

A. PROJECT MANAGEMENT

The goal of the Watershed Monitoring Section (WMS) is to provide DEP with scientifically defensible information on chemical, physical and biological characteristics of waters of the state. This information provides the basis for advising the Environmental Protection Agency (EPA), relevant DEP programs, partner agencies, and the Governor and Legislature on the status of Florida's water quality.

The department initiated the Status and Trend (Temporal Variability) Monitoring Networks for ambient ground water and surface freshwater resources in 2000. The Status Monitoring Network provides a snapshot of the chemical and biological quality of waters in the state. The Trend Monitoring Network measures changes in water quality over time. The data derived from both networks can be examined to determine if there are changes in water quality due to management and restoration efforts throughout the state. Data collection is accomplished through a collaborative effort of five department Regional Operation Centers (ROCs) (Tallahassee ROC, Southwest ROC, South ROC, Central ROC, and Southeast ROC), three Water Management Districts (Northwest Florida Water Management District, St. John's River Water Management District, and South Florida Water Management District) and one county (Alachua). For more information, please see Section 5.0 of the [Watershed Monitoring Section Quality Manual](#).

The WMS firmly believes that all personnel within the Section are vital to the overall quality of data being produced. Please see Sections 5.0 and 11.6 of the [Watershed Monitoring Section Quality Manual](#) for a brief description of staff responsibilities and an organizational chart.

The Status Network design incorporates a stratified random approach to sampling and reporting on Florida's water resources. Geographic stratification breaks the state into non-overlapping areas (zones), from which the sampling stations are chosen. These zones correspond to the state's five water management district boundaries, except for South Florida, which has been divided into eastern and western regions. According to the current Status design, every year 90 stations are attempted to be sampled for each of the following resources statewide: rivers, streams, small lakes and large lakes statewide; 60 stations are attempted to be sampled for the canals resource within Zones 3-6; and 120 stations are attempted to be sampled statewide from each ground water resource type (confined and unconfined aquifers). Each resource has a specific timeframe in which the samples must be collected. See Element 3 of the [Monitoring Design Document for the Watershed Monitoring Section](#) for more information.

The Trend Network is designed to determine if there are changes in water quality over time for selected indicators. To make trend results comparable to the Status Network, the state has separated the Trend Network into surface water (rivers, streams, and canals) and ground water (confined and unconfined aquifers) resources. The Surface Water Trend Network consists of 78 fixed sites that are sampled monthly. Data from Surface Water Trend sites are used to evaluate temporal variability in Florida's surface water resources and determine indicator trends. This network is not designed to monitor point sources of pollution, since the sites are located away from known outfalls or other regulated sources.

The Ground Water Trend Network consists of 49 fixed sites that are used to obtain chemistry and field data in confined and unconfined aquifers. These data are used to quantify temporal variability in ground water resources. Each quarter, field measurements and water samples are collected at all wells in the Ground Water Trend Network. Additionally, field measurements are taken from unconfined aquifer wells during non-quarterly months. For more information on the design and structure of the Trend networks, please see Element 3 of the [Monitoring Design Document for the Watershed Monitoring Section](#). For a list of current indicators collected for each Network and their corresponding analytical methods, see Section 7 of the [Watershed Monitoring Section Quality Manual](#).

All WMS employees are required to review the Sampling Manual (and/or provide technical assistance in editing and updating the Sampling Manual) on an approximate annual basis. All DEP or contracted staff who participate in activities directly related to sample collection are required to attend at least one Sampling Training Workshop every five years (or as needed, before then). These workshops are conducted at least once a year, and training is based on specific DEP Standard Operating Procedures (SOP) as applied to the Status and Trend Network sampling programs.

Furthermore, all samplers performing Habitat Assessments (HA) and Stream Condition Index (SCI) sampling are required to have specific training and demonstrate competency due to the expert judgment exercised during field sampling. Individuals conducting a HA must train with qualified DEP staff (via workshops and participating in field sampling) and remain in “pass” status for field performance tests. WMS field samplers conducting SCI sampling must train with qualified DEP staff (via workshops and participating in field sampling) and remain in “pass” status by passing an online knowledge test and field performance tests (audits) to demonstrate competence. At all times, a minimum of one sampler from each sampling team must be in pass status in order to perform a HA or SCI.

DEP sampling personnel are also required to obtain training on Global Navigation Satellite System (GNSS) / Global Positioning System (GPS) device operation, Class I Watercraft and Trailing operation, and safety.

A list of all sampling personnel and their respective water quality sampling training is maintained internally within the Section, and their training is consistent with FA 3100. Furthermore, training records are maintained on each WMS employee who is trained in skills commensurate with their responsibilities. See Section 5 of the [Watershed Monitoring Section Quality Manual](#) for more information.

All WMS sampling equipment is consistent with FS 1001 and Tables FS 1000-1 through FS 1000-3 of the DEP Field SOPs. Sections 7 and 8 of the [Watershed Monitoring Section Quality Manual](#) list specific pieces of equipment used for sample collection (ground water, surface water, sediments and biology) and field testing.

Sample documentation is of critical importance to the objectives of the Status and Trend Monitoring Networks. Data gathered on these projects is entered into an existing statewide water

quality database, and must be properly linked to historical data. The database is also a source of public information and is used for a variety of purposes. All WMS documentation requirements are based on the DEP SOPs, and record keeping practices are consistent with 62-160.240(1) and 62-160.340(1), F.A.C. and FD 1000 of the DEP SOPs. All records shall be retained for at least 5 years after the completion of the project.

Sample documentation begins in the DEP Laboratory. A label is placed on each container with the request (RQ) number, the major analyte group, a notation if filtration is required, and the preservation method. WMS provides the sampling agencies with station identification labels that are bar coded to uniquely identify a sample station. The field technicians place these labels on the sample containers and on the custody sheet. This links the station to both the containers and the custody sheet. See Section 17 of the [Status and Trend Monitoring Networks Sampling Manual](#).

All field documentation is recorded on appropriate field sheets which are supplied by WMS. Samplers are required to ensure that the most current versions are used by observing the date printed on the forms. All paper documentation records must be recorded in waterproof ink. Erasing or obliteration of records is not permitted. Corrections are made by marking a single line through the error so that it is still legible, and the initials of the individual performing the correction are included. All documentation records are required to be legible (see Section 6 of the [Watershed Monitoring Section Quality Manual](#)).

All documentation regarding initial activities performed by the DEP Laboratory (container preparation, supplying sampling kits, RQ information, etc.) is generated, retained and stored internally by appropriate lab personnel (see Section 6 of the [Watershed Monitoring Section Quality Manual](#)).

All documentation regarding sampling procedures (Sampling Manual) is generated, retained and stored electronically (and by hard-copy) by the WMS QA Officer. All documentation produced by field sampling personnel is retained and stored by the respective Project Manager (see Section 6 of the [Watershed Monitoring Section Quality Manual](#)).

All documentation regarding data management and review is generated, retained and stored electronically by the Data Manager (see the [Data Management Protocols for the Watershed Monitoring Section](#)).

WMS generates several types of documentation and reports that are listed below. See Section 6.0 of the [Watershed Monitoring Section Quality Manual](#).

- Sampling Manual, including paperwork as described below:
 - field sheets (ground water, surface water, biology)
 - custody sheets
 - labels
 - micro land use forms
 - permission letter templates

- o log books (calibration, standards and buffers, equipment maintenance and equipment cleaning)
 - o inventory sheets
 - o field audit forms
- Quality Manual
- Monitoring Design Document
- Data Management and Analysis SOPs
- Project Manager procedures manual
- Status Network Reconnaissance Manual
- Generalized Water Information System (GWIS) Database Utilities User's Manual
- Automated Data Management Application (ADM) User's Manual
- GNSS / GPS Basics Manual
- Data dictionaries for field data and locational data collection based on programmatic standards

Reports:

- Quality assurance reports
- Data analysis summary reports from annual ground and surface water monitoring
- Integrated report to EPA for satisfaction of Section 305(b) Clean Water Act requirements
- Report on the Integrated Florida Monitoring Strategy to satisfy section 106 reporting requirements to EPA
- Quality Assurance Project Plan in support of Florida Department of Environmental Protection monitoring activities conducted under sections 104(b)(3), 303(d), 305(b), and 604 of the Clean Water Act as amended

The Data Quality Objective(s) (DQO) process is a planning tool that can save resources. DQO invests up-front time and funding in the planning stages to ensure that the final product satisfies the needs of data users. It focuses data collection activities so only the most critical questions are addressed. Some Data Quality Objectives can be used by both monitoring networks. An overarching DQO for both Networks is providing data of a known quality and confidence for use in DEP programs and to aid in the development of rules and thresholds.

Other DQOs are specific to the monitoring program. A DQO specifically focused to the requirements of the Status Monitoring Network is to produce data for an estimate of condition for each type of water resource with a 95% confidence interval that has a margin of error between 5 and 15%.

DQOs specific for the Trend Monitoring Network are: produce an adequate amount of data to determine whether trends exist in surficial or ground water resources across the state, and collect data over a period of time that covers temporal cycles in the data (e.g. temperature changes over time and sampling must be at a rate that shows the seasonal fluctuations). See Element 2 of the [Monitoring Design Document for the Watershed Monitoring Section](#).

B. DATA GENERATION AND ACQUISITION

WMS collects samples from seven water resources to monitor water quality for the Status Network. Sediment samples are also collected at small and large lakes each year. All samples are collected and shipped following DEP-approved protocols outlined in Sections 3-16 of the [Status and Trend Monitoring Networks Sampling Manual](#). Samples are shipped to the DEP Laboratory in Tallahassee for analysis. Each resource has a specific timeframe in which the samples must be collected. See Element 3 of the [Monitoring Design Document for the Watershed Monitoring Section](#) for more information.

For the Trend Network, the state has separated the network into surface water (rivers, streams, and canals) and ground water (confined and unconfined aquifers) resources. The Surface Water Trend Network consists of 78 fixed sites that are sampled monthly for water quality; while the Ground Water Trend Network consists of 49 fixed confined and unconfined sites that are sampled for water quality on a quarterly basis (see Section 1 of the [Status and Trend Monitoring Networks Sampling Manual](#)).

The Status and Trend Networks Sampling Manual is based on the DEP SOPs that are set forth in [Rule 62-160, F.A.C.](#), Quality Assurance, and specified in the DEP document [Standard Operating Procedures for Field Activities](#). Following these SOPs is required to meet program-specific DQOs. Similarly, the DEP Laboratory has [SOPs for Laboratory Activities](#) that address handling and analyzing samples, reporting precision, accuracy, and method detection limits, and other data reporting guidelines.

The [Status and Trend Monitoring Networks Sampling Manual](#) addresses the proper collection protocols for all Status and Trend resources including the following: preparation, instrument calibration, ground water, surface water, sediments, habitat assessment, stream condition index, rapid periphyton survey, linear vegetation survey, preservation, documentation, custody and shipment, quality assurance / quality control, GPS / GNSS, and equipment cleaning.

The containers used for collection / analysis of all Status and Trend samples are provided by the DEP Laboratory. WMS staff collect water quality samples either directly with the sample container (referred to as a “direct grab”) or by using DEP-approved sampling equipment. All equipment is selected based on the sampling resource, as well as the analytes of interest and the sampling procedure. Equipment construction must be consistent with the analytes in order to ensure data quality is not compromised. See Section 7 of the [Watershed Monitoring Section Quality Manual](#) for a list of approved equipment used for Status and Trend sampling.

After collection, sample containers are preserved as necessary (Section 11 of the [Status and Trend Monitoring Networks Sampling Manual](#)), bagged, and submerged in wet ice in a cooler in preparation for delivery to the laboratory. WMS custody sheets are to be used for all sample submittals for both the Status and Trend networks and are completed and submitted with each cooler. The back of the custody sheet lists the analytes to be measured, the container type that will hold the water sample for a group of analytes, and the methods for preserving the water sample.

WMS uses specific instruments to collect field measurements such as pH, temperature, conductivity, dissolved oxygen, and turbidity. These instruments are properly calibrated on a routine basis (daily for field multi-meters, quarterly for field turbidity meters) to ensure accuracy and precision. Furthermore, all instruments and equipment are maintained and repaired (including preventative maintenance) on a routine basis. For more details, see Section 3 of the [Status and Trend Monitoring Networks Sampling Manual](#). Furthermore, all samplers are required to have access to back-up equipment and supplies in case of equipment failure while in the field. See Section 2 of the [Status and Trend Monitoring Networks Sampling Manual](#).

All field sampling measurements must be bracketed between acceptable meter calibration/verification results (see Section 3 of the [Status and Trend Monitoring Networks Sampling Manual](#)). Calibration / verification activities must be performed at intervals of no more than 24 hours, for pH, specific conductance, and dissolved oxygen. For pH, calibrated meters must read within ± 0.2 standard units of the actual buffer values. For specific conductance, calibrated meters must read within $\pm 5\%$ of the standards. Dissolved oxygen (DO) calibration is considered acceptable if it reads within ± 0.3 mg DO/L of the applicable value listed in Table 5 of the [Status and Trend Monitoring Networks Sampling Manual](#), "Solubility of Oxygen in Water at Atmospheric Pressure". This chart (or similar) must be used in order to determine the results of any and all DO verifications. Temperature measurements should agree within $\pm 0.5^\circ$ C of a NIST-traceable (National Institute of Standards and Technology) thermometer. Finally, calibrated turbidity meters must read within the range of turbidity stated below, based on the standard's value:

- 0.1 – 10 NTU: the response must be within 10% of the standard
- 11 – 40 NTU: the response must be within 8% of the standard
- 41 – 100 NTU: the response must be within 6.5% of the standard
- >100 NTU: the response must be within 5% of the standard

Records of all meter calibrations and verifications must be maintained in a calibration log book (see Section 17 of the [Status and Trend Monitoring Networks Sampling Manual](#) for an example). Each calibration and verification must be directly linked to affected samples (record project name and/or applicable sample sites on calibration record). Supplies and consumables for field testing adhere to the requirements set forth in the FT1000 series of the [Standard Operating Procedures for Field Activities](#).

All WMS samplers are encouraged to use an inventory checklist for all sampling supplies and equipment needed. Chemicals, reagents, standards, and buffers (such as pH buffers, conductivity standards, and cleaning solutions) are documented in a log book (see Section 17 of the [Status and Trend Monitoring Networks Sampling Manual](#) for an example). Inventory of all filters used by the WMS for sample collection are tracked in a log book that is maintained by the WMS QA Officer. More information about supplies can be found in Section 2 of the [Status and Trend Monitoring Networks Sampling Manual](#).

WMS uses several quality control measures to ensure that high-quality data are being collected and analyzed. The quality control procedures are consistent with the DEP SOPs. Sampling personnel collect and submit three types of blanks (field blanks, pre-cleaned equipment blanks, and field-cleaned equipment blanks) to the DEP Laboratory based on the type of equipment used

to collect the actual water chemistry samples. All blanks are collected at a 20% frequency based on the number of samples collected for a specific project over a specific period of time. Blanks are collected using analyte-free (de-ionized) water and are collected in the same manner as actual samples. Results from all field collected blanks submitted to the lab are used during data review according to the following specifications: the WMS qualifies sample data (using the “G” qualifier) if the value detected in an associated field blank or equipment blank is greater than 10% of the value detected in the sample. The WMS QA officer reviews the blank results to determine if significant or reoccurring detections are taking place. The QA officer also submits a quarterly blank detection report to each sampling entity listing any detection greater than the MDL (minimum detection limit). Any significant or reoccurring detection requires the sampling personnel to investigate possible contamination sources and initiate corrective actions accordingly (Section 9 of the [Watershed Monitoring Section Quality Manual](#)).

All samples are analyzed at DEP’s Laboratory. The DEP Laboratory consistently scores high, compared with other environmental labs in the nation, based on performance reviews by the United States Geological Survey (USGS) and EPA. It is certified under the National Environmental Laboratory Accreditation Program (NELAP) by Florida Department of Health (DOH) for most of the Status and Trend Network indicators. A complete list of indicators and the corresponding analytical methods can be located in Section 7 of the [Watershed Monitoring Section Quality Manual](#).

The management of data and metadata generated by the Status and Trend Networks encompasses the use of GIS, an Oracle database, and several in-house Internet applications. The [Data Management Protocols for the Watershed Monitoring Section](#) document details how these platforms interact and how staff can use them to review, load, and distribute data.

C. ASSESSMENT AND OVERSIGHT

Internal and external audits are conducted to evaluate field sampling protocols, laboratory data quality and all associated documentation. External audits are performed by the WMS QA Officer for each sampling entity, including DEP ROCs, contracted agencies (NFWMD, SJRWMD and Alachua County), and agencies that collect data as part of collaborative agreements (SFWMD). External audits will be scheduled for each sampling entity every 9 - 18 months. During this time period, at least one audit for the Status and/or Trend ground water networks and at least one audit for the Status and/or Trend surface water networks will be conducted with each entity. Project Managers and/or the WMS QA Officer may choose to perform additional audits at their own discretion each year, which will also be considered external audits. Those agencies under contract with WMS (NFWMD, SJRWMD and Alachua County) are entitled to create individual internal audit schedules and may perform them at their own desired frequencies. See Section 14 of the [Status and Trend Monitoring Networks Sampling Manual](#) for more information.

All audits are conducted using a WMS standardized audit form to ensure consistency across all teams. Audits are concluded with a report that summarizes the overall performance. Deficiencies are noted, and corrective actions are established for each deficiency. In response, sampling personnel are required to submit a plan of corrective action report addressing each deficiency and how they intend to prevent future occurrences. All audit reports are distributed as stated: the original is given to the supervisor of the sampling personnel; copies are provided to each sampling personnel, DEP Project Manager, and the WMS QA Officer. Additional copies are provided as requested by interested parties (internal QA Officers, team leaders, EPA, etc.). See Section 9 of the [Watershed Monitoring Section Quality Manual](#).

D. DATA VALIDATION AND USABILITY

The WMS oversees data flow through the use of several platforms including: an Oracle database, Internet applications, MS Access Applications, and standard data transfer formats in dBASE and MS Excel. Collectively, these platforms are referred to as the Oracle Generalized Water Information System (OGWIS). Once the reconnaissance, field, and lab data are received by WMS, the data are loaded into OGWIS. The data are then considered provisional and must be reviewed by the WMS Project Manager prior to release to the general public. Data collected by contracted sampling agencies is also reviewed by the sampling agency's data manager. The provisional data are exported out of the Oracle database and a documentation file is created to enable efficient data review. The WMS Project Manager also reviews the station data for all projects in the provisional status for accuracy.

The documentation (metadata) file contains information on the completeness or lack thereof of the project data, and on the quality of these data. Problems with the project data may be listed in the comments section of the documentation file. All of the sample and blank data are exported so that they may be reviewed for accuracy.

Specific data correction requests are submitted to the WMS Data Manager on the form specified in the [Data Management Protocols for the Watershed Monitoring Section](#). Once the requested corrections are made, the Project Manager is notified and asked to look over the corrections one final time. If no errors are found the data are released.

Qualifiers are codes that flag irregular or questionable measurements. Samples may be qualified for a variety of reasons; these are described in the [Florida Administrative Code 62-160](#) Table 1. The codes shall be used by the DEP Laboratory and the WMS when reporting data values that either meet the specified description outlined in the table or do not meet the quality control criteria of the laboratory or WMS.

Statistical analyses of data allow WMS to determine if water resources are meeting thresholds for state and federal water quality indicators. The analyses used range from exploratory to higher level examinations. These analyses rely heavily on nonparametric statistics, which use ranking as a means to describe variance within the data. Preliminary screening allows the determination of data completeness and potential outliers. An analysis of maximum allowable concentrations of selected indicators based on a pass/fail categorization (a binomial distribution) is used.

The design of the monitoring network determines which statistical analyses are appropriate. The statistical analyses for the Status Monitoring Network are determined by the method of site selection, i.e., probabilistic, as opposed to the fixed-station design of the Trend Monitoring Network. The evaluation of the resulting data allows water quality differences to be determined within and among reporting units (zones). See [Monitoring Design Document for the Watershed Monitoring Section](#) for more information.

To ensure that useful goals are being met, the design of the Status and Trend Networks is periodically reviewed. This review guarantees that the networks monitor variables that are useful for assessing the health of an ecosystem, add new variables when necessary, and make any other

changes that would improve their operation. WMS reviews both the Status and Trend Monitoring Networks annually to make sure water quality monitoring needs are met.