

## **A. Project Management**

The goal of the Groundwater Management Section (GWMS) is to provide the Florida Department of Environmental Protection (DEP) with scientifically defensible information on the chemical, physical, and biological characteristics of Florida's aquifers, springs, and groundwater-influenced surface waters. This information provides the basis for advising the U.S. Environmental Protection Agency (EPA), relevant DEP programs, partner agencies, and the Governor and Legislature on the status of Florida's groundwater quality.

DEP's former Springs Section (now integrated into the GWMS) initiated the Springs Monitoring Network in 2002. The network consists of over 50 Floridan aquifer system karst springs, sampled quarterly to monthly by DEP and the four northern water management districts. The goal of the Springs Monitoring Network is to measure temporal changes in water quality to provide data needed for springs restoration.

Most of the field sampling projects undertaken by the GWMS are limited in scope and size, and are tied to total maximum daily load (TMDL) and basin management action plan (BMAP) development in areas where groundwater is an important contributor to surface water lakes and rivers. Examples of projects recently undertaken or currently under way include the following:

- A survey of potential pesticides in major springs.
- The installation and monitoring of experimental septic drainfields designed to further remove nitrate from effluent before it percolates into shallow aquifers.
- Lysimeter and well sampling of nutrients in areas of high septic tank usage to quantify regional septic inputs to groundwater compared with other nitrate sources.
- Chemical and biological assessments of springs and spring runs for the development of TMDLs.
- The monitoring of shallow groundwater at disposal sites to quantify nutrient impacts resulting from the land spreading of biosolids.
- Groundwater tracing studies.
- Seepage meter and radon flux measurements to estimate groundwater base flow into surface waters.
- Nitrogen and oxygen isotope sampling to provide nutrient source information.
- Groundwater tracing studies.

Data collection is accomplished through a collaborative effort involving section staff, an in-house DEP team located in Tallahassee (Tallahassee Regional Operations Center [ROC]), four DEP ROCs (Southwest, South, Central, and Southeast), private consultants, and on occasion the five Florida water management districts (Northwest Florida, Suwannee River, St. Johns River, Southwest Florida, and South Florida). See pages 6–9 and Appendix C of the *Quality Assurance Plan for the Groundwater Management Section – October 2015*, for a brief description of staff responsibilities and an organizational chart, respectively.

All employees directly involved in 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 by the Watershed Monitoring Section (WMS), and training is based on specific DEP Standard Operating Procedures (SOPs) as applied to the Status and Trend Network sampling programs, which follow nearly identical protocols to those used by GWMS field staff.

Furthermore, all samplers performing Habitat Assessment (HA) and Stream Condition Index (SCI) sampling are required to have specific training and demonstrate competency because they need to exercise expert judgment during field sampling. Individuals conducting an HA must train with qualified DEP staff (via workshops and participation in field sampling) and remain in "pass" status for field performance tests. GWMS field samplers conducting SCI sampling must train with qualified DEP staff (via workshops and participation 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 to perform an HA or SCI. GWMS sampling staff are also required to obtain training on Class I Watercraft and Trailering Operation and Safety, and to be DEP-certified for snorkeling/SCUBA diving. All GWMS sampling equipment must be consistent with FS 1001 and Tables FS 1000-1 through FS 1000-3 of the DEP field SOPs.

Sample documentation is of critical importance to the objectives of GWMS field projects. With the assistance of the WMS, data gathered on these projects are 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. The data must be accurate to avoid incorrect evaluations and decisions regarding the state's water resources. All GWMS documentation requirements are based on the DEP SOPs, and record-keeping practices are consistent with Subsections 62-160.240(1) and 62-160.340(1), Florida Administrative Code (F.A.C.), and FD 1000 of the DEP SOPs. All records must be retained for at least five years after the completion of the project.

Sample documentation begins in the DEP Central Chemistry and Biology Laboratories. 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. For existing spring stations, the WMS provides the GWMS with station identification labels that are barcoded to uniquely identify a sample station. The field technicians place these labels on the sample containers and also on the custody sheet. This links the station to the containers and to the custody sheet.

All field documentation is recorded on appropriate field sheets developed by the GWMS (see Figures 3a and 3b on pages 39–40 of the *Quality Assurance Plan for the Groundwater Management Section – October 2015*). Samplers must 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 obliterating 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 must be legible.

All documentation requirements for initial activities performed by the Central Laboratory (container preparation, supplying sampling kits, RQ information, etc.) are generated, retained, and stored internally by appropriate lab staff and within the DEP laboratory information management system (LIMS).

All documentation for sampling procedures (sampling manuals) is generated, retained, and stored electronically by the WMS quality assurance officer (QAO). All documentation requirements produced by field sampling staff are retained and stored by the respective project manager. All documentation regarding data management and review is generated, retained, and stored electronically by the data manager.

The GWMS generates several types of documentation and reports, listed below. Reports to management are consistent with the procedures outlined in FA 3250 of the DEP field SOPs:

- *Quality Assurance Plan for the Groundwater Management Section – October 2015:*
  - o Spring sampling inventory list (Figure 2).
  - o Spring sampling field sheets (Figure 3a).
  - o Surface water sampling field sheets (Figure 3b).
  - o Calibration log (Figure 4).
  - o Springs micro land use form (Figure 6).
  - o Custody sheet (Figure 7).
  - o Field reference sample reporting form (Figure 8).
  - o Field audit form (Figure 9).
  - o Labels (provided by the WMS for springs).
  - o Equipment and maintenance log sheets (Appendix F).
- *Monitoring Design Document* (Springs Monitoring Network).

- Data management and analysis SOPs.
- Reports:
  - o QA reports.
  - o Integrated report to the EPA to meet Section 305(b) Clean Water Act requirements.
  - o Report on the Integrated Florida Monitoring Strategy to meet Section 106 reporting requirements to the EPA.
  - o Quality Assurance Project Plan (QAPP) elements in support of DEP monitoring activities conducted under Sections 104(b)(3), 303(d), 305(b), and 604 of the Clean Water Act as amended.

The Data Quality Objectives (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 DQOs 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 (see Appendix A of the *Quality Assurance Plan for the Groundwater Management Section – October 2015*).

## **B. Data Generation and Acquisition**

For the fixed Springs Monitoring Network, GWMS and Tallahassee ROC staff collect samples from 16 first and second magnitude springs on a quarterly basis. These data are used along with quarterly to monthly samples collected from other major springs by the Northwest, Suwannee River, St. Johns and Southwest Florida Water Management Districts, totaling over 50 springs. Samples are analyzed by the DEP lab and other private National Environmental Laboratory Accreditation Program (NELAP)–certified labs. GWMS staff periodically incorporate all of these results into one database, currently accessible through the WMS Generalized Well Information System (GWIS) Database.

For special projects, a work plan is developed to lay out specific monitoring goals necessary to answer the question(s) under consideration. The work plan specifies sampling sites, who will be responsible for field work, analytes needed, sampling frequency, any special equipment and/or training needs, and project duration. The installation of monitoring wells, soil moisture lysimeters, and dedicated sampling tubing, and the deployment of onsite continuous monitoring equipment, are also covered.

The DEP lab provides the containers used for the collection and analysis of all water quality samples (except for isotope analyses). GWMS 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, the analytes of interest, and the sampling procedure. Equipment materials, such as pumps, tubing, filters and sample containers that come into direct contact with actual samples, must not react with or affect the sampled analytes, to ensure data quality is not compromised. Table B-1 (page 20) in the *Quality Assurance Plan for the Groundwater Management Section – October 2015* lists the appropriate containers, maximum holding times, and sample preparation for the most commonly collected analytes.

After collection, sample containers are preserved as necessary, bagged, and submerged in wet ice in a cooler in preparation for delivery to the lab. GWMS custody sheets must be used for all sample submittals. 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.

GWMS uses specific instruments to collect field measurements such as pH, temperature, conductivity, dissolved oxygen (DO), and turbidity. These instruments are properly calibrated on a routine basis (daily for field multimeters) to ensure accuracy and precision. Furthermore, all instruments and equipment are maintained and repaired (including preventative maintenance) routinely.

All field sampling measurements must be bracketed between acceptable meter calibration/verification results, at no more than 24-hour intervals. For pH, calibrated meters must read within  $\pm 0.2$  standard units (SU) of the actual buffer values. For specific conductance, calibrated meters must read within  $\pm 5\%$  of the standard. DO calibration is considered acceptable if it reads within  $\pm 0.3$  milligrams per liter (mg/L) of DO (see Figure 4, GWMS Calibration Log, in *Quality Assurance Plan for the Groundwater Management Section – October 2015*). Temperature measurements should agree within  $\pm 0.5^\circ\text{C}$  of a National Institute of Standards and Technology (NIST)–traceable thermometer.

Records of each meter calibration and calibration checks are maintained in a calibration logbook. Each calibration and verification must be directly linked to affected samples (the project name and/or applicable sample sites must be listed on the calibration record). Supplies and consumables for field testing must adhere to the requirements set forth in the FT1000 series of the DEP [SOPs for Field Activities](#). This includes following the stated expiration dates for all standards and buffers. All GWMS samplers are encouraged to use an inventory checklist for all sampling supplies and equipment needed.

The GWMS uses quality control (QC) measures to ensure that high-quality data are being collected and analyzed. The QC procedures are consistent with the DEP SOPs. Sampling staff collect and submit three types of blanks (field blanks, precleaned equipment blanks, and field-cleaned equipment blanks) to the DEP Central 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. Blanks are

collected using analyte-free (de-ionized) water and are collected in the same manner as actual samples. The GWMS QAO reviews the blank results. Any significant or reoccurring detection requires sampling staff to investigate possible contamination sources and initiate corrective actions accordingly.

Most samples are analyzed at the DEP Bureau of Laboratories. The DEP lab consistently scores high, compared with other environmental labs in the nation, based on performance reviews by the U.S. Geological Survey (USGS) and EPA. It is certified under NELAP by the Florida Department of Health (FDOH) for most of the analytes requested by the GWMS. Table D-2 (page 24) of the *Quality Assurance Plan for the Groundwater Management Section – October 2015* lists the most commonly sampled indicators and the corresponding analytical methods.

The management of data and metadata generated by the GWMS encompasses the use of geographic information system (GIS) software, an Oracle database, and several in-house software applications.

### **C. Assessment and Oversight**

The GWMS conducts external audits designed to evaluate field sampling protocols, laboratory data quality and all associated documentation. External audits are performed at least annually by the GWMS QAO for section sampling teams and staff. All audits are conducted using a GWMS standardized audit form to ensure consistency across all teams (Figure 9, pages 46–50, *Quality Assurance Plan for the Groundwater Management Section – October 2015*). Audits are concluded with a report that summarizes overall performance. Deficiencies are noted, and corrective actions are established for each deficiency.

Additional reports generated by the WMS include a QAPP in support of DEP monitoring activities conducted under Sections 104(b)(3), 303(d), 305(b), and 604 of the Clean Water Act as amended.

### **D. Data Validation and Usability**

GWMS staff work with the WMS to help oversee data flow from specific monitoring projects through the use of several platforms, including an Oracle database, Internet applications, Microsoft Access Applications, and standard data transfer formats in dBASE and Microsoft Excel. Collectively, these platforms are referred to as the Oracle Generalized Water Information System (OGWIS). Once the WMS receives the field and lab data, they are loaded into OGWIS. The data are then considered provisional and must be reviewed by the data generators prior to release to the general public. The provisional data are exported from the Oracle database, and a documentation file is created to enable efficient data review. These files—including the documentation file and various exports of the results file—are returned to the data generators for their review. The DEP project manager reviews the station data for all projects with provisional status for accuracy.

The documentation 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 to be reviewed for accuracy.

Specific data correction requests are submitted to the DEP project manager on the form provided in the [Data Management Protocols for the WMS](#). Once DEP staff make the requested corrections, the data generators are notified and asked to look over the corrections one final time. Additionally, any problems identified with the data are documented in the project comments dialog box by the DEP project manager at this 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 Table 1 of [Rule 62-160, F.A.C.](#) The DEP lab and the GWMS must use these codes when reporting data values that either meet the specified description outlined in the table or do not meet the QC criteria of the lab or GWMS.

To ensure that useful goals are being met, the design of the Springs Monitoring Network is periodically reviewed. This review guarantees that the network monitors variables that are critical for assessing the health of springs ecosystems. Analytes may be added or removed as necessary, as well as any other changes made to improve the usefulness of the network. Similarly, the results from special project sampling are constantly reviewed, and changes are sometimes made to analytes, sampling frequency, location, and duration to obtain needed groundwater information.