

In Search of a Common Water Quality Monitoring Glossary

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Abstract

Water quality monitoring, as a subject of interest to both water quality managers and researchers, involves a wide variety of disciplines (e.g. chemistry, biology, statistics, and hydrology) and is practiced by many organizations with different missions (e.g. water quality management agencies, wildlife management agencies, natural resource management agencies, water research organizations, university researchers, and water providers). As a result of the diversity of people and organizations designing, implementing and operating water quality monitoring systems today, a variety of terms are employed to describe the same basic water quality monitoring concepts, components, practices, operations and elements. Likewise, a common term may have several definitions. The purpose of this paper is to explore development of a common glossary of basic *water quality monitoring* terms that considers the wide variety of disciplines and organizations involved in monitoring today. A selection of common water quality monitoring terms and definitions is suggested as a starting point for discussions that will lead to a widely accepted glossary of water quality monitoring terms. The list of terms presented includes terms assembled from a number of current glossaries and as well as terms suggested by lead authors of this issue of Water Resources IMPACT. For a number of the terms, ‘competing’ definitions are presented without an attempt to reconcile the differences.

Key Words: water quality monitoring, glossary, terminology, data comparability

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Over the years there have been a number of studies and panels organized to develop more consistency and comparability in water quality monitoring operations and the data and information produced by such measurement activities. Ward (1996) summarizes 18 of these efforts over the latter quarter of the 20th century.

One common element of efforts to introduce more consistency and comparability into water quality monitoring has been inclusion of a glossaries of terms related to the topic (e.g. National Research Council, 1977; U.S. Environmental Protection Agency, 1987; ITFM, 1996; and Groot and Villars, 1995). In general, the glossaries are highly focused, i.e. selective, based on the view of monitoring presented in each report. However, the fact that the authors of the reports felt it necessary to include a glossary with the report indicates the lack of standardization in terminology associated with water quality monitoring.

Why is it necessary to include a glossary with reports discussing water quality monitoring? Perhaps the main reason is associated with the multiple disciplines involved in a water quality monitoring. As Ward (1979), UN/ECE Task Force on Monitoring and Assessment (1996) and the National Water Quality Monitoring Council (2002) all note, there are many activities and functions involved in obtaining water quality information. From collecting samples, to analyzing them in the laboratory, to storing the data in databases, to statistically analyzing the data, to interpreting the chemical, biological and physical meaning of the findings – there are many disciplines involved in the design and operation of a water quality monitoring program. Each discipline, in many ways, brings its own terminology to the monitoring process, complicating ease of communication among people involved in water quality monitoring.

Furthermore, water quality monitoring is conducted at all levels of government by agencies having quite diverse missions (e.g. reducing water pollution; managing natural resources; and protecting endangered species). Thus, different agency terminology often describes the same aspect of monitoring, adding additional hurdles to the consistency and comparability sought across all water quality monitoring efforts.

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There are numerous *water quality* glossaries, as well as water quality monitoring glossaries, in existence today (the reference list at the end of this paper cites a number of them). A review of the *water quality* glossaries, alone, reveals a large set of terms – so large, in fact, that it may be difficult to identify the terms most relevant to the design and operation of a water quality monitoring system.

Thus, any attempt to prepare a widely accepted glossary of water quality monitoring related terms must be selective in terms to be included. It is beyond the scope of this paper to present a widely accepted water quality monitoring glossary. However, it is possible to begin creation of such a glossary with a review of existing glossaries and a careful evaluation of the inconsistencies and conflicts that currently exist in monitoring terminology. The purpose of this paper, therefore, is to conduct a review of current glossaries and assemble an initial list of terms and, in some cases, multiple definitions from which dialogue toward a common water quality monitoring glossary can begin. The glossary presented below contains terms and definitions developed during the formulation of the National Water Quality Monitoring Council's Monitoring Framework, presented in this issue of Water Resources IMPACT.

To illustrate the focus of the paper, consider the term *monitoring* itself. As a noun, it can mean anything from making sure no one misbehaves regarding discharging pollutants to water, to any effort by society to obtain information about the chemical, physical and biological aspects of water, via statistical sampling. By placing adjectives in front of the noun, a more focused definition of 'monitoring' can be obtained. For example, *biological* monitoring appears to limit the measurements to strictly biological characteristics of water. *Compliance* monitoring limits monitoring to checking effluent and stream concentrations against an applicable limit or standard. *Groundwater* monitoring focuses on measuring water quality conditions in a part of the hydrologic cycle, but without much definition beyond the location of the water. While each adjective fits with the needs of a particular discipline and/or agency, the combination of the adjective with the noun 'monitoring' creates a concept that may not be familiar to others working with the more general concept of *water quality* monitoring.

Glossaries that are particularly relevant to the task at hand, i.e. monitoring terminology, are those provided by the Intergovernmental Task Force on Monitoring (1995) and EMAP (2002). It should also be pointed out that the Data Methods and Comparability Board recently established a set of 'Data Elements' needed to fully explain what a particular water quality measurement represents. The Data Elements are to be recorded with water quality data, as meta data, in order to facilitate data sharing.

Below is a set of water quality monitoring terms, with definitions from referenced sources, assembled from a review of 15 glossaries and from the lead authors of the 'Monitoring Framework' papers presented in this issue of Water Resources IMPACT. Again, it is anticipated that this list of terms and definitions will serve to initiate a dialogue among water quality monitoring professionals that will lead to a widely accepted water-quality monitoring glossary.

Selected Water-Quality Monitoring Terms and Definitions

Accuracy - The degree to which a calculation, a measurement, or set of measurements agree with a true value or an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. EPA recommends that this term not be used and that precision and bias be used to convey the information usually associated with accuracy (EMAP, 2002).

Ambient - The natural background conditions in the surrounding environment that are not directly influenced by human activities.

- The natural conditions that would be expected to occur in water unaffected or not influenced by human activities (Oregon Water Resources Research Institute, 2002).
- Refers to natural background conditions in the surrounding environment outside the zone in which water quality may be influenced by a discharge or source of contamination. (British Columbia Ministry of Water, Land and Air Protection, 2001).

Ambient Monitoring - All forms of monitoring that determine existing environmental conditions.

- Performed to determine existing environmental conditions or contaminant levels in the environment, against which future conditions can be compared (North Carolina Cooperative Extension Service, 1996).
- All forms of monitoring conducted beyond the immediate influence of a discharge pipe or injection well and may include sampling of sediments and living resources (ITFM, 1995).

Ambient Water Quality - Water quality of a water body measured immediately upstream (or outside) of the influence of a particular source of pollutants or pollutant parameters during average flow conditions. This is the water quality that the Department shall utilize as the means water quality when implementing the antidegradation policies on a site-specific basis as defined in N.J.A.C. 7:9B 1.1. (New Jersey Farm Bureau, 2002).

Ancillary data

- Other categories of data (see *Water-quality data*) critical to interpreting water-quality data and formulating courses of action. These ancillary categories of data will be considered only as they relate to information management and data sharing. Ancillary data critical to water-quality decision-making include, but are not limited to, land use/land cover; water use; population and demographics; soils, geology, and geochemistry; municipal and industrial waste disposal; agricultural and domestic chemical applications; climatological data; and human health and ecological effects [Intergovernmental Task Force on Monitoring Water Quality (ITFM, 1995)].

- Those variables that might influence the indicators independent of what they are designed to denote [Environmental Monitoring and Assessment Program (ITFM, 1995, as reported from EMAP).
- Data that are collected as a consequence of collecting target data, but that are not considered to be essential (ITFM, 1995, as reported from the Ohio EPA).

Annual statistical summary - A document that presents a brief and comprehensive report of EMAP data collected on a single EMAP resource for a specific year. Annual statistical summaries may include cumulative frequency distributions, estimates of the extent of nominal or subnominal condition, comparisons among regions, or comparisons of data over time (EMAP, 2002).

Aquatic ecosystem - The stream channel, lake or estuary bed, water, and (or) biotic communities and the habitat features that occur therein (ITFM, 1995, as reported from the U.S. Forest Service).

Aquatic habitat - Environments characterized by the presence of standing or flowing water (ITFM, 1995, as reported from the U.S. Forest Service).

Aquifer - A body of rock that is sufficiently permeable to conduct ground water and to yield economically significant quantities of water to wells and springs (ITFM, 1995).

Assessed waters - Water bodies for which the State is able to make use-support decisions based on actual information. Such waters are not limited to those that have been directly monitored; it is appropriate in many cases to make judgments based on other information (ITFM, 1995, as reported from USEPA Region 5, modified).

Assessment - Interpretation and evaluation of EMAP results for the purpose of answering policy-relevant questions about ecological resources, including (1) determination of the fraction of the population that meets a socially defined value and (2) association among indicators of ecological condition and stressors (EMAP, 2002).

Auxiliary data - Data derived from a source other than EMAP, that is, from an experiment or from another monitoring or sampling program, either Federal or State. The sampling methods and quality assurance protocols of auxiliary data must be evaluated before the data are used. It is always important to establish the population represented by auxiliary data. (Preferred term 1993; replaces "non-EMAP data," and "found data," deleted in 1993; see related: **ancillary data**.) (EMAP, 2002).

Base flow:

- The part of streamflow derived from groundwater flowing into a stream (Wilkes University, 2002).
- Streamflow derived from groundwater seepage into the stream (Arizona Water Resources Research Center, 2002).

Bias: In a sampling context, the difference between the conceptual weighted average value of an estimator over all possible samples and the true value of the quantity being estimated. An estimator is said to be unbiased if that difference is zero. The systematic or persistent distortion of a measurement process which deprives the result of representativeness (i.e., the expected sample measurement is different than the sample's true value). A data quality indicator. (EMAP, 2002).

Biological assessment - An evaluation of the biological condition of a water body by using biological surveys and other direct measurements of a resident biota in surface water (ITFM, 1995, as reported from USEPA Region 5).

Biological monitoring (or biomonitoring) - The use of a biological entity as a detector and its response as a measure to determine environmental conditions. Toxicity tests and biological surveys are common biomonitoring methods (ITFM, 1995, as reported from USEPA Region 5).

Biological survey (or biosurvey) - Consists of collecting, processing, and analyzing representative portions of a resident aquatic community to determine the community structure and function (ITFM, 1995, as reported from USEPA Region 5).

Biomonitoring - The measurement of biological parameters in repetition to assess the current status and changes in time of the parameters measured (ITFM, 1995, as reported from the U.S. Fish and Wildlife Service).

Censored data - Data either below or above a detection limit. The "less than" data are typically reported from a laboratory unsure of a low value; "greater than" data arise when concentrations are larger than expected and performing a laboratory test at higher dilutions has not been possible. (NIWA, 2003)

Collaboration - The process in which two or more participants work collectively to deal with issues that they cannot solve individually; partnerships, alliances, teams.

Communication - The process of conveying information; can be one way or an exchange of thoughts, messages, or ideas.

Compliance monitoring - A type of monitoring done to ensure the meeting of immediate statutory requirements, the control of long-term water quality, the quality of receiving waters as determined by testing effluents, or the maintenance of standards during and after construction of a project (ITFM, 1995).

Condition indicator - A characteristic of the environment that provides quantitative estimates of the state of ecological resources and is conceptually tied to a value. (New term 1993; replaces environmental indicator.) (EMAP, 2002)

Confidence interval - An interval defined by two values, called confidence limits, calculated from sample data using a procedure which ensures that the unknown true value of the quantity of interest falls between such calculated values in a specified percentage of samples. Commonly, the specified percentage is 95%; the resulting confidence interval is then called a 95% confidence interval. A one-sided confidence interval is defined by a single calculated value called an upper (or lower) confidence limit. The numerical interval constructed around a point estimate of a population parameter, combined with a probability statement (the confidence coefficient) linking it to the population's true parameter value. If the same confidence interval construction technique and assumptions are used to calculate future intervals, they will include the unknown population parameter with the same specified probability. (EMAP, 2002).

Comparability - A data quality indicator, comparability is the degree to which different methods, data sets, and/or decisions agree or are similar. (Bradford County Conservation District, No Date)

Coordination - The process in which two or more participants link, harmonize or synchronize interaction and activities.

Criteria:

- *Criteria* that comprise numerical and narrative *criteria*. Numerical criteria are scientifically derived ambient concentrations developed by the USEPA or the States for various pollutants of concern so that human health and aquatic life can be protected. Narrative criteria are statements that describe the desired water-quality goal ITFM, 1995, as reported by USEPA Region 5).
- Scientifically derived ambient numerical values for physical, chemical or biological characteristics of water, biota or sediment which must not be exceeded to prevent specified detrimental effects from occurring to water uses, recommended concentrations, levels or narrative statements that should not be exceeded in order to protect the life or health of organisms. (British Columbia Ministry of Water, Land and Air Protection, 2001).

Data analysis – The portion of a water quality monitoring system (framework) where water quality data are evaluated (for example by statistics or physical, chemical and/or biological models) and interpreted in order to understand and infer information about the quality of water being sampled.

Data collection – That portion of a monitoring system (framework) where water quality samples are collected, measurements are made (either in the field or in a laboratory), and numbers are generated that represent the quality of the water sampled.

Data comparability - The characteristics that allow information from many sources to be of definable or equivalent quality so that this information can be used to address program objectives not necessarily related to those for which the data were collected. These characteristics need to be defined but would likely include detection limit precision,

accuracy, bias, and so forth (ITFM, 1995, as reported by the Data Methods Collection Task Group).

Data handling – That portion of a monitoring system (framework) where data are stored, usually electronically, tabulated, and retrieved, at some point in the future when sufficient data are available, to support the pre-selected data analysis procedure.

Data quality - The totality of features and characteristics of data that bears on their ability to satisfy a given purpose; the sum of the degrees of excellence for factors related to data (EMAP, 2002).

Data quality indicators - Quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy, comparability, completeness, and representativeness (EMAP, 2002).

Data quality objectives (DQOs):

- Quantitative and qualitative statements of the overall level of uncertainty that a decision-maker is willing to accept in results or decisions derived from environmental data DQOs provide the statistical framework for planning and managing environmental data operations consistent with the data user's needs (QAMS 1993, 8). A data quality objective may include goals for accuracy, precision, and limits of detection. It may also include goals for completeness, comparability, and representativeness. Data quality objectives are established before sampling is begun and may influence the level of effort required to select a sample (EMAP, 2002).
- In the context of water- quality monitoring, the characteristics or goals that are determined by a monitoring or interpretive program to be essential to the usefulness of the data. They would include, but not be limited to, the specification of delineation of the limits of precision and bias of measurements, the completeness of sampling and measurements, the representativeness of sites relative to program objectives, the validity of data, and so forth (ITFM, 1995, as reported by the Data Methods Collection Task Group).
- The DQO process is a systematic, iterative, and customized planning framework through which project goals and objectives are articulated, appropriate types of environmental and quality-control data are determined, and tolerable levels of uncertainty are established that will support decisions (USEPA 1994, 2000; Crumbling, 2001).
- Data quality objectives are quantitative and qualitative statements describing the degree of the data's acceptability or utility to the data user(s). They include indicators such as accuracy, precision, representativeness, comparability, and completeness. DQOs specify the quality of the data needed in order to meet the monitoring project's goals. The planning process for ensuring environmental data of the type, quality, and quantity needed for decision making is called the DQO process.(Bradford County Conservation District. No Date)

Deterministic models - Attempt to quantitatively represent the transformation and transport processes occurring in natural systems.

Ecological indicators - Plant or animal species, communities, or special habitats with a narrow range of ecological tolerance. For example, in forest areas, such indicators may be selected for emphasis and monitored during forest plan implementation because their presence and abundance serve as a barometer of ecological conditions within a management unit (ITFM, 1995, as reported from the U.S. Forest Service).

Effectiveness monitoring - Documents how well the management practices meet intended objectives for the riparian area. Monitoring evaluates the cause and effect relations between management activities and conditions of the riparian dependent resources. Terrestrial and instream methods constitute monitoring that evaluates and documents the total effectiveness of site-specific actions (ITFM, 1995, as reported by the U.S. Forest Service).

Effluent:

- The discharge of a contaminant or contaminants with water from animal production or industrial facilities or wastewater treatment plant. (Wilkes University, 2002)
- Treated wastewater discharged from sewage treatment plants (Arizona Water Resources Research Center, 2002).

Environmental indicators - A measurable feature or features that provide managerially and scientifically useful evidence of environmental and ecosystem quality or reliable evidence of trends in quality (ITFM, 1995).

Equivalence test - A classical procedure in which the hypothesis tested posits that differences between variables are either within or beyond a stated interval. If the test conclusion is that the differences are within that interval, one infers "equivalence". (NIWA, 2003)

Existing water quality - means the water quality in a water body at the time a water body was designated for its current level of antidegradation protection, as modified to reflect permitted loadings not actually being discharged on the date of designation, provided that such loadings were contained in issued permits prior to the effective date of the designation. This is the water quality that the Department shall utilize as mean water quality when implementing a watershed approach to water quality management for a particular waterbody (New Jersey Farm Bureau, 2002).

False Negative – no signal, when, in fact, a contaminant is present (Data Collection: Field and Laboratory Methods, AWRA, IMPACT September 2003)

False Positive - a false signal that a contaminant has been detected in the sample, or no signal, when, in fact, a contaminant is present (Data Collection: Field and Laboratory Methods, AWRA, IMPACT September 2003)

Framework for Water Quality Monitoring - An approach to designing and implementing a water monitoring system that organizes and coordinates the activities involved in monitoring that is information-goal oriented and accountable for the information produced.

- The process of monitoring and assessment should principally be seen as a sequence of related activities that starts with the definition of information needs, and ends with the use of the information product.... Successive activities in this monitoring cycle should be specified and designed based on the required information product as well as the preceding part of the chain. In drawing up programmes for the monitoring and assessment of river basins, riparian countries should jointly consider all stages of the monitoring process. (The UN/ECE Task Force on Monitoring and Assessment, 2000)

Freshwater - Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L of dissolved solids is undesirable for drinking and many industrial uses (U.S. Geological Survey, 1990).

Fixed-station monitoring - The repeated long-term sampling or measurement of parameters at representative points for the purpose of determining environmental quality characteristics and trends (ITFM, 1995, as reported by USEPA Region 5).

Implementation monitoring - Documents whether or not management practices were applied as designed. Project and contract administration is a part of implementation monitoring (ITFM, 1995, as reported by the U.S. Forest Service).

Index - Mathematical aggregation of indicators or metrics (EMAP, 2002).

Index period - The sampling period during which selection is based on the temporal behavior of the indicator and the practical considerations for sampling.

- The sampling period during which selection is based on the temporal behavior of the indicator and the practical considerations for sampling (ITFM, 1995, as reported from the Ohio EPA, modified).
- The period of the year when measurement of an indicator yields meaningful information (EMAP, 2002).

Index sample - A standardized judgment sample for which explicit rules for generating the index measure are formally prescribed. An index sample is appropriate only for ecologically integrated systems. For example, in the National Lake Survey, a lake in the

probability sample of lakes was field sampled at a prescribed season of the year (index period), in a prescribed standardized location in the lake (index site), and in a prescribed manner (field protocol) (EMAP, 2002).

Indicator - In EMAP, characteristics of the environment both abiotic and biotic, that can provide quantitative information on ecological resources. (Revised definition 1993. Preferred term for environmental indicator, deleted 1993.) "In biology, an organism, species, or community whose characteristics show the presence of specific environmental conditions, good or bad" (EMAP, 2002).

Indicator organism - Microorganisms, such as coliform bacteria, that are not in themselves harmful but whose presence is indicative of possible pollution or the presence of other more harmful microorganisms, species whose presence is indicative of pollution or of more harmful microorganisms, a species which, through its population size or condition, mirrors environmental conditions within an ecosystem. (British Columbia Ministry of Water, Land and Air Protection, 2001).

Judgment sample - A form of non-probability sample in which the sample is chosen according to the judgment of the sampler (EMAP, 2002).

Laboratory analysis – That portion of a monitoring system (framework) where water samples are evaluated for chemical and biological characteristics, under carefully controlled conditions, and the results are documented prior to entry into a data management system.

Load allocation - The portion of a receiving water's total maximum daily load (TMDL) for a specific pollutant that is allocated to existing or future nonpoint sources of pollution (New Jersey Farm Bureau, 2002).

Metadata - Information that describes the content, quality, condition, and other characteristics of data [Federal Geographic Data Committee (ITFM, 1995, as reported by the FGDC).

Method comparability - The characteristics that allow data produced by multiple methods to meet or exceed the data-quality objectives of primary or secondary data users. These characteristics need to be defined but would likely include data-quality objectives, bias, precision, information on data comparability, and so forth (ITFM, 1995, Data Methods Collection Task Group).

Method validation - The process of substantiating a method to meet certain performance criteria for sampling and (or) analytical and (or) data handling operations (ITFM, 1995).

Metric - A biological attribute, some feature or characteristic of the biotic assemblage, that reflects ambient conditions, especially the influence of human actions on these conditions (ITFM, 1995; Technical Appendix G).

Monitoring

- Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and (or) pollutant levels in various media or in humans, animals, and other living things (ITFM, 1995).
- In EMAP, the periodic collection of data that is used to determine the condition of ecological resources. "Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media [air, soil, water] or in humans, plants, and animals" (EMAP, 2002).
- Scrutinizing and checking systematically with a view to collecting data (Water Environmental Federation, 2002).

Monitoring Councils - Provide a forum for communication, coordination, and collaboration among monitoring groups. Each of these entities seeks to provide a forum for effective communication, coordination, and collaboration among individuals and organizations involved in water monitoring. In a very real way, they provide a formal arena--including an actual table around which people can gather—for exploring monitoring and assessment issues of interest.

Network design – Refers to the process of planning, in an integrated manner, the establishment of a water quality monitoring system, including the location of sampling sites, the frequency of sampling, and the measurements to be made on each sample collected. Increasingly, the term also includes defining how the water samples will be analyzed in the laboratory, how the data will be stored and retrieved, how the data will be analyzed to obtain information, and how the information will be reported.

Non-parametric method - Methods that do not require knowledge (or assumptions) about the shape of the distribution of the population. These methods work with the ranks of data, rather than with the actual data values. (NIWA, 2003)

Parameter - Any quantity such as a mean or a standard deviation characterizing a population. Commonly misused for 'variable,' 'characteristic,' or 'property' (EMAP, 2002).

***p*-value** - The key probability calculation in a null hypothesis test. It is the probability of getting data at least as extreme as has been obtained if that hypothesis is true. It can be calculated only if the distribution of the test statistic is known. If *p* is small the hypothesis is rejected and one states that a "statistically significant" result has been obtained. "Small" means less than the significance level (i.e., $p < \alpha$). (NIWA, 2003)

Parametric method - Methods using knowledge (or assumptions) about the shape of the distribution of the population. (NIWA, 2003)

Point source - A source of water pollution that originates from a single point, such as an outflow pipe from a factory (Arizona Water Resources Research Center, 2002).

Peer-reviewed literature - A referable, obtainable, published document that is reviewed by a minimum of two technical reviewers who are located external to the author's organization (ITFM, 1995).

Performance-based systems (PBS):

- A system that permits the use of any appropriate measurement methods that demonstrates the ability to meet established performance criteria and that complies with specified data-quality needs. Performance criteria, such as precision, bias, sensitivity, specificity, and detection limit, must be designated, and a method-validation process must be documented (ITFM, 1995).
- A PBS approach would require documenting the quality of data obtained from a method without specifying the method itself (NWQMC – Methods Board, 2001).

Precision - The degree to which replicate measurements of the same attribute agree or are exact. The degree to which a set of observations or measurements of the same property, usually obtained under similar conditions, conform to themselves; a data quality indicator (EMAP, 2002)

Probability sample: A sample chosen in such a manner that the probabilities of including the selected units in the sample are known, and all population units have a positive probability of selection. This implies that the target population is represented by the sample and that the target population is explicitly defined (EMAP, 2002).

Probability survey network design - Sites are randomly chosen in specific stratum of the regionalization scheme.

Professional judgment network design - Sites are selected to represent specific conditions.

Quality assessment - The evaluation of environmental data to determine if they meet the quality criteria required for a specific application (EMAP, 2002).

Quality assurance (QA) - An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence (EMAP, 2002).

Quality Assurance Project Plan - Documents the planning, implementation, and assessment procedures for a particular project, as well as any specific quality assurance and quality control activities. It integrates all the technical and quality aspects of the project in order to provide a "blueprint" for obtaining the type and quality of environmental data and information needed for a specific decision or use.

Quality control (QC) - The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. The aim is to provide quality that is satisfactory, adequate, dependable, and economical (EMAP, 2002).

QA/QC (Quality Assurance/Quality Control) - A system of procedures, checks, audits, and corrective actions to ensure that all EPA research design and performance, environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality (EMAP, 2002).

Reference value/conditions

- A single measurement or set of selected measurements of unimpaired water bodies characteristic of an ecoregion and (or) habitat (ITFM, 1995, as reported by the USEPA/OST).
- The chemical, physical, or biological quality or condition that is exhibited at either a single site or an aggregation of sites that represent the least impacted or reasonably attainable condition at the least impacted reference sites (ITFM, 1995, as reported from the Ohio EPA).

Reporting – That portion of a monitoring system (framework) where information, obtained from analysis and interpretation of data, is conveyed to water quality managers, policy makers and the public, using a variety of means, such as formal technical documents, oral presentations, and/or web pages.

Response indicator - An environmental indicator measured to provide evidence of the biological condition of a resource at the organism, population, community, or ecosystem level of organization (ITFM, 1995, as reported from EMAP).

Representative sample – A sample collected to represent specific monitoring objectives.

River reach - A river or stream segment of a specific length. Most reaches extend between the points of confluence with other streams (ITFM, 1995, as reported from USEPA Region 5).

Sample:

- A subset of the units from a frame. A sample may also be a subset of resource units from a population or a set of sampling units (EMAP, 2002).
- A small portion of water or other substance taken at a given place and time for analysis; it is assumed to be representative of the whole body of water or the rest of the substance within specified statistical limit. (British Columbia Ministry of Water, Land and Air Protection, 2001).

Sampling and Analysis Project Plan (SAPP) - These plans incorporate information and decisions from the systematic planning process, and stipulate the appropriate field and laboratory methods to be used (USEPA, 2000).

Sampling strategy - A sampling design, together with a plan of analysis and estimation. The design consists of a frame, either explicit or implicit, together with a protocol for selection of sampling units (EMAP, 2002).

Sampling unit - An entity that is subject to selection and characterization under a sampling design. A sample consists of a set of sampling units or sites that will be characterized. Sampling units are defined by the frame; they may correspond to resource units, or they may be artificial units constructed for the sole purpose of the sampling design (EMAP, 2002).

Statistically significant - Results are reported as "statistically significant" when there is only a small probability of getting data at least as extreme as has been obtained if the tested hypothesis is true. This probability is the p -value. "Small" means that $p < \alpha$ (α is the significance level). (NIWA, 2003)

STORET – Established by the USEPA to be a national central repository of water information. Contains water data from a variety of organizations across the country, from small volunteer watershed groups to State and Federal environmental agencies.

Stressor indicator:

- A characteristic measured to quantify a natural process, an environmental hazard, or a management action that results in changes in exposure and habitat (ITFM, 1995, as reported from EMAP).
- A characteristic of the environment that is suspected to elicit a change in the state of an ecological resource, and they include both natural and human-induced stressors. Selected stressor indicators will be monitored in EMAP only when a relationship between specific condition and stressor indicators are known or if a testable hypothesis can be formulated (EMAP, 2002).

Trend Monitoring -

- The repeated measurement of some parameters to assess the current status and changes over time of the parameters measured (ITFM, 1995, as reported from the U.S. Fish and Wildlife Service).
- To check, measure or examine water quality over a period of time to note any changes which may occur. (British Columbia Ministry of Water, Land and Air Protection, 2001).
- Consistent and systematic long-term data collection to provide a quantitative means to distinguish long-term trends from short-term fluctuations and natural fluctuations from effects of human activities.

Validation monitoring - Determines if predictive model coefficients are adequately protecting the targeted resources. A long-term commitment to data collection is often required to establish an adequate data base. If the standard, which requires use of 50 percent or less of streamside herbaceous forage, for example, fails to achieve the desired instream habitat condition, then the standard would have to be modified for less forage

consumption in the riparian complex(es) (ITFM, 1995, as reported from the U.S. Forest Service, modified).

Water quality - A term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a particular use.

- A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose (US Geological Survey, 2002).
- The physical, chemical and biological characteristics of water and how they relate to its suitability for a particular use (Arizona Water Resources Research Center, 2002).
- A term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a particular use (Texas Environmental Center, 2002).
- A term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a particular use (Oregon Water Resources Research Institute, 2002).
- The condition of water with respect to the amount of impurities in it (Water Environment Federation, 2002).
- A term used to describe the chemical, physical and biological characteristics of water, usually in respect to its suitability for a particular purpose. (British Columbia Ministry of Water, Land and Air Protection, 2001).

Water Quality Criteria (standards) - Levels of water quality expected to render a body of water suitable for its designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, fish production, or industrial uses (Applied Resource Economics and Policy Group, 1994).

Water-quality data - Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters, atmospheric deposition, potable water, treated effluents, and waste water and of the immediate environment in which the water exists (ITFM, 1995).

Water-quality information Derived through analysis, interpretation, and presentation of water-quality and ancillary data (ITFM, 1995).

Water-quality limited segment - A stretch or area of surface water where technology-based controls are not sufficient to prevent violations of water-quality standards. In such cases, new permit limitations are based on ambient-water-quality considerations (ITFM, 1995, as reported from the USEPA Region 5).

Water-quality monitoring:

- An integrated activity for evaluating the physical, chemical, and biological character of water in relation to human health, ecological conditions, and designated water uses (ITFM, 1995, as reported from the ITFM Technical Appendix B).

- A sequence of inter-related activities that, together, result in scientifically sound data and information about the physical, chemical and biological characteristics of water, via statistical sampling.

Water quality guideline - Numerical concentration or narrative statement recommended to support and maintain a designated water use. (British Columbia Ministry of Water, Land and Air Protection, 2001).

Water-quality limited segment - A stretch or area of surface water where technology-based controls are not sufficient to prevent violations of water-quality standards. In such cases, new permit limitations are based on ambient-water-quality considerations (ITFM, 1995, as reported from USEPA Region 5).

Water quality objective- A water quality criterion or water quality guideline adapted to protect the most sensitive designated water use at a specific location with an adequate degree of safety, taking local circumstances into account. (British Columbia Ministry of Water, Land and Air Protection, 2001).

Water-quality standard:

- A law or regulation that consists of the beneficial designated use or uses of a water body, the numerical and narrative water-quality criteria that are necessary to protect the use or uses of that particular water body, and an antidegradation statement (ITFM, 1995, as reported from USEPA Region 5).
- Ambient standards for water bodies adopted by the EMC and approved by the EPA that prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses. Water quality standards may apply to dissolved oxygen, heavy metals, pH, and other water constituents (Applied Resource Economics and Policy Group, 1994).
- Law or regulation that consists of the designated use or uses of a waterbody or a segment of a waterbody and the water quality criteria that are necessary to protect the use or uses of that particular waterbody. (British Columbia Ministry of Water, Land and Air Protection, 2001).

Water-resource quality:

- The condition of water or some water-related resource as measured by biological surveys, habitat-quality assessments, chemical-specific analyses of pollutants in water bodies, and toxicity tests (ITFM, 1995, as reported from the USEPA/OST).
- The condition of water or some water-related resource as measured by the following: habitat quality, energy dynamics, chemical quality, hydrological regime, and biotic factors (ITFM, 1995, as reported from the Ohio EPA).

XML - XML is the Extensible Markup Language. It is designed to improve the functionality of the Web by providing more flexible and adaptable information identification. XML is actually a `metalanguage' --a language for describing other languages--which lets you design your own customized markup languages for limitless different types of documents.

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