed description of this process is provided in the following flow chart.* Issues will be noted on the form and also entered into a comments section in the online database. A report will be generated from the database listing flagged and removed data. Copies of this report and control charts (before and after data removal) will be attached. This information will be used to look for trends, such a problematic meter, a team that might need more training, or something unique about a particular sampling site. Data collected prior to March 2008 was handled manually using control charts constructed in Excel spreadsheets. These data were physically removed from the database but can be found in the archived raw field datasheets.

In cases where all three measurements for a sample are removed, a notation of "ND" should be displayed in the time trend graphs. If one measurement has been removed, the mean value of the remaining two will represent the sample. For the control chart update, either a SD is computed from $n=2$ or the %difference between the remaining two measurements is used. If $n=1$ because two measurements were removed, this single remaining measurement will represent the sample. Since no SD or % difference can be computed for $n=1$, this sample will be dropped from the updated control chart.

4 – The volunteer monitoring coordinator has verified that all other control activities and limits were met, i.e., all meter calibrations and the field LCS checks were in control. The QA officer signs off on this information.

In summary, this form collates all QC failures for a specified sampling period to enable a joint review by the volunteer monitoring coordinator and Quality Assurance officer. This will result in a determination of what corrective action is to be taken. The form should also be used to document what corrective action was taken.

*The mean SD for $n=20$ should never be greater than the Data Quality Objectives for each parameter as listed in Table x.xx.



Decision pathway for review of control charts

