

1.1.4.2 The CWT Data Quality Management (DQM) System

What is Data Quality Management? As mentioned above, known data quality requires documentation. Documentation means keeping records of all relevant Result descriptors and this requires placeholders, or a “data management system”. Because quality depends on documentation, quality-related information has to be managed in a way that links it to the Results, i.e., in a system that manages both the data and its quality at the same time. Hence the term “data quality management”. Data quality management is different from Quality Assurance and Quality Control (QA/QC), which rely on a series of actions and tests. Essentially, a data quality management system can provide placeholders for the outcomes of QA/QC procedures, and thus link them to the data they are intended to support. The next section describes how it works.

What is the DQM made of? The DQM system is an array of forms, spreadsheets, and dictionaries for information transfer and communication between operators within a scientifically based data collection effort. It supports environmental monitoring Projects focused on water quality and related watershed information. A “**Project**” is defined as a data collection effort that is limited in space and time (e.g., routine monitoring of one creek over one year, or a special study to identify the source of a particular constituent, or a Snapshot Day monitoring in multiple locations). DQM revolves around the “**Project File**”, a Microsoft Excel workbook with multiple spreadsheets that include all the Results and all the supporting documentation relevant to one Project.

The DQM Project File contains over 250 placeholders, or “Fields”, for information bits and descriptors that support one or more Result points. Many descriptors are linked to a Result point through an “information bit” that has a unique identification number and represents a unique entity (e.g., Sample ID, Station ID, etc.). Information bits that describe these entities are sometimes packaged in separate tables for convenience, for example the Station is described in detail in a table called “Location” by a large number of information bits such as landmark description, latitude-longitude coordinates & datum, etc. Instruments are described in their own table (called “Instrumeth” to combine instruments and methods) and also link the calibration and accuracy records to the Results through their unique Instrument ID and the ID of the Standard used for calibration. Introduction of the Instrument ID concept brought about a huge improvement in the reliability of citizen monitoring data and paved the way to helping groups generate data of known measurement quality, i.e., data that can speak for themselves!

How does the DQM work? The Data Quality Management (DQM) system consists of **manageable pieces** of guidance and tools (= DQM materials), organized to accomplish the following:

- provide instructions tailored to the different **roles** people play within the data collection effort
- support the various **phases** and **steps** of a typical monitoring Project
- enable flow of **information** between all roles, in all directions
- enable flow of **fully-documented monitoring results** from the data gatherers to the data users”.

The DQM provides tools and instructions that help any person communicate information and data in a consistent way through all planning, monitoring, and data reporting tasks of a typical monitoring Project. These tools and instructions are organized for three types of operators that play three distinct “roles” in the Project, using guidance and forms or templates that are specifically tailored to each of the roles. **Project roles** include the **Field Operator**, the **Trainer**, and the **Technical Leader**. There are additional roles that the DQM materials address (the Member of the Public, the Data User, and the Technical Expert); these roles are not an integral part of the Project, but persons in these roles provide input during the planning and designing phase of a Project.

Project tasks start with the Project planning phase (question formulation, parameter package & sampling design development, data quality objectives development, and monitoring methods selection; see the four planning steps in Section 1.1.4.1 above). The next phase includes all the tasks of data acquisition (field measurements, sampling, and off-site analyses). The last phase is transfer of the Results, through all the data validation and qualifying process, from the data collectors (Field operators, lab technicians) to the data users.

The DQM is based on the premise that communication of scientific contents has to be very specific. Each term or bit of information has to mean one thing only, and each word has to have only one meaning. The DQM also recognizes that operators need very detailed and clear guidance to assure clear, unambiguous communication. The DQM provides the specificity and level of detail that leaves nothing to interpretation. Another special feature of the DQM is that it is comprehensive, and contains placeholders for most, if not all, of the bits of information that describe the Results or water quality monitoring.

The DQM system deals with very complex scientific content, which cannot be easily simplified, by organizing it in small pieces that are complementary to each other and support one comprehensive system. Their information bits have simple, straightforward relationships, and are connected by linkages that are intuitive and conform to simple criteria (e.g., what entity does this bit of information describe”). This flexibility allows for arrangement of the information in any database structure.

The DQM Project File itself is a small, easily manageable package. It is totally transparent – no automation or macros – and can be viewed directly, but can also be combined with automated data entry forms and/or queries. Any person with minimum spreadsheet skills can use it for data entry. It can be sent by email and be easily transported via a 56K modem. These features make the file useful for low-tech and high-tech organizations alike.

Where are the DQM materials in the CWT Compendium? Many of the guidance documents in the CWT Compendium are compatible with the DQM and the Project File. However there are a number of forms, templates and instructions that are related to it specifically, i.e., use the same codes and mention specific Fields in the Project File, and these are labeled as DQM materials. The Instrument-Specific DQM guidance items are distributed in the Parameter Folders (mostly in Section 3). Some of the DQM materials are utilized as building blocks for a Quality Assurance Project Plan in Section 7. Generic guidance and explanation of basic concepts about data

quality, sampling design, etc. are provided in Section 8. Specific “How-to” guidance for the different roles (Field Operator, the Trainer, and the Technical Leader) are packaged in Section 9 of the compendium. The reader is encouraged to consult the Guidance Road Map for the numbers (and locations) of desired items.