Quality Assurance Plan for the Groundwater Management Section

Water Quality Evaluation and TMDL Program
Division of Environmental Assessment and Restoration
Florida Department of Environmental Protection

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Signature Page

The undersigned have read and understood this Quality Assurance Plan, are charged with managing and improving the quality system, and are responsible for ensuring that all staff properly execute the procedures discussed in the plan.

Erin Ravnaas — 08/25/17

[Water Quality Evaluation and TMDL Program Administrator] **Date**

8/25/17

[Groundwater Management Section Administrator] **Date**

8/23/2017

[Groundwater Management Section QA Officer] **Date**

NOTE: This Quality Assurance Plan supersedes the document *Quality Plan for Ground Water Protection and Springs Initiative Sections,* dated June 2010. It has been revised to reflect the Florida Department of Environmental Protection's internal reorganization that eliminated the Springs Initiative Section and consolidated the responsibilities of both former sections into the present Groundwater Management Section.

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Introduction

The Florida Department of Environmental Protection (DEP) Quality Assurance (QA) Program involves the implementation of a management system (planning, review, training, and assessment) to ensure that data collection, generation, interpretation, reporting, evaluation, and archiving are of sufficient quality to support DEP decisions. One aspect of our program is to ensure that DEP QA activities are carried out according to commitments made to the U.S. Environmental Protection Agency (EPA), as enumerated in the DEP Quality Management Plan (QMP) (Revision 7; February, 2014) and as authorized in Section 403.0623, Florida Statutes (F.S.), and Chapter 62-160, Florida Administrative Code (F.A.C.) (the DEP QA Rule). These obligations and requirements are detailed in the DEP QA Directive (November, 2016).

To execute the components of the DEP QA Directive, the Groundwater Management Section (GWMS) has developed this QA protocol document, which describes the steps we take to ensure the scientific and legal defensibility of the environmental data we generate or use. It details the process of planning, training, execution, assessment, and corrective action we undertake to ensure that environmental data meet our established quality criteria.

Overview of Our Quality Plan

Our Quality Plan explains both the process and criteria by which the quality system is managed. The plan is used as an instrument of internal communication to inform our staff of current and future QA activities. It discusses how specific QA duties are assigned to responsible staff. We will revise our Quality Plan as needed, and pledge to ensure the consistent application of procedures and criteria for the generation or use of our environmental data. The Quality Plan will be used as a training document for new staff and as a reference for experienced staff. The plan and its revisions also serve as an archival record of our formal quality protocol.

The elements of our plan are consistent with the DEP Quality Management Plan (QMP), Quality Assurance Directive and Quality Assurance Rule (Rule 62-160, F.A.C.). In addition, we ensure that our plan for all sampling activities, including field meter testing, is consistent with DEP Standard Operating Procedure (SOP) FA 1000, Subpart FA 3300. Our plan addresses all activities associated with sampling, field testing, lab analysis, and data review of any type, including those activities associated with database construction and management. Our plan also discusses how decisions about data use are made based on data quality assessments.

Where appropriate, we cite existing internal and external documents, including training manuals, guidance documents, SOPs, rules, and tables.

We expect all staff to understand and follow the procedures and criteria as discussed in this plan, and to carry out their assigned responsibilities for the effective use of our quality system.

Policy Statement

Our unit's policies are as follows:

- Use the best available data for our decisions affecting the protection of the environment.
- Have and implement the Quality System described in this document.
- Adaptively manage our Quality System to be consistent with the provisions of the DEP QMP.
- Ensure that each individual is properly trained to execute his or her assigned functions.
- Implement procedures to evaluate the quality of the data we use and to implement corrective actions when data do not meet our Data Quality Objectives (DQOs).
- Periodically audit the performance and record-keeping practices of GWMS data generators.
- Implement QA procedures for the management of our data repositories.
- Perform a yearly systematic assessment of our QA activities, including any corrective actions, with the findings submitted to the Standards and Assessment Section.

Ethics

All DEP employees are held to high professional ethical standards. All employees are required to read, understand and sign an "Ethics Statement" attesting to their commitment to honesty and integrity in the performance of their duties. In addition, all employees are required to attend an annual ethics training class. Improper, unethical, or illegal actions will be dealt with according to the published DEP Administrative Directives.

Organization and Responsibilities

The GWMS resides within the Water Quality Evaluation and Total Maximum Daily Load (TMDL) Program of the Division of Environmental Assessment and Restoration. The GWMS is responsible for conducting statewide, basin-scale, and detailed assessments of groundwater quality, focusing on groundwater as a potable water resource as well as a source of base flow to streams, lakes, and estuaries. The GWMS also is responsible for data management (water quality and discharge data), QA and the assessment of data from the Springs Monitoring Network, and special GWMS monitoring projects. The GWMS collects springs data from various agencies,

analyzes the data, and produces reports to support other program and division needs. The GWMS also plays an integral role in assessing springs for TMDL development and basin management action plan (BMAP) reports, meetings, and other related activities.

The objectives of the GWMS are accomplished by analyzing acquired groundwater, springs, and surface water data stored in various DEP databases, conducting field data collection, reviewing available information with geographic information system (GIS) maps of soil and land use data, performing analyses of base flow, and formulating findings into reports. Groundwater, springs, and surface water quality data in DEP databases are acquired from a variety of sources, including the Florida STORET Database via the Watershed Assessment Section's Impaired Surface Waters Rule (IWR) Retrieval Tool, the Groundwater Information System (GWIS) Database via the GWMS Hydroport Retrieval and QA Tool, the National Water Information System (NWIS) Database provided by the U.S. Geological Survey (USGS), and the Groundwater Management Section's Springs Water Quality Database, which consists of various DEP and outside agency databases, including the water management districts.

DEP has developed an integrated water quality data system, the Watershed Information Network (WIN). WIN is the DEP repository for reporting and managing environmental quality data from non-regulatory databases or data sources from a range of data providers across the State of Florida. WIN replaces Florida STORET as an active data repository. WIN data, together with Florida STORET data, are used for a range of purposes, including but not limited to Impaired Waters Rule assessments, development of Total Maximum Daily Loads, Basin Management Action Plans, Strategic Monitoring Plans, and criteria development, including Site Specific Alternative Criteria (SSAC). Data providers to WIN and users of those data include federal, DEP and other state agencies, local agencies, academic institutions, volunteer organizations, private laboratories, and others.

GWMS staff also conduct sampling to support special groundwater/surface water interaction and springs projects. Field data collection for GWMS is conducted by section staff on surface water/groundwater interaction studies on a case-by-case basis. Surface water and shallow groundwater samples, as well as seepage readings, are collected from waterbodies to help characterize the basic chemistry and water quality of the waterbodies and quantify the loadings of constituents from groundwater to surface water.

GWMS staff members provide technical support to the Florida Department of Agriculture and Consumer Services (FDACS) by reviewing both new pesticide registrations and evaluating the efficacy of best management practices (BMPs). This cooperative interaction between FDACS and DEP serves to identify new pesticide products that have a potential for groundwater contamination, and to verify that the BMPs are protective for fertilization and pesticide applications. This is accomplished by reviewing and commenting on new pesticides that are being considered for registration and use in the state. BMP verification monitoring may be conducted after a BMP has been demonstrated to work on a small scale and has been implemented industrywide. Monitoring is conducted on a suite of agricultural sites selected as representative of the agricultural practice.

The GWMS is responsible for the monitoring of Florida's springs for water quality, discharge, and biological conditions using appropriate assessment tools, in coordination with section staff, other DEP staff, and contractors. The section carries out its monitoring responsibilities by reviewing the monitoring design, including analytes and selected stations, analyzing biological data from DEP databases, and managing contracts for various springs-related projects and sampling activities. GWMS staff are responsible for overseeing the quarterly monitoring network, including the scheduling and QA monitoring of samplers. Field data from springs are collected by section staff, other DEP staff, and contractors for spring conduit and surface water quality, quantity, and biota to assess the overall health of springs.

GWMS staff manage the quarterly collection of water quality and discharge data from a monitoring network of first magnitude springs, associated conduits, and several significant second magnitude springs. Water quality sampling for the quarterly network is performed by GWMS and water management district staff, in support of a long-term assessment of the health of these springs. GWMS staff members manage special projects associated with the collection and assessment of biological monitoring data, mostly for TMDL development. GWMS biological monitoring data are kept in the DEP Statewide Biological (SBIO) Database and can be accessed by contacting Devan Cobb (devan.r.cobb@dep.state.fl.us).

The Quality Assurance Officer (QAO) for the GWMS is Gary Maddox (gary.maddox@dep.state.fl.us). The Section QAO coordinates and participates in the quality evaluation of program data and provides oversight to ensure that staff perform their QA functions. The QAO may delegate some responsibilities to properly trained and qualified staff, when appropriate. The QAO conducts systems audits of the springs' data generators (field) and conducts sampling performance audits. The QAO also ensures that corrective actions are implemented for data nonconformance incidents as determined by the evaluation of the data against our program's DQOs. Additionally, the QAO assists program managers in the development of the Quality System and other logistical aspects of its implementation, such as coordinating associated training needs. The QAO documents all program QA activities, including training, audits, and corrective actions and provides this information to the DEP Standards and Assessment Section when necessary.

Our program staff routinely carry out duties involving data collection, data usability evaluation, data interpretation, and the generation of DEP work products in a manner that ensures scientific defensibility and adherence to DEP rules and policies. GWMS staff members are encouraged to provide feedback to the QAO for improving the quality system of our programs.

Staff members evaluate data using program DQOs and Data Quality Indicators (DQIs) and implement corrective actions as directed by the QAOs. **Appendix A** contains a list of our DQOs and DQIs.

Specific staff members and their QA functions are as follows:

- **Debra Harrington** acts as liaison with other units, data providers, data consumers, or other external parties concerning QA matters for the GWMS. She supervises the data QA process for the springs quarterly sampling and reviews the blank reports. When necessary she audits the samplers' activities and laboratory practices for any relationship to contamination found in blanks. She supervises database management for a large collection of springs data, conducts routine inspections of data, and coordinates corrections with data providers for both DEP and outside agencies. She analyzes data for various assessment projects and produces technical reports. She answers public or external technical inquiries about data interpretation, approved procedures, suspected QA problems, and site-specific issues, etc. She reviews and evaluates springs quarterly sampling data for errors and compliance with standards after it has been submitted by the samplers and the laboratory and before it is released to the public with the Springs Data Review Checklist (**Appendix B**). She manages a large collection of springs data and facilitates periodic updates from data providers throughout the state. She maintains the GWMS Hydroport Retrieval Tool software application and related Oracle tables.

- **Gary Maddox** coordinates GWMS springs and groundwater quality monitoring efforts, creates and maintains the section sampling schedule, and works with DEP laboratory staff to schedule project-appropriate analytes and the assembly of sampling field kits through laboratory information management system (LIMS) software. He tracks and organizes analytical results received from the DEP laboratory and passes along these results to the appropriate DEP staff. As Section QAO, he schedules project-specific QA samples and conducts field audits of GWMS sampling staff.

- **Richard Hicks**, who manages the GWMS, ensures that this quality system is fully operational within our program, designates our QAO, and provides general oversight. He evaluates the DQOs and DQIs described above to ensure they meet our program's needs and periodically evaluates the effectiveness of staff data quality activities, including reviewing audit results. He evaluates corrective action policies and procedures to be implemented when data do not meet program DQOs. He discusses audit results with the QAOs, reviews the annual QA Report to the Secretary, and discusses findings with the QAOs.

The GWMS organizational chart depicted in **Appendix C** shows the chain-of-command relationship among section staff.

Training

All staff are properly trained to perform their duties. Supervisors periodically assess staff performance to ensure that it conforms to the policies and procedures of the GWMS. Staff members also go through yearly training on DEP ethics and standards.

DEP holds training sessions on implementing the field SOPs of the agency, proper laboratory practices, auditing, and data evaluation and assessment. These training sessions are offered to in-house staff and contractors. All employees directly involved in sample collection activities 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 SOPs as applied to the Status and Trend Network sampling programs.

All samplers, including DEP and non-DEP, who collect data for the GWMS or any groundwater and springs related network and/or projects must undergo training to ensure that the data are collected using DEP-approved general SOPs (FS 1000 and FS 2000) and groundwater and surface water–specific SOPs (FS 2200 and FS 2100, respectively). The current versions of these DEP SOPs are available online.

For sampling for biological communities, samplers must be specifically trained by expert DEP staff and pass field testing in order to perform the procedures based on DEP SOPs (FS 7000 LD 7000, and LQ 7000) and follow all QA procedures. Sampling staff are also required to obtain training on collecting standard global positioning system (GPS) locational data for DEP, Class I Watercraft and Trailer Operation, and Safety Training. DEP snorkeling and/or SCUBA diving certifications are required of staff who perform these tasks as a part of normal field work. A list of all sampling staff and their respective training is maintained internally within the GWMS.

Sample collection must comply with sampling procedures identified in the QA Rule, Rule 62-160, F.A.C. The QA Rule requires laboratory certification for all data provided to DEP (Rule 62-160.300, F.A.C.). The laboratory certification must be from the Florida Department of Health Environmental Laboratory Certification Program (FDOH ELCP). The FDOH ELCP is recognized by the National Environmental Laboratory Accreditation Program (NELAP) as a NELAP accrediting authority, and therefore requires adherence with National Environmental Laboratory Accreditation Conference (NELAC) standards.

Sampling Design and Procedures

The Florida Springs Initiative Water Quality Monitoring Network is a fixed station network consisting of over 50 discrete sampling locations that are sampled quarterly by the GWMS and water management districts. Spring water quality samples are collected from vents, as well as from some subaquatic conduits. The GWMS has created a QA document for this work that consolidates all relevant water quality sampling information for the convenience of the samplers and the QAO (**Appendix D**).

The data collected for the biological assessment of springs may include algal growth potential, periphyton, chlorophyll-*a*, various bacteria, sediment percent organics and particle size, and Stream Condition Index. Other biological surveys conducted may include, but are not limited to, the Qualitative Periphyton Survey (DEP SOP 7120), Quantitative Periphyton Survey (DEP SOP 7110), Rapid Periphyton Survey (DEP 7130), and Linear Vegetation Survey.

Water quality data collected in association with biological data follow DEP SOP FS 2100 and vary depending on the project. They may include the following:

- Total organic carbon (TOC).
- Nutrients (nitrate + nitrite [NO_3+NO_2], ammonia [NH_3], total Kjeldahl nitrogen [TKN], and phosphorus [P]).
- Cation (calcium [Ca], potassium [K], sodium [Na], magnesium [Mg], aluminum [Al], arsenic [As], cadmium [Cd], chromium [Cr], copper [Cu], iron [Fe], lead [Pb], magnesium [Mn], and zinc [Zn]).
- Anion (chloride [Cl], sulfate [SO_4], and fluoride [F]).
- General parameters (alkalinity, color, total dissolved solids [TDS], specific conductance, and turbidity).

In addition to the statewide program conducted by the WMS, the GWMS conducts a variety of special projects. These include groundwater/surface water interaction and tracer studies, septic system studies, land-applied waste application projects, spring nutrient and loading determinations, real-time instrumentation of spring discharge and well and spring water quality, spring and base flow determinations, and TMDL data collection. These projects include sample collection by GWMS staff as well as contractors with site-specific QA project plans associated with them that also conform to EPA requirements in form and content and follow all the DEP SOPs and sampling manuals.

For most GWMS sampling projects involving nutrient analyses, groundwater samples for nitrogen and oxygen isotopes are collected. Nitrogen and oxygen isotopic signatures help to determine inorganic vs. organic nitrate sources, and are only submitted for analysis from sites that show elevated nitrate + nitrite concentrations. Samples are stored frozen and periodically shipped out to a private lab for isotopic analysis. **Appendix F** contains information on the nitrogen and oxygen isotope sampling protocols used by the GWMS.

The number of samples taken for general water quality varies depending on the project focus. However, there is typically one bottled (opaque, plastic, or glass, depending on the analyte of concern) sample taken for each of the following per well, spring, and/or lake/stream: TOC, chlorophyll, nutrients (NO_3+NO_2, NH_3, TKN, P), cation (Ca, K, Na, Mg, Al, As, Cd, Cr, Cu, Fe, Pb, Mn, Zn), anion (Cl, SO_4, F), and general parameters (alkalinity, color, TDS, specific conductance, turbidity); and two samples per well, spring, and/or lake/stream for various bacteria. The maximum holding times of analytes, detailed container description, sample preparation, and methodology information are shown in DEP SOP-001/01, FS 1000 - General Sampling Procedures, Table FS 1000-4.

Sampling staff collect and submit three types of 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. All blanks are collected using analyte-free (de-ionized) water and are collected in the same manner as actual samples. The DEP Central Laboratory also supplies Field Reference Samples/Standards (FRS) to sampling staff for measurements of pH and specific conductance to ensure that field meters remain in calibration mode throughout a sampling day.

Data Review

The GWMS acquires data from other DEP program areas and other agencies to assist in the implementation of groundwater assessments and projects, as well as groundwater regulatory activities. The types of data needed or used from these sources by the GWMS include existing and historical surface water, groundwater, and springs data; current and historical flow data; GPS latitude/longitude measurements; and results from groundwater seepage and flow model studies. DEP data are reviewed, edited, and certified as being ready for general release before being uploaded to the DEP Oracle Database. Therefore, acquired in-house groundwater and surface water DEP data are not taken through an acceptance/rejection process by GWMS staff but by other DEP staff (Laboratory and WMS staff), as outlined in the *Quality Manual for State of Florida Department of Environmental Protection Laboratory* and the *Generalized Water Information System (GWIS) Database Utilities User's Manual* of the WMS, which identifies the provisional data review, data correction, and certification of data before uploading it to internal databases.

Springs quarterly water quality monitoring data are reviewed by Data Assessment and Statistics staff in the GWMS (specifically, Debra Harrington) before they are released to the public. The QA inspection of the springs data from the Springs Initiative Monitoring Network is conducted according to the *Springs Data Management Protocols* document provided and includes data review, data correction, and certification of data before they are uploaded to internal databases. The Springs Data Management Protocols are used for this evaluation (**Appendix B**). Springs biological monitoring data are currently reviewed by Biology Section staff.

Data acquired from the USGS and the water management districts are taken "as is" without alteration. However, correction reports are sent to the data providers when necessary, and stations and/or results data with known errors are not used in assessments. Data collected by GWMS contractors are in compliance with all DEP SOPs and do not go through a routine acceptance criteria assessment. However, Data Assessment and Statistics staff in the GWMS (Debra Harrington) screen data for anomalies, outliers, and questionable results using range of values, as well as consistency between similar parameters and missing values, along with the field and lab result comments. Data that have been qualified with Code "F" (failed to meet established field quality control criteria for precision or accuracy) or Code "V" (analyte was detected in both sample and associated blanks, at similar concentrations) are automatically excluded. Based on the number of samples that remain after data screening, data are evaluated as to whether the level of uncertainty is acceptable for the particular project for which the data have been acquired. A disclaimer is attached when these data are transmitted to other users, with the qualifiers listed and identified.

Documentation

DEP has specific record keeping and reporting requirements for both field and laboratory procedures, as codified in the QA Rule (Rule 62-160.240 and Rule 62-160.340, F.A.C. Further detail on field operation record keeping and reporting tasks is specified in DEP SOP FD 1000, such as recording all field documentation on appropriate field sheets (field readings, instrument calibrations, sample preservation techniques, and equipment cleaning logs), using waterproof ink for all paper documentation, making corrections by a single line mark through for errors with initials of staff, the retention of original raw data, the use of electronic software, and equipment maintenance. The laboratory documentation procedures must be consistent with NELAC requirements and are specified in DEP SOP LD 1000, which points out the documentation needs for laboratory sample log-in records, sample identification requirements (site, sample type, STORET station number, date collected, and identification of samplers), and data entry into the DEP master laboratory database. All data records specified in the field and laboratory rules and regulations must be retained for a period of no less than five years after the completion of the project. **Appendix E** contains examples of GWMS equipment and maintenance log sheets.

Contract Management

Our program ensures that DEP contracts that we administer are properly managed to ensure appropriate data quality. The project manager of each contract ensures that all sampling and analyses performed conforms to the requirements set forth in Chapter 62-160, F.A.C., and DEP QA-002/02 - Requirements for Field and Analytical Work performed for the Department of Environmental Protection under Contract. As such, the project manager reviews the sampling and analysis plan or QA project plan submitted by the contractor to ensure that the scope and purpose of the contract are clear and that DQOs and acceptable data quality are defined. The project manager will also assure that all contractors use DEP SOPs for field analysis (and cite them) or submit for review and approval copies of any nonstandard field procedures to be used, as well as making sure that an FDOH-certified NELAC laboratory is used.

Audits and Corrective Actions

Audits provide objective feedback concerning the effectiveness of our program's quality system and may identify areas in need of improvement. Therefore, our unit performs the following activities:

- Conducts audits and compiles audit reports:
    - For springs quarterly water quality sampling, the QAO performs four field and documentation audits per year (quarterly). Figure 8 shows the field audit form.
    - For GWMS contracts, the GWMS QAO (or designated staff) performs one audit per contract.

  - For internal GWMS sampling projects, the GWMS QAO (or designated staff) performs audits on an as-needed basis.

- Handles complaints and other reports received from data users and the public concerning data quality:

  - The QAO officer or other designated staff carries out this function depending on the dataset.

- Devises and implements corrective actions for problems with procedures, data reviews, etc., after review by section administrators.

Report Compilation

To provide the Secretary with information on DEP's ongoing QA efforts, our unit describes and compiles the results of all appropriate QA activities, and relays it to the Standards and Assessment Section for an annual report.

Appendices

Appendix A: Data Quality Objectives for the Groundwater Management Section

The primary objectives of the GWMS are to obtain and use data that are representative of the quality and condition of groundwater resources, detect or predict the contamination of the state's groundwater resources, assess its potable use, determine groundwater contributions to surface water sources, and oversee the quarterly sampling of the Springs Monitoring Network. To meet these objectives, the following activities and requirements are needed:

- Sample collection procedures are designed so that the sample represents the characteristics of the source.

- To ensure data comparability, all sample collection is based on procedures outlined in the DEP SOPs applicable to groundwater (DEP SOP-001/01 FS 1000, FS 2000, and FS 2200), surface water (DEP SOP-001/01 FS 1000, FS 2000, and FS 2100), sediment (DEP SOP-001/01 FS 1000 and FS 4000), and biological communities (DEP SOP-001/01 FS 7420 and FS 3000), and only methods approved by the DEP Chemistry and Biology Laboratories may be used for analysis.

- The selected methods must be sensitive enough to detect a contaminant at a level below the state and federal maximum contaminant levels for the type of sample, and must meet the federally and state-mandated detection limits.

- The minimum quality controls as specified by the analytical methods, laboratory certification rules of FDOH, Chapter 64E-1, F.A.C., and/or the DEP QA Rule, as well as GWMS data checklists, will be used to assess the quality of the data and if they fit the purpose for which they were intended.

Appendix B: Springs Data Management Protocols

GENERAL PROJECT INFORMATION

1. REVIEW OF JOB NAMES AND PROJECT NAMES

The project name, job name, and request for quote (RQ) are compared with the field custody sheet and the LIMS reports. All job names are reviewed to make sure they are assigned to the proper project.

BLANK SUMMARY REPORT

2. RETRIEVAL OF BLANK CONCENTRATIONS

The blanks collected as part of the project are reviewed in ADM application to ensure that the proper number and type were collected, as are any blanks with a positive result (hit). Turbidity values are taken into account, and if turbidity values are 0.10 or less, the hits are considered less significant for reporting purposes.

A blank report is generated, and any hits are compared with sample results. The sample results are qualified where necessary. If the blank is greater than the method detection limit (>MDL), then the hit is not qualified. If the blank is >MDL but less than the practical quantitation limit (<PQL), it should be qualified with an "I" in QUALIFIER. If it does not have an "I," then it needs to be reported and qualified. If the blank is >PQL, then all the associated samples should be qualified with a "V" in QUALIFIER regardless of the concentration. If it does not already have a "V," then each instance needs to be reported with a request to have the sample(s) qualified with a "V." Any sample that is below detection with a "U" qualifier does not get an additional "V" qualifier. Method blank hits are an exception to the above. The lab will already have a "V" qualifier for the blank, and the associated samples should also have a "V." This is regardless of whether the value exceeds the PQL.

The lab comments are reviewed for those samples with an "I" and "V" qualifier. The lab comment should say that the result was confirmed. Whenever a sample or blank has had problems in the lab and is qualified, it may be necessary to obtain more information from the Nonconformance Lab Report. Retrieve any associated Nonconformance Lab Report from the WQETP\Library\GWMS LIMS Raw Data directory. Review the items and comments.

The Blank Summary Hit Report is shared with samplers, WMS data managers, DEP lab staff, and other pertinent DEP staff. The samplers are informed of any hits, and an audit may be scheduled to determine if sampling procedures, equipment, or other influences were the cause. Questions about the possible nature of contamination or about lab data should be directed to Colin Wright (colin.wright@dep.state.fl.us) and Tim Fitzpatrick (timothy.fitzpatrick@dep.state.fl.us). A request to WMS data managers is made to qualify the blank data when appropriate.

WATER QUALITY SAMPLE DATA – BLANK QUALIFIERS

3. RETRIEVAL OF RESULTS

The sample results are retrieved for the project under review by using ADM application. This file is then imported to ACCESS, where automated queries are used to check data. The blanks and samples are ordered by time/date for a project. The samples are bracketed between the initial blank hit and the next "clean" blank by collection dates. These dates are used to assign a "V" qualifier ("analyte detected in both sample and associated blank") if the sample(s) do not already have a "V" qualifier from the lab QA staff.

When the same parameter is a hit in more than one blank, use the highest concentration to compare with all the water quality sample data. When an analyte is present in E blank, evaluate water quality sample concentrations in all results for that project for that analyte.

FIELD AND LAB DATA QA

4. STATIONS CHECK

Look at the list of stations for this project compared with the master list of stations that should be sampled and the analyte count (expected number of observations [rows of data] for each station) (see spring from the Springs Master List).

Check the Contract Managers book for the information/letter sent over by samplers with the field sheets to see if they mention not sampling some stations for that particular project, and obtain a copy for your file. You should also have copies of the field sheets and calibration logs.

MISSING STATIONS COMMENT — Go to the ADM REVIEW tab and put in a PROJECT COMMENT for any stations not sampled for that project.

Use ADM to check the number of samples for this project. The number of samples scheduled includes 1 sample for each station and the blanks. The number of samples received will show "primary," "duplicate," and "blank." There shouldn't be many duplicates. Make sure there are enough blanks (there should be about 1 blank for every 5 samples).

MISSING STATIONS -– Using the master list of stations, do a query to compare the master list stations with individual project stations to make sure all the stations have been included in this project. Note any stations that seem to be missing in the project — did you already know that they weren't sampled from the information above? If not, then check the field sheets to see if there are any for that station and ask the samplers. Enter a MISSING STATIONS COMMENT for the project in ADM application. Also put in a PROJECT COMMENT for any stations not sampled as expected for that project.

5. PARAMETERS CHECK

Make sure that the SAMPLE_TYPE is listed as "primary" for each station with some stations having an additional "duplicate." Blanks should have "blank" as SAMPLE_TYPE. Any problems with SAMPLE_TYPE should be corrected before proceeding.

TOO MANY OR MISSING PARAMETERS — In ACCESS, do a Make Table query to export the sampling results for each station to an individual table. Compare the master list of parameters with the list of project parameters and note any that weren't sampled or where the count has too many parameters—each parameter should be sampled once, and 41 is the total number. When there is more than 1 result for a parameter, look to see if 1 is primary and 1 is a duplicate for SAMPLE_TYPE. Does the analyte count of expected parameters in the master list match those counts of analytes in the project? If not, then check the field sheets and ask the samplers or lab staff.

TRANSPARENCY (SECCHI) and STAGE — Some stations should not have values for these two parameters, and at times samplers will erroneously report a value. When this happens, request that values be removed and replace with a "NULL" for VALUE (do not use zero for value) and "O" value qualifier with the comment "Samplers did not take measurement." These edits are requested on a Data Correction sheet.

SAMPLE DEPTHS — Sometimes the samplers will report a sample depth that really is the length of tubing used. There is a list of stations that should never have a sample depth reported—a column for Sample Depth is listed in the Springs Master List. Request that the values be removed and request value qualifier "O" with the comment "Samplers did not take measurement" for each of these stations. If the Secchi depth equals the total depth (sample depth), then have an "L" comment added to the result. This can be done on one Data Correction sheet for all these stations.

STATIONS ALWAYS MISSING PARAMETERS — There is a maintained list of station and instructions for each parameter where there are never any measurements for sampled depth, Secchi depth, or stage. The sample results for these stations need to routinely have an "O" qualifier added.

6. FIELD SHEETS DATA CHECK

Review the field sheets and determine if any values appear to be unusual. Make sure any data qualifiers shown on the field sheets are listed with the sample data. Make sure any samplers' comments are included with both field and lab sample data. If there is a comment on the field sheet, then you need to request that it be added to all samples by using the PK SAMPLE number—this will put a comment in all field and lab data for that sampling event. Any comments that need to be added for a specific sample must be requested using the Data Correction sheet.

Where the field sheet says "YES" for QA/QC taken, this is where a blank was collected—check the date and time. Make sure the instrument was stabilized before collecting the final value.

CALIBRATION LOGS — Sort the field sheets by date. Check calibrations and calibration verification. Check for "P" (Pass) or "F" (Fail) on each sheet. Check calibration readings per the notes at the bottom of the field sheet. The relative percent difference (RPD) should be equal to or less than 20 %. If RPD > 20 %, then the result is considered an estimate. Request that an "F"

value qualifier be added and provide a statement explaining why data need to be qualified on a Data Correction sheet for any problems.

Check DO by using the solubility and temperature chart to get the expected DO value. The field DO should be within 0.3 milligrams per liter (mg/L) of the chart—round up to hundredths on chart and then round to tenth. The first reading can fail for DO–Conductance–pH and still be okay with subsequent readings. DO less than 1.0 mg/L is usually not within the RPD and gets an "F" qualifier, with the comment added, "DO did not come in 20 % of RPD."

pH is calibrated with a standard of 7 standard units (SU) and then verified with a standard of 10 SU. pH must be within 0.2 of the standard (e.g., for 7 the calibration must be between 6.8 and 7.2 SU). If the samples are not close to the calibration values of 7 to 10 SU, then the results should be qualified with an "F" qualifier if a post-calibration is not done at a lower standard of 4 SU.

There are different standards for specific conductance calibration. If the standard is 1000, the calibrated reading in the calibration sheet should be around 100 to 5000, and if the standard is 5000 to 10000, the calibrated reading should perhaps go up to 8000 or 9000. Compare the calibrated reading with the standard listed in the sheet. If the conductance calibrated reading is too low or too high, the sample result should be qualified with an "F" qualifier, and a comment added, such as, "Specific conductance is not properly bracketed."

LAB WATER QUALITY DATA CHECK

Review laboratory data and determine if any values appear to be unusual. Examples include values out of an expected range, incorrect units for a parameter, or value qualifiers that do not exist.

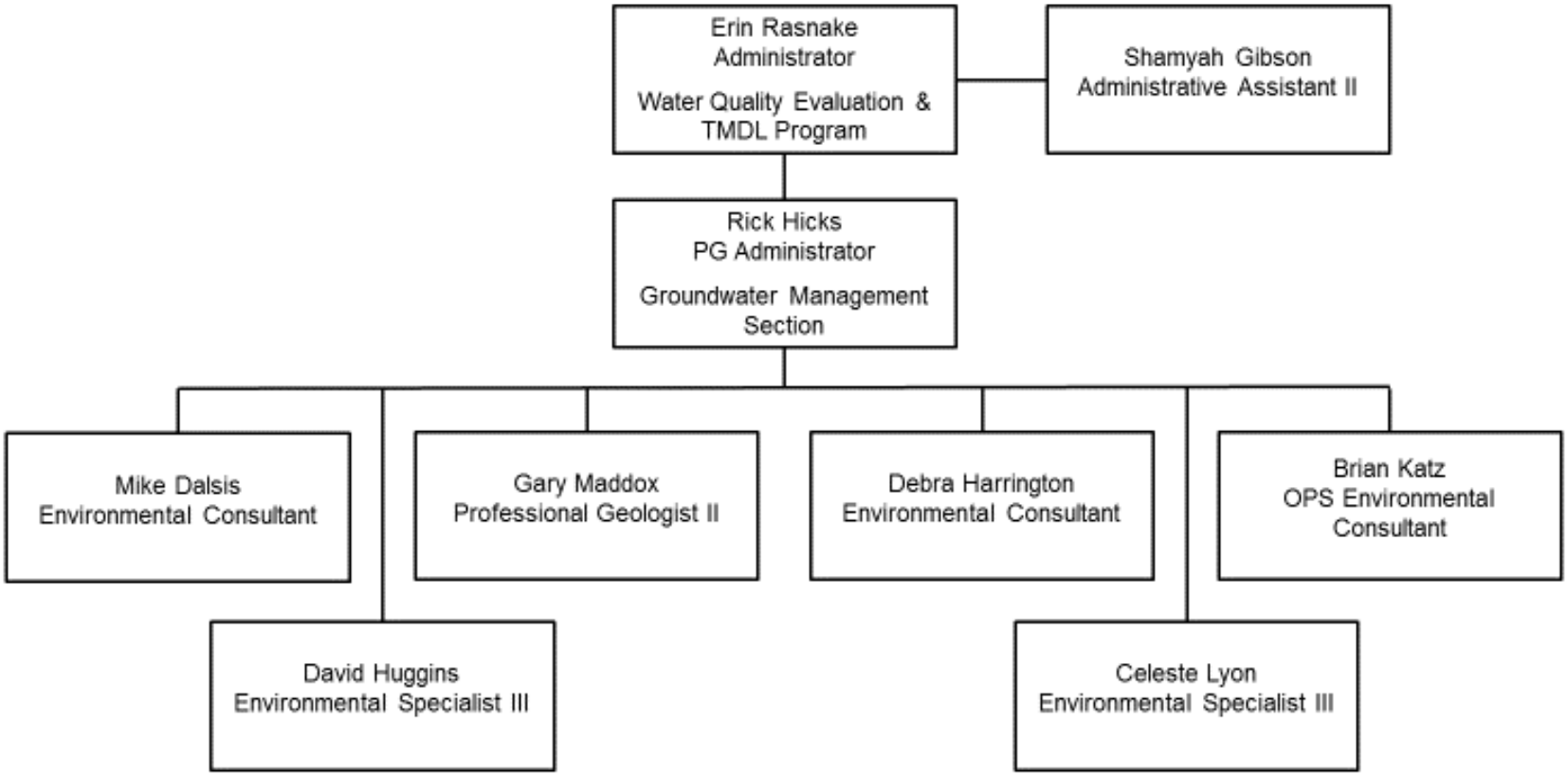
Check for missing data that do not have an "O" value qualifier and/or lab comments. Check the field sheets to see if samples were obtained and sent to the lab. Check with the lab to see if the samples were received and analyzed.

Any problems with lab data should be first checked for inclusion in Nonconformance reports and then discussed with lab staff, since they already have completed a rigorous QA check of their own. Data corrections may need to take place at the laboratory level with a Data Correction sheet going to WMS staff.

7. HOLDING TIMES

SAMPLING DATE–LAB ANALYZED DATE should be compared (there is a way to do this in ACCESS to obtain the total time elapsed between the two events). Where this elapsed time is over the holding limit for the parameter, a value qualifier should be added. All of the fecal coliform, total coliform, *Escherichia coli*, and *Enterococci* results may already have a "Q" qualifier if they all exceed the holding time due to shipping to the lab with a short holding time. There is a specific holding time for each parameter (DEP-SOP-001/01 FS 1000 General Sampling Procedures, Table FS1000-4). The value qualifiers that need to be added for holding time should be requested on a Data Correction sheet.

Appendix C: GWMS Organizational Chart



Appendix D: QA Plan for Springs Water Quality Sampling

BACKGROUND AND PURPOSE

As a part of the Springs Monitoring Network in Florida, water quality measurements are collected from selected springs throughout the state. There are two parts to this effort: a baseline measurement and ongoing monitoring. A one-time expanded list of inorganic and metal analytes at all selected springs provided information for the Florida Geological Survey "Springs of Florida" (FGS Bulletin 66) update. Quarterly monitoring using a basic list of analytes is carried out at select springs to provide a long-term investigation of the "health" of springs under state or federal ownership. Other analytes may be added to this list as deemed necessary.

The focus of this investigation is the quality of the water as it first enters the system, and thus, samples are collected at the "vent," where the discharge enters the system. Other water quality sampling efforts overseen by the DEP Biology Section focus on the biological health of the system by addressing the surface water component of the spring system, and are separate from this effort.

Field Sampling Requirements

During sampling, staff must adhere to the requirements set forth in Chapter 62-160, F.A.C., the document Requirements for Field and Analytical Work performed for DEP under Contract, dated April 15, 2002 (DEP QA-002/02), and this QA Plan. This document lists specific procedures for sampling at springs that may not be directly addressed in the document Standard Operating Procedures for Field Activities (DEP SOP-001/01, dated March 1, 2014). If a sampling agency wants to deviate from a standard procedure, the nonstandard procedure must be submitted for review and approval in accordance with FA 2000 of the DEP SOPs. The procedure must be approved by DEP before use.

Project Initiation

The GWMS field coordinator oversees the scheduling of water quality sampling events for springs. Sampling of some of the springs is based on low tide to measure the maximum freshwater output from the springs. Sampling will be coordinated with companion sampling projects, such as DEP biological monitoring or water management district sampling projects.

SAMPLE ANALYTES AND SAMPLE KITS

Figure 1 lists the analytes, containers, and sample preparation methods for the samples that are collected quarterly. Trace metals sampling is addressed in a later section. The sampling agency should inventory sample kits and supplies within a week of the sampling date to ensure all the necessary supplies are present. For samples analyzed by DEP, the DEP lab will send sampling kits to the agency one to two weeks before the scheduled sampling date. All paperwork and site labels will be included with the sample containers in the coolers shipped to the sampling agencies. Preservatives, filters, and reference samples are supplied by DEP and must be ordered in advance of the sampling date.

SAMPLE EQUIPMENT

Before going into the field, staff should check supplies and equipment to ensure everything needed for proper sampling is present and working. An inventory list, such as that shown in Figure 2, will aid in

this task. Field measurements are collected with appropriate instruments, as discussed below. Unfiltered water samples are collected directly into sample containers or by using a pump and tubing to immediately collect the water and transfer it to the sample containers. Pumps for springs sampling are usually low-rate pumps such as submersibles and various peristaltic pumps. These pumps are used because they are portable and high pumping rates are not needed, as the discharge of most springs eliminates the need for purging. Filtered samples are collected with a pump, tubing, and in-line 0.45-micron capsule filter. Collection methods using this equipment are further addressed in later sections. Maintain an equipment maintenance logbook in accordance with FD 3000 of the DEP SOPs.

Site Arrival

The spring vents are identified based on coordinates provided by DEP. Sampling staff need to verify the proper spring vent to be sampled. Make every effort to ensure that the field measurements and the water sample are collected from the same location in the vent during each sampling event. General information is entered into the springs sampling field sheet (Figure 3a). For spring run and other surface water sampling, the surface water sampling field sheet (Figure 3b) is used.

FIELD MEASUREMENTS

Collect the following field measurements:

- pH.
- DO.
- Specific conductance.
- Temperature.
- Secchi depth (where possible).
- Estimated sample depth.
- Stage (where available).
- Discharge (if required, collect where possible).

The next section addresses calibration of the instruments for pH, DO, specific conductance, and temperature measurements. Instrument operating instructions should be followed when taking measurements. Readings should be taken with instruments placed directly in the vent or placed in a contained flow chamber.

Secchi depth is collected where possible. If collected, it will be measured to 0.1 meter and in accordance with FT 1700 of the DEP SOPs. At a spring where the sampler is able to see to the bottom, the Secchi depth is the same as the deepest bottom depth measured. This measurement can be collected by dropping a Secchi disk to the bottom and recording the appropriate length shown on the line or measuring the deepest bottom depth with a portable depth sounder.

When a sampling agency provides such a Secchi depth value to DEP, it must be qualified with an "L," indicating that the actual value is known to be greater than the value given. The value qualifier "L" is used if the depth value could not be obtained because the water was not deeper than the Secchi depth, or if an obstruction prevented the actual depth from being measured. Obstructions may include flow from a constriction that stops the Secchi disk from sinking deep enough for an accurate reading, or vegetation that prevents samplers from viewing the Secchi disk. A comment of Secchi "Visible on Bottom" (VOB) and the "L" qualifier must be denoted if samplers can see the bottom. If a sampler is unable to see to the bottom, the Secchi depth will be the actual deepest depth to which the Secchi disk is visible, as specified by FT 1700.

Sample depth is required in STORET. Because this measurement at springs is not reproducible, it will be recorded as an estimated sample depth. Both field measurements and water samples are collected at the same estimated sample depth. Samplers will obtain the best possible measurement for this depth. A diver's depth gauge attached to the weighted sampling tubing, portable depth sounder, appropriately marked line, or steel tape can be used to measure the deepest depth where the end of the tubing has been placed. The depth must be measured to 0.1 meter.

Stage will be collected in feet where available. If a discharge measurement is required, it will be measured where possible in accordance with FT 1800 of the DEP SOPs. Documentation of the discharge will be as listed in Form FD 9000-11, Discharge Measurement Notes.

METERS

Instrument calibrations and checks must be performed in accordance with procedures listed in FT 1000 through FT 1500 of the DEP SOPs. Minimum calibration requirements are needed to ensure that an instrument is capable of producing quality data at the beginning of the analysis sequence, and that the initial calibration is still valid after continued system operation.

Minimum Calibration Requirements

See the equipment manufacturer's recommendations for specific calibration procedures as well as the DEP SOPs. Instruments measuring pH, specific conductance, and DO must be calibrated prior to collecting actual measurements each sampling day. Calibration only needs to be performed once during the day unless problems are encountered with an instrument. An instrument can be calibrated for pH, specific conductance, and DO in the field at the first sample site, and immediately verified by reading a standard or buffer as an actual sample (initial calibration verification) prior to collecting actual measurements. Continuing verification of the calibration must be made at no more than 24-hour intervals during use and at the end of use if the instrument will not be used within the next 24 hours.

If the instrument is calibrated for these parameters at the base of operations, perform initial calibration verification immediately following the calibration by reading a standard or buffer as an actual sample. Then the verification of the calibration must be carried out at the first sample site prior to use. A third verification of the calibration must be made at no more than a 24-hour interval during use and at the end of use if the instrument will not be used within the next 24 hours. Field readings must be chronologically bracketed between acceptable calibrations/ calibration verifications (see Figure 4 for acceptance criteria).

The concentrations of the standards used for calibration and verification must bracket the actual measured values (referred to as a quantitative bracket). For field conductivities less than 100 microSiemens (µS/cm), use a standard at or near 100, but a standard less than 100 µS/cm is not required.

Thermistors or thermometers do not allow for calibration. Check temperature sensors monthly against a National Institute of Standards and Technology (NIST)-traceable thermometer with varying temperatures that are expected to be seen in the field. Extreme temperatures, such as ice water and hot water, may be used because they will provide a temperature bracket for the instrument.

Documentation of Instrument Calibrations and Checks

Document the process of calibrating and checking field instruments in accordance with the procedures listed in FD 1000 of the DEP SOPs, using a calibration log (Figure 4). Record the make, model, and meter identification number of all meters in the calibration log. When a calibration is performed on an instrument, document the following: the meter name, model number, and identification number; method used to calibrate; time and date of calibration; standard(s) used; lot number and the expiration date of standards (information that is linkable to the standards and reagents logbook), resulting meter response; actions taken; the results of the calibration; and the name of the sampler performing the calibration.

Note any problems with the meters on the field sheet and in the calibration log. If a meter fails its calibration or is suspect in any way, it must be replaced with a backup meter. Adequately track the solutions used for calibrating and checking instruments. The sampling agency must ensure that no expired solutions are used. Log in all standards and buffers according to FD 1000.
Figure 5 shows an example of a standards and reagents logbook.

SAMPLE PREPARATION

Prior to sampling, inspect all containers in the sample kit to be sure the kit is complete and the bottles are all clean and labeled. ln the field, record the date and the time (in HHMM or military format) on the sample container label. Place the appropriate site bar code label vertically on each bottle. The bottles are now ready to be filled. Set the bottles aside in a clean area and out of the sun.

Set the wrapped filter, the nitric and sulfuric acid, and the pH litmus paper that will be used to check the acidification of the sample in a clean area away from sunlight.

Collection of Field Measurements

Collect field measurements by placing the instrument(s) in a flow chamber. Set up the flow chamber as a closed system so that the water in it has no contact with the atmosphere. Weight the pump intake line to hold it in position and place the line in the active spring discharge (vent). Make every effort to collect the measurements from the same location during each sampling event. The groundwater in the spring vent is the matrix being measured and should not be subjected to any potential influences by the surrounding surface water.

If sampling from a boat, make every effort to keep the boat in place and minimize the shifting of the field instrument(s) or tubing. Set the intake rate through the flow chamber to reduce the pumping of sand or organic material, at about 1 to 2 gallons per minute (gpm) for submersible pumps. Peristaltic pumps

will have an even lower flow, approximately 0.25 gpm. For tidally influenced springs, set up field meter(s) so that readings can be taken 1 hour prior to low tide. For springs that are not tidally influenced, obtain stable readings for temperature, specific conductance, and pH according to specified limits prior to collecting the final field measurements and water sample. Readings are taken at regular (2- to 5-minute) intervals until stabilization. Stabilization occurs when the lowest and highest values for 3 consecutive measurements are within 20 % when calculating the RPD:

$$\text{RPD} = \frac{\text{(Highest Value — Lowest Value)}}{\text{(Mean Value of Highest and Lowest Values)}} \times 100\ \%$$

If these values are not within 20 %, the final field measurement value will be qualified as being estimated with an "F" value qualifier. Field readings are recorded on the front page of the springs sampling field sheet (Figure 3a) at the appropriate times. Note the color, odor, and turbidity of the water in the comments section of the field sheet, as well as any other relevant items.

If stabilization of the field parameters has not occurred for nontidal springs, and readings have been taken over a 30-minute period, a second set of field meters should be set up to document the inability to achieve stabilization. If these meters reflect stabilization within 30 minutes, assume that the original meters are malfunctioning and remove them from service. If the second set of meters fails to show stabilization after a minimum of 3 readings, sample the spring but indicate on the springs sampling field sheet the lack of stability. Springs that fall into this category are usually investigated as to their origin and sample point.

For tidally influenced springs, take readings at 5-minute intervals within 1 hour of estimated low tide. If the conductance fluctuates over 5 % per reading based on the last reading, then readings should be taken more frequently. It is not practical to establish stabilization ranges as a universal value for all tidally influenced springs. The proper sample time should be based on the conductance reading. Once the lowest conductance is reached and the conductance begins to increase, it is time to sample.

Disconnect the tubing from the flow chamber after stabilization is achieved and field measurements are recorded. Adequately flush the tubing and reduce the discharge to 1 gpm or less prior to collecting the water samples.

SAMPLE COLLECTION

Collect samples in the order listed in Figure 1. Collect unfiltered samples through pump and tubing into sample containers. For filtered samples, connect a new 0.45-micron capsule filter to the pump's tubing and flush with at least 300 milliliters (mL) of the appropriate water prior to filling the sample containers. Do not touch the inside of any of the containers. Leave air headspace in the sample containers that require the addition of an acid preservative.

SAMPLE PRESERVATION

All sample bottles must be preserved on ice in a cooler within 15 minutes of collection. Keep sample bottles out of direct sunlight prior to preserving.

Identify the bottles that need to be acidified. Wear gloves and eye protection when handling acids to prevent burns and damage to clothing. First acidify the bottles requiring sulfuric acid, one bottle at a time. Unscrew the cap of the sample container, add 1 vial of acid and recap the sample container. Dispose of the open acid vial in the acid waste container. Invert the sample bottle several times to mix the acid with the sample water. Pour off a small amount of acidified sample water into the cap of the sample bottle. Pour the water over a pH test strip and compare the color of the strip with the pH color scale provided on the pH paper box. The pH must be <2. If the pH is not <2, add more acid and repeat this procedure as needed, being careful not to severely over-acidify. You will rarely need more than 1 vial of acid for adequate preservation. Place all bottles preserved with sulfuric acid in a zip-top bag.

Follow the same procedures for samples requiring nitric acid. The pH of the samples must be below 2 SU. Place the bottle preserved with nitric acid in a separate zip-top bag. The nitric acid preservative must be handled at the end of the sampling process to avoid contaminating the nutrient samples.

Combine all zip-top bags of sample bottles (retain separate bags) from a single sample site in one large zip-top bag and place on ice in the cooler.

TRACE METALS SAMPLE COLLECTION AND PRESERVATION

Section FS 8200 of the DEP SOPs, EPA Method 1669, and USGS Open-File Report 94-539 provide guidelines for trace metals sampling and should be referred to for further information. Ultimately, protocols for trace metals sampling are performance based. Equipment blank results will determine how rigorous the procedures are for each sampling agency. The following are the minimum requirements. If equipment or field blanks show detections of trace metals, then the sampling agency will have to improve sampling techniques. For example, alternative sampling equipment or supplies may have to be used or the sampling equipment may need to be decontaminated more frequently.

Two people are required to collect, filter, and preserve trace metals samples. One person must be the "clean hands," and the second person works as the "dirty hands." The "clean hands" person handles the processing of the sample: opening the sample container, filling the container, acidifying the water sample, closing the container, and packaging the sample. The "dirty hands" person is responsible for the operation of the pump and any other activities that do not require direct contact with the sample. Both samplers must wear fresh gloves during the entire sampling process. If there is a metal structure in the vicinity of the sampling, such as a bridge rail or the side of a boat, clear plastic sheeting should be laid down on the metal as a barrier.

Collect both filtered and unfiltered water samples for trace metals analyses. The analytes of interest are boron, aluminum, arsenic, cadmium, cobalt, chromium, copper, iron, manganese, nickel, lead, selenium, tin, strontium, zinc, and barium. Collect the unfiltered metals sample in a 500-mL sample container (the same container in which water for calcium, magnesium, sodium, and potassium analyses is collected) prior to collecting the bacteria samples. The filtered trace metals sample is the first filtered sample collected, as shown in Figure 1. All metals analyses using filtered sample water will be performed from the 125-mL sample container, including analyses for calcium, magnesium, sodium, and potassium. Preserve samples with nitric acid, allowing for a small amount of headspace in the bottle when collecting the water. However, this space should be minimized.

All equipment coming into contact with the sample water must be constructed of uncolored or white fluorinated ethylene propylene (FEP), polytetrafluoroethylene (PTFE), conventional or linear polyethylene, polycarbonate, polypropylene, or ultrapure quartz. Sample containers must be documented to be free of the analytes of interest. Unfiltered samples can be collected directly into the sample containers or by using a pump and tubing composed of the appropriate material. Use new or laboratory-cleaned tubing at each sample site.

Do not clean equipment in the field because of the high risk of contamination. Laboratory cleaning must take place in a clean area and consist of washing with a 0.5 % solution of Liquinox® detergent, rinsing with tap water, rinsing with 10 % trace metals grade hydrochloric acid, and rinsing with de-ionized water. The equipment is then allowed to dry. Wrap equipment in polyethylene film to prevent contamination during storage or transport. Additional information about cleaning sampling equipment is provided in a later section.

Filter trace metals samples at the sample site with a new 0.45-micron capsule filter. Each filter used must have a certificate of analysis indicating that the levels of detection for the metals of interest are below the MDLs of the analytical laboratory. DEP will provide filters meeting these requirements to all sampling organizations. The use of a capsule filter will ensure that the exposure of the sample to air is minimized during the filtering process. If unfiltered samples are grabbed directly into sample containers, use a peristaltic pump and tubing to collect the filtered samples with the capsule filter. Condition the filter by flushing it with approximately 500 mL of the sample water prior to collecting the water in the containers. In addition, rinse each container 3 times with the filtered sample water prior to filling it. If at any time during the filtration process, the flow of the water through the capsule filter appears to be obstructed, possibly as a result of the filter being clogged or a manufacturer defect, then replace the filter immediately. Do not use a filter at more than 1 sample site.

Preserve all samples with nitric acid within 15 minutes of collection. The sampling agency must ensure that the nitric acid used to preserve the samples does not contaminate them. DEP will provide nitric acid that is acceptable for the preservation process to all sampling organizations. After adding the acid to the appropriate sample containers, check the pH to ensure it is below 2 SU, adding acid as described above if it is not. The previous section contains further information about preservation procedures.

MICRO LAND USE FORM

Complete the micro land use form (Figure 6) annually to document the land features and uses found within a 300-foot radius of the spring. Check off the appropriate details observed surrounding the spring vent. Most of these are observational features, (e.g., categories for erosion), and the sampler should evaluate them to the best of his or her ability. The following will help with the assessment of erosion around the spring sampling site: none indicates no observed erosion around the immediate spring area, slight indicates that less than 25 % of the surface soil is removed, moderate indicates that 25 % to 75 % of the original surface layer is missing, and severe indicates that more than 75 % of the original surface layer is removed. ln addition to completing the form, take 5 pictures of the site: 1 at the vent and 4 to the north, south, east, and west of the vent. Submit these pictures with the micro land use form.

DGPS PROCEDURES

Use differentially correcting global positioning system (DGPS) technology to record the location and complete a data dictionary when a spring is first sampled. In addition, DGPS may be used to navigate to the sampling location. The use of DGPS must adhere to the DEP Geographic Information Systems (GIS) Location Data Standard. This standard requires specific minimum settings. Guidance on proper DGPS protocols are available from the DEP GPS coordinator (Tom Biernacki, at thomas.biernacki@dep.state.fl.us).

Sample Shipment and Paperwork

Complete the custody sheet (Figure 7), seal it in a plastic zip-top bag, and attach it to the inside cover of the cooler. A copy of the custody sheet should be retained by the sampling agency, and one copy sent to the DEP project manager. Deliver or ship samples to the lab daily to meet holding times for analysis.

The sampling agency will maintain field sheets, QA sheets, and any other records pertaining to sampling. Send copies of the field sheets to the DEP project manager at the end of each quarter. Notify the DEP project manager immediately if sampling problems arise.

Equipment Cleaning

All equipment must be new or cleaned prior to use. Decontamination procedures must follow Section FC 1000 of the DEP SOPs and are ultimately dependent on the analyte list. Because of the risk of contamination during field cleaning, enough laboratory-cleaned or new equipment should be taken into the field to avoid cleaning.

In the laboratory, clean equipment in a relatively contaminant-free area with a 0.5 % solution of standard brand phosphate-free laboratory detergent (such as Liquinox®) and tap water from any municipal water treatment system. After rinsing the detergent off with tap water, the equipment is next rinsed with 10 % reagent grade hydrochloric acid (HCI). If sampling for trace metals, the sampling agency must ensure that the acid is free of the analytes of interest. Finally, rinse the equipment with analyte-free water (de-ionized water). If field cleaning is absolutely necessary, the equipment can be scrubbed with Liquinox® detergent and tap water, rinsed with tap water, and finally rinsed with de-ionized water.

Keep soap and water in clean containers and handle properly to avoid contamination. Do not store de-ionized water for more than seven days. Wear safety equipment during cleaning to prevent injury to eyes and skin.

Specific Procedures for Pumps and Tubing

These are the minimum decontamination procedures that must be followed when using pumps and tubing for sampling at springs. Clean pumps and tubing in-house once a week when sampling at springs, according to the above procedures. When collecting water for trace metals analyses, clean equipment in the laboratory prior to reuse.

Keep the exterior of the pump free of oil and grease. Clean with detergent and tap water and rinse with analyte-free water as necessary.

Use new tubing at each new sample site. Protect the tubing from potential environmental contamination by storing it in the original packaging or by placing it in a clear plastic bag. If new tubing is exposed to

potential contamination, thoroughly rinse the exterior and interior with hot tap water followed by de-ionized water.

Documentation of Cleaning

Maintain documentation of cleaning for each item of sampling equipment according to FD 1000 of the DEP SOPs. Make each equipment item identifiable by means of serial numbers, tags, or labeled carrying cases. Keep a cleaning log that includes each equipment item. Record the decontamination procedures used for each item. Enter the name of the person performing the cleaning, the date of cleaning, the location of cleaning, and any deviations from the approved cleaning procedure each time an item is cleaned. Allow equipment to air dry completely after cleaning, then wrap it as specified in the cleaning procedure. Tag, mark, or label equipment with the date of cleaning and any deviation from procedures.

QA Field Reference Samples (FRS)

Measure conductance and pH FRS for approximately every 10 actual measurements collected. Reference samples for pH and specific conductance are prepared by the DEP Central Laboratory. The DEP lab determines the most probable (mean) value and standard deviation for each sample. Values measured by the samplers are compared with the DEP lab statistics and used to evaluate field measurement performance.

In the field, the sampler measures the values of the FRS, completes an FRS reporting form (Figure 7), and reports the results to the DEP QAO or project manager by fax, telephone, or electronic mail. The results are evaluated quickly. They are given a satisfactory, marginal, or unsatisfactory rating. ln the case of unsatisfactory or marginal performance, a follow-up reference sample is analyzed. Typical reasons for poor performance on field reference samples are dirty probes, low batteries, contaminated standards, faulty meters, and occasionally analyst error.

If unsatisfactory results are not resolved before actual field measurements are taken, calibration verification should be conducted to determine if measurements must be qualified, as estimated with an "F."

Equipment and Field Blanks

An equipment or field blank sample is collected approximately every five samples. Equipment blanks test the cleanliness or purity of the sampling equipment and containers, preservatives, and analyte-free water, in addition to sampling methods and laboratory methods. Collect the equipment blank by running analyte-free water through all equipment used to collect actual samples. All procedures should be the same as for an actual sample. Place the equipment blank labels on the bottles and write the date and time on the sample labels. To collect a blank with a pump, fill a container with analyte-free water, insert clean tubing into the container, pump water through the tubing to rinse it, then rinse and fill the sample containers. Preserve the equipment blank as an actual sample, bag the bottles, and place them on ice. Enter the time in the QA section of the field notes.

Field blanks must be taken in cases where the only sampling equipment is the sample container. They should also be collected if analytes are detected at high levels in equipment blanks to better isolate the contamination source. These blanks will aid in determining if the equipment blank contamination is a

result of the analyte-free water not being analyte-free, the water container being dirty, or acid preservatives being fouled. Field blanks consist of filling on-site a suite of sample containers with analyte-free water from the water container, preserving the appropriate containers with the necessary acid preservative, sealing the containers, documenting them as QA samples/field blanks, and shipping them to the laboratory as is done with actual field samples. The Custody and Field Sheets must indicate that a field blank sample was collected.

Additional QA

Other QA measures may include analytical reference samples and audits. Analytical reference samples are prepared and submitted "blind" to the analytical laboratories to test laboratory performance. Audits are performed by DEP staff as necessary. Field audits are conducted according to the form in Figure 8. Further information about audits can be obtained from the DEP project manager or QAO.

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Appendix E: Equipment and Maintenance Log Sheets

Equipment Cleaning Log
DEP Groundwater Management Section
Project ID _____

Log each action/piece of equipment separately **Revised 12/14**

Equipment	Serial #	Unique ID	Date	Time	Lab/Field	Procedure	Initials

Equipment Cleaning Log
DEP Groundwater Management Section
_____ Quarter

Log each action/piece of equipment separately **Revised 12/14**

Equipment	Serial #	Unique ID	Date	Time	Lab/Field	Procedure	Initials

Equipment Maintenance Log
DEP Groundwater Management Section
Project ID _____

Log each action/piece of equipment separately **Revised 12/14**

Equipment	Serial #	Unique ID	Date	Procedure	Comments	Initials

Equipment Maintenance Log
DEP Groundwater Management Section
_____ Quarter

Log each action/piece of equipment separately **Revised 12/14**

Equipment	Serial #	Unique ID	Date	Procedure	Comments	Initials

Appendix F: Nitrogen and Oxygen Isotope Sampling Protocols

(For samples submitted to the University of California-Davis Stable Isotope Laboratory)

Collecting Isotope Samples

1. Sampling Bottles and Bottle Labeling

Two 60 mL Nalgene® sample bottles will be provided per site for sample collection. Label each isotope sample bottle with sampling date and sampling time.

Pre-printed bar-coded labels will be provided and affixed to each bottle. The labels will display the site ID and Project. Use either permanent ink or permanent marker to note sampling date and time on each bottle to ensure that this information is readable after freezing for sample storage.

2. Sample Filtering

All isotope samples must be field filtered using a 0.2-micron filter.

Field filtering is important for several reasons. In particular, once a sample is received, it is frozen for storage until analysis. Once a sample is frozen for storage, it cannot be thawed, filtered, and refrozen. If an isotope sample is not field filtered, it cannot be used.

3. Bottle Filling

During sample collection, it is important to leave 1 to 1 1/2 inch of air head space in each sample bottle when filling isotope sample bottles.

Again, once received, the samples are frozen for storage until analysis. Leaving 1 to 1 1/2 inches of air head space in each bottle allows for natural expansion to occur in the freezing process without compromising the sample bottle or the sample.

4. Sample Preservation and Shipping

Once isotope samples are properly collected, pack them in with their respective site sample kit on ice in coolers following standard sample preservation guidelines. Isotope samples are preserved on ice without acids.

Ship isotope samples as part of their respective site sample kits preserved on ice in coolers to the DEP sample receiving following normal sample shipping guidelines.

5. Sample Shipping Confirmation

Once you have properly collected and shipped isotope samples to the DEP lab, please notify Gary Maddox (Gary.Maddox@dep.state.fl.us) or Mike Dalsis (Michael.Dalsis@dep.state.fl.us) in the Groundwater Management Section.

In your email, include the sampler name, the number of isotope samples collected and shipped, and the project name. This way, we can collect and freeze the isotope samples upon delivery to the DEP Lab.

Appendix G: List of Complete Web Addresses
(Listed in order of first occurrence in this document):

DEP Quality Management Plan (QMP), Revision 7; February, 2014:
http://www.dep.state.fl.us/water/sas/qa/docs/DEP-QMP.pdf

Section 403.0623, Florida Statutes (F.S.):
http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0400-0499/0403/Sections/0403.0623.html

Quality Assurance Rule: Chapter 62-160, Florida Administrative Code (F.A.C.):
https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-160

DEP-approved general SOPs (FS 1000, FS 2000), surface water SOPs (FS 2200), and groundwater SOPS (FS 2100):
http://www.dep.state.fl.us/water/sas/sop/sops.htm

DEP QA Directive; November, 2016:
http://www.dep.state.fl.us/water/sas/qa/docs/DEP-Directive-972.pdf

Florida STORET database:
http://storet.dep.state.fl.us/DearSpa/public/welcome

U.S. Geological Survey (USGS) National Water Information System (NWIS) database:
https://waterdata.usgs.gov/nwis

DEP Watershed Information Network (WIN):
http://prodenv.dep.state.fl.us/DearWin/public/welcomeGeneralPublic?calledBy=GENERALPUBLIC

Florida Department of Health Environmental Laboratory Certification Program (FDOH ELCP):
https://fldeploc.dep.state.fl.us/aams/index.asp

National Environmental Laboratory Accreditation Conference (NELAC) standards:
http://www.nelac-institute.org/content/NELAP/

DEP SOP 001/01, FS 1000 - General Sampling Procedures, Table FS 1000-4:
http://flenviro.com/FDEP_Holding_Times_and_Preservations.pdf

Quality Manual for State of Florida Department of Environmental Protection Laboratory; January 2016:
http://publicfiles.dep.state.fl.us/dear/labs/lab_qualitymanual_16.pdf

DEP Generalized Water Information System (GWIS) Database Utilities User's Manual; February, 2017:
http://publicfiles.dep.state.fl.us/dear/watershed%20monitoring/documents/WMS-GWISManual.pdf

Chapter 62-160.240, Florida Administrative Code (F.A.C.):
https://www.flrules.org/gateway/RuleNo.asp?title=QUALITY%20ASSURANCE&ID=62-160.240

Chapter 62-160.340, Florida Administrative Code (F.A.C.):
https://www.flrules.org/gateway/RuleNo.asp?title=QUALITY%20ASSURANCE&ID=62-160.340

DEP QA-002/02 – Requirements for Field and Analytical Work performed for the Department of Environmental Protection under Contract:
http://www.dep.state.fl.us/water/sas/qa/officer.htm

Florida Department of Health (FDOH) Chapter 64E-1, F.A.C.:
https://www.flrules.org/gateway/ChapterHome.asp?Chapter=64e-1

DEP Florida Geological Survey "Springs of Florida" (FGS Bulletin 66):
http://www.dep.state.fl.us/geology/geologictopics/springs/bulletin66.htm

U.S. Environmental Protection Agency (EPA) Method 1669 – Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels; July, 1996:
https://www3.epa.gov/caddis/pdf/Metals_Sampling_EPA_method_1669.pdf

U.S. Geological Survey (USGS) Open-File Report 94-539: U.S. Geological Survey protocol for the collection and processing of surface-water samples for the subsequent determination of inorganic constituents in filtered water; 1994:
https://pubs.er.usgs.gov/publication/ofr94539

DEP Geographic Information Systems (GIS) Location Data Standard; June, 2009:
https://www.dep.state.fl.us/waste/quick_topics/publications/pss/pcp/GIS-Location-Data-Standard_06Feb15.doc