QUALITY ASSURANCE PROJECT PLAN

FOR THE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
AMBIENT MONITORING NETWORK
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Project Description

The Ambient Monitoring Network (formerly,Ground Water Quality Monitoring Network) was established under the auspices of the Water Quality Assurance Act passed by the Florida Legislature in 1983. A portion of that act required the Department of Environmental Protection to “establish a ground water quality monitoring network designed to detect or predict contamination of the state’s ground water resources...” (F.S. 403.063). To facilitate this effort, the act requires that the Department work cooperatively with other federal and state agencies, including the five Water Management Districts, in the establishment of the network. The three basic goals of the program are:

1) To establish the baseline water quality of major aquifer systems in the state
2) To detect and predict changes in ground water quality resulting from the effects of various land-use activities
3) To desseminate to local governments and the public, water quality data generated by the network.

To fulfill the first goal, the DEP established the Background Ground Water Quality Monitoring Network. The Background Network includes 1851 wells that are believed to represent the general ground water quality of the major potable aquifers. Each well is analyzed for the list of physical and chemical parameters shown in table 3.1(a). Each well will be sampled once every three years. This will allow approximately one-third of the Network to be sampled each year.

Because certain aspects of ground water quality may respond to seasonal influences, some wells must be sampled periodically if trends are to be distinguished from natural variation. Thus, two subnetworks were created from the Background Network for the purpose of assessing temporal variability. The first subnetwork consists of approximately 150 wells to be sampled quarterly for the parameters given in table 3.1(b). The second subnetwork consists of approximately 75 wells to be sampled monthly for the parameters listed in table 3.1(c).

The Very Intense Study Area Network, or VISA Network, was designed to achieve the second goal of the program. The VISA network monitors specific areas of the state believed to be highly susceptible to ground water contamination, based on predominant land use and hydrogeology. Areas of predominant land use were located, relative susceptibility to contamination for each potable aquifer was determined, and the degree to

which the aquifer served as a potable water source was evaluated. Based on this information, 20 VISA sites were selected to encompass a variety of aquifer and land use combinations. Each VISA site consists of 10 to 20 wells. Sampling is for the parameters given in table 3.1(d). All VISA sites have been sampled once. Future sampling of VISA sites will be done at a frequency of once every three years.

Table 3.1(a) BACKGROUND NETWORK PARAMETERS AND METHODS

ORGANICS (unfiltered)		
Purgeable Organics	624	
NUTRIENTS (filtered)		
Nitrate + Nitrite, Diss.	353.2	
Phosphorus, Diss.	365.1	
O-Phosphate	365.1	
Ammonia + Organic Nitrogen, Diss.	351.2	
Ammonia, Diss.	350.1	
Total Kjeldahl Nitrogen		
Total Organic Carbon	415.1	
MAJOR IONS (filtered)		
Alkalinity, Diss.	310.1	
Chloride, Diss.	300.0	
Sulfate, Diss.	300.0	
Sulfide,	376.2	
Calcium, Diss.	200.7, 6010	
Magnesium, Diss.	200.7, 6010	
Potassium, Diss.	200.7, 6010	
Sodium, Diss.	200.7, 6010	
Fluoride, Diss.	340.2	
Silica, Diss.	370.1	
TRACE METALS (filtered & unfiltered)		
Aluminum	200.7, 6010	200.8, 6020
Antimony	200.7, 6010	200.8, 6020
Arsenic	200.7, 6010	200.8, 6020
Barium	200.7, 6010	200.8, 6020
Beryllium	200.7, 6010	200.8, 6020
Cadmium	200.7, 6010	200.8, 6020
Chromium	200.7, 6010	200.8 ,6020
Copper	200.7, 6010	200.8 ,6020
Iron	200.7, 6010	
Lead	200.7, 6010	200.8, 6020
Manganese	200.7, 6010	200.8, 6020
Mercury	245.2, 245.7	200.8, 6020
Nickel	200.7, 6010	200.8, 6020
Selenium	200.7, 6010	200.8, 6020
Silver	200.7, 6010	200.8, 6020
Strontium	200.7	
Thallium	200.7, 6010	200.8, 6020
Vanadium	200.7, 6010	200.8, 6020
Zinc	200.7, 6010	200.8, 6020

MISCELLANEOUS		
Turbidity	180.1	
Sp. Conductance, Lab	120.1	
FIELD PARAMETERS		
pH	150.1	**
Temperature	170.1	**
Dissolved Oxygen	360.1	**
Conductivity	120.1	**
Water Depth	t&c	**
Eh	none	**

** analyses performed by sampling agency
Note: All other analyses performed by DER Central Laboratory (#870688G)

TABLE 3.1(b) QUARTERLY PARAMETERS AND METHODS

NUTRIENTS (filtered)		
Nitrate + Nitrite, Diss.	353.2	
MAJOR IONS (filtered)		
Alkalinity, Diss.	310.1	
Chloride, Diss.	300.0	
Sulfate, Diss.	300.0	
Calcium, Diss	200.7, 6010	
Magnesium, Diss.	200.7, 6010	
Potassium, Diss.	200.7, 6010	
Sodium, Diss.	200.7, 6010	
Fluoride, Diss.	340.2	
TRACE METALS (filtered)		
Iron, Diss.	200.7,6010	200.8, 6020
MISC. (filtered)		
Sp. Conductance, Lab	120.1	
Field Parameters		
pH	150.1	**
Temperature	170.1	**
Dissolved Oxygen	360.1	**
Conductivity	120.1	**
Water Depth	t&c	**
Eh	none	**

TABLE 3.1(c) MONTHLY FIELD PARAMETERS

pH	150.1	**
Temperature	170.1	**
Dissolved Oxygen	360.1	**
Conductivity	120.1	**
Water Depth	t&c	**
Eh	none	**

** analyses to be performed by sampling agency

TABLE 3.1(d) VISA PARAMETERS AND METHODS

ORGANICS (unfiltered)		
Fumigant pesticides	504 ALT	
Carbamate pesticides	531.1	
Organohalide pesticides	608	
Organophosphorus pesticides	614 ALT	
Organonitrogen pesticides	619 ALT	
Purgeable Organics	624	
Base neutral & acid extractables	625	
Carbamate and urea pesticides	632	
Chlorinated herbicides	644 ALT	
NUTRIENTS (filtered)		
Nitrate + Nitrite, Diss.	353.2	
Phosphorus, Diss.	365.4	
O Phosphate	365.1	
Ammonia + Organic Nitrogen, Diss.	351.2	
Ammonia, Diss.	350.1	
Total Kjeldahl Nitrogen		
Total Organic Carbon	415.1	
MAJOR IONS (filtered)		
Alkalinity, Diss.	310.1	
Chloride, Diss.	300.0	
Sulfate, Diss.	300.0	
Sulfide	376.2	
Calcium, Diss.	200.7, 6010	
Magnesium, Diss.	200.7, 6010	
Potassium, Diss.	200.7, 6010	
Sodium, Diss.	200.7, 6010	
Fluoride, Diss.	340.2	
Silica, Diss.	370.1	
TRACE METALS (filtered & unfiltered)		
Aluminum	200.7, 6010	200.8, 6020
Antimony	200.7 ,6010	200.8, 6020
Arsenic	200.7, 6010	200.8, 6020
Barium	200.7, 6010	200.8, 6020
Beryllium	200.7, 6010	200.8, 6010
Cadmium	200.7, 6010	200.8, 6020
Chromium	200.7, 6010	200.8, 6020
Copper	200.7, 6010	200.8, 6020
Iron 200.7,6010	200.8, 6020	
Lead 200.7,6010	200.8, 6020	
Manganese	200.7, 6010	200.8, 6020
Mercury	200.7, 6010	200.8, 6020
Nickel	245.2, 245.7	200.8, 6020
Selenium	200.7, 6010	200.8, 6020
Silver	200.7,6010	200.8, 60 20
Strontium	200.7, 6010	
Thallium	200.7, 6010	200.8, 6020
Vanadium	200.7, 6010	200.8, 6020
Zinc 200.7,6010	200.8, 6020	

TABLE 3.1(d) VISA PARAMETERS AND METHODS (Continued)

MISCELLANEOUS			
Turbidity	180.1		
Sp. Conductance, Lab	120.1		
FIELD PARAMETERS			
pH		150.1	**
Temperature	170.1	**	
Dissolved Oxygen	360.1	**	
Conductivity	120.1	**	
Water Depth	t&c	**	
Eh		none	**

** analyses to be performed by sampling agency
Note:all other analyses will be performed by the DEP Central Laboratory (#870688G)

Project Organization and Responsibility

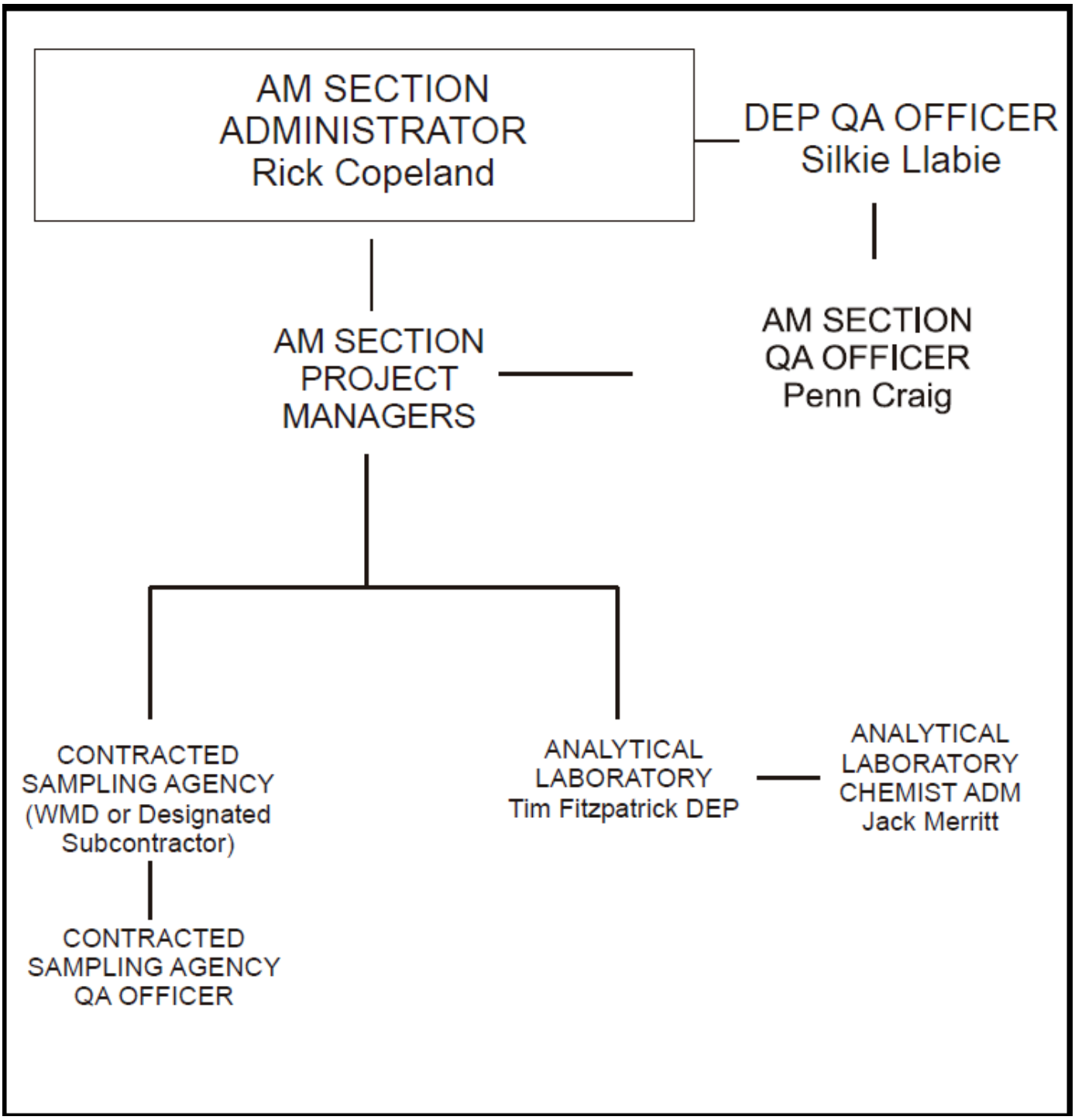
Project responsibility is shared among the project managers and QA officers of the DEP AM Section, the DEP Central Analytical Laboratory, and the sampling agencies. Figure 4.1 illustrates the responsibilities and relationships between project personnel.

Quality Assurance Officers are responsible for implementing the quality assurance program described in this plan with respect to field sampling, laboratory analysis, and data review. QA officers are also responsible for conducting internal field audits, preparing quarterly QA reports to management (section 15), and preparing the QA Supplement to this plan (see attachment A)

Project managers are ultimately responsible for assuring adherence to this plan. Project managers for contracted sampling agencies adopting this plan will indicate their commitment to its guidelines on a signature page included in the QA supplement. Periodic audits (discussed in section 11 and section 4) will be conducted by the DEP AM section QA officer, the DEP QA officer, and other parties. If compliance to this plan is found to be incomplete, the QA officer will indicate to the AM section Project Manager the need for corrective action. Should a need for corrective action persist, the Section Administrator will correspond directly with the Project Manager of the sampling agency to resolve the problem.

Refer to section 4 of the Laboratory QA Plan(s) for details on organization and responsibility which are internal to the lab. The laboratory which has been selected for the contract period beginning October, 1996, through October, 1997, is the DEP Tallahassee Central Laboratory (#870688G).

FIGURE 4.1 PROJECT ORGANIZATION



QA Targets for Measurement Data

QA targets for field parameters are given in table 5.1. In all cases, the matrix shall be drinking water and/or ground water. The sources for accuracy and precision are either EPA or manufacturer specifications. The QA supplement will contain agency-specific (in-house) determinations for these targets. The targets may derive from this document until they have been determined by the agency.

Analytes and laboratory analytical methods requested by the AM are given in tables 3.1(a-d). The QA objectives for laboratory parameters are listed in the DEP Central Laboratory (#870688G), section 5, pp.2-24.

TABLE 5.1 QA Targets for Field Measurement Data

PARAMETER	METHOD	PRECISION	ACCURACY	RANGE
pH	EPA 150.1	2% RSD	± 0.1 s.u.	0-14 s.u.
Conductivity	EPA120.1	10% RSD	± 5%	0-5000 umhos
Temperature	EPA 170.1	5% RSD	± 0.5º C	0-40º C
DO	EPA 360.1	0.1 mg/L	± 1%	.05-20 mg/L
Eh	USGS	5% RSD	± 10 m.v.	-1500 to 1500 m.v.
Water Level	tape & chalk	0.1 ft.	0.1 ft.	0-500 ft.

SAMPLING PROCEDURES

Sampling of ground water by the AM Network is done such that samples will approximate as closely as possible actual aquifer conditions. To this end, the following considerations are standard:

1) Well construction and development is carefully documented.
2) Purge techniques are documented for each well.
3) Field measurements are made with minimal disturbance.
4) Samples are collected and preserved rapidly.
5) Samples are collected in a known and reproducible manner.

Capabilities

Samples from ground water may be taken for the following parameter groups: volatile organics, extractable organics, pesticides, nutrients, inorganics, and trace metals. Field measurements include: pH, temperature, specific conductivity, and water depth. Eh, and DO are optional field parameters. Network specific parameter lists are given in tables 3.1 (a-d).

Equipment

Because sampling will be done by a number of state and local agencies, an agency-specific equipment list will be included in the QA Supplement. However, certain equipment is specified by this plan.

Purging Equipment is selected so that a well may be purged quickly enough to prevent significant equilibration of sample and atmosphere, yet slowly enough to avoid re-developing the well. This eliminates the use of bailers in well purging. Pumps used for purging should have either adjustable flow rates or flow rates which are signicantly less than those used during well development. Portable pumps used for purging include centrifugal, peristaltic, and submersible pumps. The following requirements apply:

1) A teflon one-way flow valve must be installed on any submersible pump used for purging, or on any purge delivery hose use in conjunction with a peristaltic or centrifugal pump. This is to prevent previously purged water from back-flushing into the well.
2) If the purge delivery hose is composed of a substance other than teflon, then a removable teflon adaptor must be used. The adaptor should be 2-3 feet in length, so that it is the only part of the purge delivery system (except for submersibles) to come into contact with well water.
3) If a submersible pump is used for purging, the housing must be of stainless steel or teflon construction.
4) For various reasons, purging by bailer is discouraged and should be done as a last resort.
5) To monitor for chemical stability, field measurements will be made using a flow chamber, when pos-

sible. Construction requirements are minimal; the flow chamber must effectively isolate sample water from the atmosphere, and a flow-control valve should allow variable flow rate through the chamber.

Sampling Equipment is chosen so that the composition of the sampling device is compatible with the project parameter list. While some equipment used in sampling may be sampler-specific (and therefore addressed separately in the QA Supplement), certain aspects will be required.

1) All ground water sampling of Background and VISA Network wells performed under the provisions of this QA Plan will be with teflon bailers.
2) Because both filtered and unfiltered samples must be collected, and because trace metals and organics are collected, all bailer attachments (control-flow bottom, hand pump adaptor,etc) must be composed of teflon.
3) Samples will be filtered through disposable filter units which attach to the bailer via a bottom adaptor. To provide consistency with analysis results from filtered samples collected during the history of the program, the filter pore size will be 0.45 microns. The source vendor of these disposable filtration cartridge will be agency specific; and will be documented in each agency's QA supplement.
4) A hand-held pump is necessary for moving the sample through the bailer.
5) Analyte-free water containers will be composed of high-density polyethlyene.

Cleaning Procedures

Equipment cleaning procedures will be in accordance with EPA Region IV Compliance Branch Standard Operating Procedures and Quality Assurance Manual (May 1996), and DEP SOP (September, 1993; section 4.1.4.1). Copies of these documents will be available to sampling agency staff for instant reference and all relevant staff will be familiar with the procedures defined in the documents. It is the policy of the AM Program that all field sampling equipment should be precleaned in-house, and sufficient clean equipment should be transported to the field in order to minimize field cleaning. Cleaning procedures and frequencies are given in table 6.1.

Documentation of cleaning will be maintained for each item of sampling equipment. Each equipment item will be made identifiable by means of serial numbers, tags, or labeled carrying cases. A cleaning log will be kept with subsections for each equipment item. The cleaning log will be entered with the name of the person performing the cleaning, the date of cleaning, the location of cleaning, and any deviations from the approved cleaning procedure. After cleaning, equipment should be wrapped as specified in the cleaning procedure and

tagged, marked, or labeled with the date of cleaning and any deviations from the sampling procedure.

Cleaning materials to be used in the field and in-house are defined in Appendix B.1.2 (EPA Region IV, 1996). Additionally, analyte-free water is defined here as water, which, given the limits of detection for the analyses to be performed, is free from all interferences and analytes of interest. The source of analyte-free water will be stated in the QA supplement. This water will be used for blank preparation as well as the final decontamination rinse. Data from blank analysis shall be maintained for a period of three years, and will be used to demonstrate the reliability and "purity" of analyte-free water sources.

Disposal of cleaning materials, both in-house and in the field, must be done properly. Detergents and calibration buffers and standards may be disposed of through a sanitary sewer system. Acids should be diluted and neutralized prior to similar disposal. All solvents must be collected and returned to the office or laboratory to be handled by a commercial disposal or recycling contractor. Clean equipment will be stored according to Appendix B.1.8.

Sample Containers Sample containers are provided to samplers in pre-cleaned condition. Containers for all organic analyses will be supplied by the DEP Central Laboratory. Reference should be made to the DEP Central Laboratory QA plan (#870688G) section [6] for specific information regarding container cleaning and sources.

Table 6.1 Cleaning Procedures and Frequencies

Equipment Item	In-House Cleaning Procedure	Frequency	Field Cleaning Procedure	Frequency
Water-level measuring devices	EPA B.7.1	monthly[a]	EPA B.7.1 (ommitting steps 4&5)	after every use
Submersible pumps used for ourging	EPA B.7.2.1 (ommitting step 4; may be wrapped in aluminum foil)	monthly[a]	EPA B.7.2.2 (may be wrapped in aluminum foil)	after every use
Teflon bailers and other sampling equipment	DEP QA SOP Section 4.1.4.1 (substituting 10% HCl for 10% HNO_3; with note 3)	after every use	DEP QA SOP Section 4.1.4.1 (substituting 10% HCl for 10% HNO_3)	after every use[b]
Polyethylene analyte-free water containers	DEP QA SOP Section 4.1.4.1 (ommitting solvent rinse)	prior to refilling	procedure not performed in the field	n/a
Teflon-coated stainless steel bailer lines	DEP QA SOP Section 4.1.4.1 (ommitting solvent rinse)	monthly[a]	DEP QA SOP Section 4.1.4.1 (ommitting solvent rinse)	after every use
Flow-through cells	EPA B.7.1 (ommitting steps 4&5)	monthly[a]	procedure not performed in the field	n/a

a) these items must be cleaned in-house on a monthly basis, in addition to field cleaning after every use

b) bailers and other teflon sampling equipment will be thoroughly rinsed with tap water as soon as possible if not cleaned immediately after use.

c) if it is discovered that a heavily contaminated well (see below) has been sampled, then the equipment used to sample the well will be identified from the field log sheet. That equipment will be taken out of circulation until it can be cleaned according to DEP QA SOP Section (4.1.4.1 note 2). Furthermore, results for all other wells sampled with that equipment will be carefully examined for the offending contaminants, and if detected, will be marked as possible false postives.

Sampling Protocol

Before actually going into the field, maps and previous field logs are used to determine the number of wells to be sampled and the order in which they will be sampled. The time necessary to sample wells varies with such things as depth and diameter of the well, distance to the site, etc. At cluster well sites, wells should be sampled from shallowest to deepest. When wells are known to contain low-level contamination, sampling should proceed from the least contaminated well to the most contaminated. Wells known to be severely contaminated (eg. presence of free product, trace contaminant concentrations in parts per million, etc.) should not be sampled under this quality assurance plan and other arrangements must be made if the well must be sampled. Prior to visiting wells which are privately owned, the owner may be informed by phone call or letter, if necessary.

Depth to Water Measurement

The water depth relative to a known measuring point is measured using a graduated steel tape and chalk. The depth to water is measured twice to the nearest 0.1 feet; both values are recorded in the field log.

Purging the Well

Prior to sampling, the well is purged with a purge pump. Purge pumps must be powered by an external power source; extreme care must be used when handling and locating these power sources to minimize on-site contamination (eg.locate downwind). Though the type of pump used to purge the well may vary, certain constructional aspects are standard. All purge pumps will have delivery hoses composed of polyethylene or pvc. In addition, a bottom length of teflon hose or pipe will be used to actually contact the formation. All pumps will be equipped with a one-way flow check valve composed of either teflon or stainless steel to prevent backflow of purged water into the well. Finally, submersible pumps must have housings composed of inert materials (eg. teflon or stainless steel).

The pump is lowered into the top of the standing water column so that purging removes the standing water first and then draws replacement water from the formation of interest. The well is considered purged when one of the following criteria is met:

1) Three standing water volumes are removed and chemical parameters subsequentlystablize
2) Five standing water volumes are removed.
3) The well is purged dry once, allowed to recover, then purged dryagain.

The standing water volume is calculated using the following terms: depth of well (DW) in feet, depth to water from land surface (DTW) in feet, and casing diameter (D) in inches. A single standing water volume, in gallons, is given by[1]: ONE VOLUME = (D^2) *(DW-DTW)*0.041

The volume of water removed from the well must be measured to avoid excess purging. This may be done using a flow meter to measure the purge rate, and then dividing the necessary minimum purge volume by the purge rate for the length of time necessary for purging. If a flow meter is not available, the flow rate can be estimated by measuring the time required to fill a container of known volume. The required purge volume is then divided by the estimated flow rate to find the estimated time necessary to purge the well. If a flow meter is used, it should be calibrated periodically in this fashion. When the first purge method is utilized, purging is not considered complete until the well is determined to be chemically stable. Temperature[2], pH, and conductivity are monitored and readings are recorded at regular intervals until two consecutive measurements, taken after three standing water volumes have been removed, agree within the amounts given in table 6.2. The interval of measurement will be every half standing water volume (equals one-fifth of the calculated purge time). Thus, the minimum amount of water purged under any circumstances can be no less than 3.5 standing water volumes.

These measurements, in addition to Eh, should be made in a flow-through chamber to minimize atmospheric contact with the sample. Refer to table 5.1 for information regarding field meter precision and accuracy. Instrument calibration procedures are discussed in section 7. If more than 3.5 purge volumes are required to achieve chemical stability, the extra purge volume must be noted in the field log. When the well is stabilized, the final field measurements are recorded in the field log. While still pumping, the pumping apparatus must be

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1) The constant 0.041 is an approximation based on the conversion factor for cubic feet to gallons, inches to feet, pi, etc
2) Temperature may not be indicative of chemical stability when measured after a centrifugal pump and thus may be omitted in stability readings at the discretion of the sampler.

slowly withdrawn from the well to remove the uppermost segment of water. Once clear of the water the pump and/or purge hose should be quickly retrieve to reduce backflow from the pump.

TABLE 6.2 CHEMICAL STABILITY

Temperature	0.2º C
Conductivity	5% or % umho (C<100)
pH	0.1 s.u.

Disposal of Purge Water

Because the AM Network is involved primarily with ambient ground water monitoring, in general, no special precautions apply to treatment of purge water. Purge hoses should be placed as far away as possible from the sampling site, to prevent mucking up the immediate area. Shallow wells should be sampled first at sites with multiple-depth wells, to reduce the possibility of vertical contamination. If sampling is to take place in an area of known contamination, as defined by Chapter 62-3, 62-550, or 62-770 of the Florida Administrative Code, special disposal methods may apply. The purge water will likely be disposed of on-site if the water will infiltrate the same zone from which it was withdrawn. Otherwise, at the direction of the DER Project Manager, arrangements will be made to transport the purge water to a sewer system or plant, if the contaminant concentrations are within their treatment specifications.

Sample Collection

All sampling of Background and VISA wells must be done by bailer, the exception being those wells with in-place plumbing. Bailer composition must be of teflon. When handling bailers or sample containers, disposable untreated latex gloves are worn. The samples should be collected while the bailer is on a bailer stand. This prevents the bailer bottom from coming into contact with the sample container. Prior to the actual collection of the sample, and immediately after purging, 5 bailer volumes are removed and discarded to further diminish artifacts of the purging process. Sampling should take place immediately after purging; if a well is slow to recover, the time between purging and sampling should not exceed 6 hours.

Sample containers, preservatives, and holding times are given in table 6.3.

Figure 7.2 shows a container inventory sheet with the type, size, and number of each container to be filled. Both filtered and unfiltered samples are taken for some parameter groups; this information is given in table 6.3 and is listed on the container inventory sheet (figure 7.2).

Bailer lines should be handled in such a way as to disallow contact with any surface other than the samplers gloves. Bailer lines composed of nylon or braided rope must be discarded after use. Disposable and reusable bailer lines should be decontaminated as described above prior to being introduced into the well. Prior to sampling, a protective covering should be place on the ground around the wellhead.

The sample collection sequence is given on the container inventory (figure 7.2). The collection sequence is designed to a) get samples to the right laboratory, b) use the correct preservatives, c) to prevent cross contamination, and d) to avoid aeration of vocs.

1. All organics samples are collected first.
2. All the inorganic samples are collected next.
   A. Unfiltered samples are collected first.
      1) Unpreserved are collected before preserved.
   B. Filtered samples are collected after unfiltered samples
      1) Unpreserved are collected before preserved.
      2) Because nitrate is an analyte and nitric acid is a metals preservative, the metals sample is collected last.

Organics Sampling

Volatile organic compounds (voc) are among the most difficult compounds to sample. Because these volatilize at low temperatures, they will readily escape from ground water samples. But because they are ubiquitous chemical compounds, they are also readily added to a sample. To effectively sample for vocs, the collection process must be clean, gentle, and rapid. The voc sample should be collected immediately after purging the well.

1. Be sure all gas-powered equipment is located downwind of the well.
2. Wearing new unpowdered latex gloves, remove the three voc vials from the can. Examine each for any obvious defects or contaminants. Discard any vials which appear flawed.
3. Add 5 drops of 1:1 hydrochloric acid (supplied by DEP Lab) to each vial, placing the teflon-coated lid on top of the vial afterwards. Add 5 drops of acid to a fourth test vial also.

4. Unwrap the foil from the pre-cleaned bailer and firmly attach a bailer line to the bailer top.
5. Gently lower the bailer into the top of the water column, allow it to fill completely, and retrieve, carefully handling the bailer lines. Discard the bailer contents and repeat for 5 bailer volumes.
6. After acclimating the bailer to the sample matrix, fill the bailer again and attach a control-flow bottom to the bailer.
7. Fill the test vial to the rim with sample. Screw the lid on and invert the vial 2-3 times to mix the preservative and the sample. Quickly check the test sample with pH paper to verify that the pH is between 1 and 2. If the pH of the test sample is greater than 2, do not add more acid to the sample vials. Instead, state in the comment section of the field custody sheet that the voc sample has a pH greater than 2. This will alert the laboratory to analyze the sample within 7 days of receipt. Rarely should this occur.
8. Discard the test sample and allow approximately 100 ml of sample to flow through the bailer bottom, adjusting the flow until it is a slow steady stream.
9. Now fill the first sample vial, allowing the sample stream to flow down the side of the vial, being careful to avoid contact between the bailer and the sample container. When the sample nears the top of the vial, slow the stream to a minimum, fill to the rim, leaving a positive meniscus on the vial top, without losing the preservative. Once filled, cap the vial and invert, tap the capped end with hand, and inspect the sample for any bubbles. If air bubbles are present in the vial, uncap it and attempt to top it off with sample from the bailer. After two attempts to eliminate air from the vial, discard the vial, and begin again.
10. Generally, three voc vials should be filled in this manner, though DEP often will request that you collect a fourth vial at every tenth site. Place the vials in the ziplock bag. Place the bag in the paint can, and fill the can with vermiculite. Vermiculite can be obtained at any garden store and due to it's sorbtive qualities, it is an excellent safeguard against cross-contamination. Now hammer the lid onto the can, so that a screwdriver will be needed to pry it open.
11. Fill out a DEP Label, and place the label on the outside of the can.
12. Place the can in its cooler with plenty of ice. A trip blank should also be in the cooler.

Fumigant pesticide sample collection is in the same manner as VOCs, except that no preservative is necessary. However, because these pesticides are volatile, care must be taken to minimize sample aeration. Furthermore, the fumigant pesticides are vulnerable to degradation in sunlight, so they should not be allowed

to remain in the open any longer than necessary.

1. Wear unpowdered latex gloves.
2. Open a ziplock bag containing two 40 ml amber vials.
3. Discard any vials which appear dirty or defective.
4. Using the control-flow bailer attachment, fill a vial to the rim, with a slow steady stream of sample down the side of the vial. When the sample nears the top of the vial, slow the flow rate to minimum, and bring the sample to the top, leaving a positive meniscus. Avoid contact between the bailer and the container.
5. Cap and examine for air bubbles as above.
6. Collect two vials for most sites. Collect three vials every tenth site.
7. Place in the ziplock bag.
8. Place a DEP label on the ziplock bag.
9. Place in cooler with plenty of ice. DO NOT PUT IN A VOC CAN!

Collecting the base/neutral and acid extractable sample is not as tricky as for vocs. However, do not allow the samples to remain in sunlight any longer than is absolutely necessary.

1. Wear unpowdered latex gloves.
2. Examine two 1000 ml amber bottles and their caps for flaws. Discard if necessary.
3. Rinse bottles with 20-30 mls of sample from the bailer. Discard rinse.
4. Fill two bottles with sample to within a half inch of the top. It is not necessary to use the control flow bottom but every effort should be made to prevent contact between the bailer and the sample container. At every tenth site, collect three bottles.
5. Place a DEP label on each bottle.
6. Place the bottles in the cooler with plenty of ice.

Collecting the remaining pesticides samples is similar to collection of the BNA samples. They will be collected in 1000 ml amber bottles. The number of these bottles will be variable for any given project, depending on the number of pesticide analyses requested.

1. Wear unpowdered latex gloves.
2. Examine the appropriate number of 1000 ml amber bottles and their caps for flaws. Discard if necessary.
3. Rinse bottles with 20-30 mls of sample from the bailer. Discard rinse.
4. Fill the bottles with sample to within a half inch of the top, taking care to avoid contact between the

bailer and the sample container. At every tenth site, collect the appropriate number of additional bottles.

5. Place a DEP label on each bottle.
6. Place the bottles in the cooler with plenty of ice.

Carbamate pesticides are collected in 40 ml glass vials similar in appearance to VOC or fumigant containers but are distinguishable because they contain a preservative of monochloroacetic acid buffer. To avoid loss of preservative, carbamates samples are filled to just slightly under the lip of the container. They are not considered volatile so removal of air is not necessary.

1. Wear unpowdered latex gloves.
2. Open a ziplock bag containing two 40 ml amber vials with preservative.
3. Discard any vials which appear dirty or defective.
4. Fill the vials with sample from the bailer, leaving a slight headspace.
5. Collect two vials for each site, label each, and place in ziplock bag
6. Place a DEP label on the ziplock bag.
7. Place the bag in the cooler with lots of ice. DO NOT PUT IN A VOC CAN!

At this point, all the containers for organic analyses are filled and preserved. All the containers for the sample should now be in the same cooler. While more than one complete sample may be placed in a cooler, under no circumstances should samples be split up between one or more coolers. Each cooler should have a trip blank, and each cooler should contain a custody sheet in a ziplock, taped to the inside top of the cooler. Please refer to section 7 for further information on sample custody, sample documentation, and sample transmittal.

Inorganics Sampling

Sampling for inorganic compounds is generally less difficult than for organic compounds. For VISA and Background sampling, you will be collecting filtered and unfiltered samples. Many of these samples will be preserved. The following manner and sequence of collection will enable you to collect the samples from the well rapidly, and reduce the possibility of contaminating samples with preservatives meant for other containers.

With the entire container set out of the cooler and labeled, arrange the containers into two groups. The first group will be containers for unfiltered samples and the second group will be for filtered samples. Fill the containers as follows:

1. Wear unpowdered latex gloves. Wearing protective glasses is also advised.
2. Inspect containers for flaws. Discard any which look suspicious.
3. Fill each of the unfiltered containers with sample from the bailer. It is not necessary to rinse these containers with sample as they are acid-rinsed in the laboratory.
4. Cap and set back in unfiltered group.
5. Refill bailer. Check flow direction arrow on disposable filter unit and attach to bailer accordingly.
6. Using a hand-held pump to pressurize the bailer, pump 300 ml of sample to rinse filter.
7. Rinse 500 ml plastic anion bottle with 30-50 ml of sample.
8. Fill nearly to top and cap.
9. Set anion bottle in filtered group.
10. Fill remaining filtered containers to within a half inch of top, cap and set back with filtered group. Replenish bailer as necessary.
11. Remove the turbidity bottle from the unfiltered group and the anion bottle from the filtered group. Place in the yellow mesh sample bag in a cooler with ice.
12. Remove the amber nutrient bottle from the filtered group. Using a sulfuric acid ampule, break the neck and carefully pour the acid into the container. Place the empty ampule in a rigid container for subsequent disposal and cap the bottle.
13. Using pH paper, check the pH of this sample. Invert the bottle several times to disperse the preservative, then pour just a few ml into a disposable cup. Insert the pH paper and compare the resultant color to the color scale on the box. Usually, the pH will be less than 2, indicating that the amount of preservative is sufficient. Should the pH be greater than 2, add more preservative, and recheck the pH. Be sure to document this procedural deviation on the custody form and field log.
14. Set the nutrient bottle in the mesh bag in the cooler.
15. Next, remove all remaining plastic containers from unfiltered group. Also, remove the remaining container from the unfiltered group. These containers will each receive one ampule of nitric acid. After adding the preservative, cap bottle tightly. Place the empty ampules in the disposal container.
16. f the nutrient sample was sufficiently preserved with one ampule, it should not be necessary to check each of the metals bottles. However, if it was necessary to use more than one ampule to preserve them nutrients, check the metals samples to verify a pH < 2. If pH is greater than 2, add more preservative in one ampule increments, until the pH is below 2. Document the additional preservative amount on the custody sheet and the field log.
17. Place the metals bottles in the yellow mesh bag in the cooler.

18. Place broken ampules in disposal container.

Sample collection is now complete for all containers to be shipped to the DEP Central Laboratory in Tallahassee. All the containers for the sample should now be in the same cooler. While more than one complete sample may be placed in a single cooler, under no circumstances should samples be split up between one or more coolers. Each cooler should contain a custody sheet in a ziplock, taped to the inside top of the cooler. Please refer to the custody sheet instructions and the shipping instructions for further information on shipping these samples to the DEP Laboratory in Tallahasse.

Collection of Duplicate and Split Samples

Duplicate samples for ground water are collected by filling sample containers from consecutive bailer volumes. Refer to section 11 (QC Samples) for required frequency. Split samples are obtained by filling containers from the same bailer volume, or by mixing in a large intermediate vessel. When more than one bailer volume is required to fill both container sets, the first container(s) should be filled using the first half of the first bailer and the second half of the second bailer; the second container(s) vice versa. Split samples are not required under this QA Plan.

Sampling of wells with in-place plumbing

Well will be purged for a minimum of 15 minutes and until chemical stability is achieved. The sample will be taken from the faucet closest to the source and before any screens, aerators, filters, etc. Flow rate must be reduced to less than 500 ml. per minute to avoid undue disturbance (ie. > 2 minutes to fill bailer). Unfiltered samples should be collected directly from the spigot, while filtered samples must be collected by filling the bailer.

Sample Documentation

Sample documentation begins in the laboratory. Sample containers are prepared for the analytes listed in tables 3.1(a-d). The containers are then connected to the requested analytical work via the sample container type, and a container information label. The container information label is preprinted at the laboratory and lists the analyte group, the preservation requirements, filtered or unfiltered, and the holding time. Just prior to sample collection, the site information label is completed. The site information label includes the field id, the sampler code, and the date and time the sample was collected. The field id links the sample container to the custody sheet and to the field log. Please refer to section 7 for a more detailed discussion of sample custody.

Sample Preservation

Preservatives are supplied by both the DEP and USGS laboratories. Please refer to QA Plan (#870688G) for the DEP Laboratory for specific information on preservative grade and source. DEP provides hydrochloric acid for preservation of VOCs. The DEP provides Laboratory nitric and sulfuric acid for preservation of metals and nutrients, respectively. Refer to table 6.3 for analyte-specific preservation requirements and holding times. Sample preservation is confirmed by drawing off a few millimeters of sample from the nutrients container into a disposable cup, and checking pH with pH paper in the 1-2 range. If the pH is greater than 2, the sample will be preserved to pH < 2, then analyzed and reported with appropriate documentation concerning preservation. Field logs and custody sheets will document deviations in the preservation procedure. If an equipment blank is being done at the site, the equipment blank will be similarly preserved. All samples are immediately placed in an ice chest and chilled to 4 degrees C with wet ice.

Sample Dispatch

Samples are packed in polyurethane ice chests with 2-3 samples per cooler. The cooler is lined with a garbage bag to prevent leakage of melted ice water. Special effort is taken to segregate the VOCs by placing them in a paint can. Individual containers may be sealed in a ziplock bag to reduce the chance of cross-contamination. This also protects the label from water damage. The coolers are filled with ice. Custody sheets for listing all samples and all blanks are shipped with the cooler in a ziplock bag. Two lines of strapping tape across the cooler top are adequate to prevent the cooler from accidentally opening during shipment. However, special care is taken to tape the cooler spigot to prevent its inadvertant opening during shipment. Shipping is direct to the DEP Central Laboratory via Federal Express Overnight Shipping. Services are pre-arranged to minimize the delivery time.

Reagents and Standards Storage

Although most equipment is pre-cleaned, decontamination solvents and solutions may be utilized for cleaning of bailer attachments, non-disposable bailer lines, and emergency cleaning purposes. These cleaning materials include 10% nitric acid solution, pesticide-grade isopropanol, analyte-free water, tap water, and detergents. Most preservatives are carried in sealed ampules and are not opened until the time of sampling. Used ampule containers are returned in a sealed container to the USGS Laboratory for disposal. Hydrochloric acid provided by DEP will be stored with other preservatives, away from samples and preferably in a vented cabinet, if possible. Conductance, Eh and pH standards will be stored out of direct sunlight. It is recommended that two

vehicles be used in the field, one for clean equipment and reagents, and one for used equipment and pump generators. If two vehicles are not available, a trailer may be used to segregate equipment. In the event neither are available, the QA supplement must detail storage procedures which are employed for the purpose of preventing contamination of unused sampling equipment, reagents, and standards.

TABLE 6.3 CONTAINERS, PRESERVATION, AND HOLDING TIMES

GROUP	CONTAINER	PRESERVATIVE	ANALYTE	HOLDING TIME
Metals	plastic	HNO_3 to pH <2 HNO_3 to pH <2	Hg other metals	28 days 180 days
Nutrients	plastic	$H2SO_4$ to pH <2 cool to 4º C $H2SO_4$ to pH <2 cool to 4º C $H2SO_4$ to pH <2	Nitrate/Nitrate + Ammonia + Total Kjedahl N + Phosphorus + Orthophosphate + Total Organic Carbon	28 days 28 days 28 days 28 days 48 hours 28 days
Major Ions	plastic	cool to 4º C add ZnAcetate + NaOH to pH >9	Chloride + Fluoride + Sulfate + Sulfide Alkalinity (HCO_3^-) + Silica + Turbidity + Spec. Conductance * (lab)	28 days 28 days 28 days 7 days 14 days 28 days 48 hours 28 days
Fumigants	glass vial w/ teflon cap	cool to 4º C	Fumigant Pesticides *	14 days
Carbamates	glass vial w/ teflon cap	acetate buffer cool to 4º C	Carbamate Pesticides *	7/40 days
Pesticides	glass	cool to 4º C	Other Pesticides *	7/40 days
Extractable Organics	glass	cool to 4º C	Base neutral/acid extractables *	7/40 days
Purgeable Organics	glass vial w/ teflon cap	cool to 4º C HCl to pH <2	Purgeable Organics *	14 days 7 if unpreserved

* unfiltered sample only
+ filtered sample only
(rest filtered & unfiltered)

Sample Custody Objectives

Of critical importance to AM Network objectives is sample custody. Though the magnitude and scope of the Network do not allow for legal chain-of-custody procedures, proper sample custody is a high priority. Data gathered will be incorporated into an existing statewide water quality database; thus, it is necessary for incoming data to be properly linked to historical data. This database is also a source of public information, therefore every effort must be made to avoid erroneous association of analytical results to well locations.

Sample custody begins when the lab project manager is notified several weeks prior to the sampling event of the number of samples to be submitted for analysis and the types of analyses which will be requested. The notification is done both electronically (LIMS) and/or via personal communication with the lab project manager. Sample containers and preservatives are prepared in each laboratory for the analytes to be analyzed by that laboratory; each container is labeled with the analysis type, the preservation requirements, and the holding time for the most critical parameter. Shipping to the sampling agency is by UPS or Greyhound.

Field custody sheets (shown in figure 7.1) are prepared in advance for return shipment of samples and are supplied to the sampling agency by DEP AM staff. The container inventory (figure 7.2) is also prepared by DEP AM staff. This inventory lists for each container the container description, appropriate preservative, the number of containers to be filled, the analyses to be performed on the sample, and the lab performing the analysis. Prior to sampling, the coolers are inventoried by the samplers. The actual inventory is compared to the container inventory appropriate for the project (see figure 7.2) and in the event of any discrepancies, the sampling agency will contact AM staff to verify changes in inventory. The coolers are then packed with each container needed to sample a well.

In the field, all the containers for a single complete sample are labeled prior to filling. Custom waterproof labels (figure 7.3) are used. On the label is a unique field identifier which links the container to the field custody sheet. The field identifier consists of two parts, the root, which identifies the entire sample container set, and the extension, which identifies the container for a particular analysis. In this way, custody is verifiable from the field to the resulting data report for each sample, as well as for each container. Valid field id extensions are shown on the container inventory sheet (figure 7.2). As each container is filled and appropriately preserved, the inventory list will be initialled by the sampler in the right margin next to the container description in order to signify proper collection, preservation, and labeling. Sample containers are labeled with the container name, which addtionally links the container to the inventory sheet. The analysis request number is placed on the sheet; from it, the analyses to be performed can be determined. The container information label (figure 7.4) also lists the desired analyses.

FIGURE 7.1 FIELD CUSTODY SHEET

GROUND WATER QUALITY MONITORING NETWORK — SAMPLE CUSTODY RECORD
(904) 488-3601

SAMPLING AGENCY	PROJECT NAME	SAMPLED BY	MATRIX	LABORATORY	SCHEDULE
	QUARTERLY		AQUEOUS GROUND WATER		4004

SAMP NO	SAMPLE DESCRIPTION	LAB ID
1	DER WELL ID _____ TEMP (00010) _____ Eh (00090) _____ FIELD ID _____ pH (00400) _____ DO (00300) _____ DATE _____ TIME _____ COND (00095) _____ DTW (50410) _____ COMMENTS _____	
2	DER WELL ID _____ TEMP (00010) _____ Eh (00090) _____ FIELD ID _____ pH (00400) _____ DO (00300) _____ DATE _____ TIME _____ COND (00095) _____ DTW (50410) _____ COMMENTS _____	
3	DER WELL ID _____ TEMP (00010) _____ Eh (00090) _____ FIELD ID _____ pH (00400) _____ DO (00300) _____ DATE _____ TIME _____ COND (00095) _____ DTW (50410) _____ COMMENTS _____	
4	DER WELL ID _____ TEMP (00010) _____ Eh (00090) _____ FIELD ID _____ pH (00400) _____ DO (00300) _____ DATE _____ TIME _____ COND (00095) _____ DTW (50410) _____ COMMENTS _____	
5	DER WELL ID _____ TEMP (00010) _____ Eh (00090) _____ FIELD ID _____ pH (00400) _____ DO (00300) _____ DATE _____ TIME _____ COND (00095) _____ DTW (50410) _____ COMMENTS _____	

SHIPPED VIA: _____

DATE/TIME SHIPPED: _____

SAMPLE LOGGED BY: _____

DATE/TIME LOGGED IN: _____

Field custody sheets are completed (in carbonless triplicate) by the sampler, one for each return cooler. The following information is included on the custody sheet: well identifier, field identifier, project name, sampler name, date and time sample was collected, and the number of containers collected. Mistakes on the custody sheet will be deleted by drawing a single line through the error. One copy of the custody sheet is placed in a sealed plastic bag and taped to the inside top of the DEP cooler. The last copy is kept for the field log book. At the laboratory, information on the field custody sheet is used DEP laboratory to log in samples. Laboratory receipt files are electronically transmitted to the AM Section where they are compared to the scheduled list of samples and checked for mistakes or deviations from the original sampling plan. The receipt file database is then linked to a pre-established well database by the well id. The well database provides the well owner's name and address, the address of the well, well contruction data, and geologic information for the aquifer tapped by the well.

Field logs are also maintained. Minimum information to be recorded on the field log sheet includes:

- program name
- sampling agency
- county
- der well id
- agency site id
- aquifer
- actual purge time/volume
- network (ie. visa,background,etc)
- casing diameter
- casing material
- total depth of well
- measuring point elevation (mpe) in feet
- land surface elevation (lse) in feet
- date/time on site; date/time off site
- personnel and visitors on site
- analytical laboratory(s) (if samples taken)
- condition of well
- date/time well purged
- additional comments
- field id
- water level measurement calculation/data
- water elevation calculation
- minimum purge volume calculations
- purge pump id;
- purge rate
- calculated purge time/volume
- calibration data for field instruments[1]
- chemical stability monitoring data
- physical observations (ie. odor, color, etc.)
- sampling device identifier
- ambient weather conditions
- field decon performed[2]
- list of qa samples collected
- use of fuel-powered units
- sampling flow rate (in-place plumbing)
- condition of well tag
- date/time well sampled

1 this information will be kept in separate field instrument calibration logbook

2 this information will be kept in separate field equipment decontamination log

FIGURE 7.2 CONTAINER INVENTORY EXAMPLE

LAB	CONTAINER	ANALYSES	DESCRIPTION	#	FILTER	PRESERVATION
DEP	Anions	Cl, SO_4, F, Alkalinity & PO_4	500 mL plastic	1	yes	Chill
DEP	Nutrients, DOC	NO2+NO3, P, TKN, NH3 & DOC	500 mL plastic	1	yes	H_2SO_4--pH<2 Chill
DEP	W-ICP-23-F W-ICPMS-F	Filtered Metals	250 mL plastic	1	yes	HNO_3--pH<2
DEP	Turbidity	Turbidity	250 mL plastic	1	no	Chill
DEP	W-ICP-23 W-ICPMS HG-H-W	Total Metals	1 Liter plastic	1	no	HNO_3--pH<2
DEP	W-TOC	TOC	250 mL plastic	1	no	H_2SO_4--pH<2
DEP	Sulfide	Sulfide	250 mL plastic NaOH preservative	1	no	7-10 drops Zn-Acetate; Chill

The field logs are kept in two bound notebooks, one for each well and one for each project. Prior to visiting a well, information from the most previous visit to the well is reviewed and a copy of the log sheet will be on-site so that reference can be made to it during sampling. Copies of field custody sheets also are kept in the field log notebook, along with container inventory forms, carrier receipts, and other records pertaining to sampling. Copies of the notebooks will be forwarded to AM Staff. An example of a field log sheet is shown in figure 7.5; the QA supplement will contain an example of the field log sheet, if different from figure 7.5.

Refer to the Laboratory QA plan(s) #870688G for the DEP Central Laboratory for information on sample custody in the laboratory (section 7).

FIGURE 7.3 SAMPLE CONTAINER LABEL

FIGURE 7.4 EXAMPLE OF CONTAINER INFORMATION LABEL

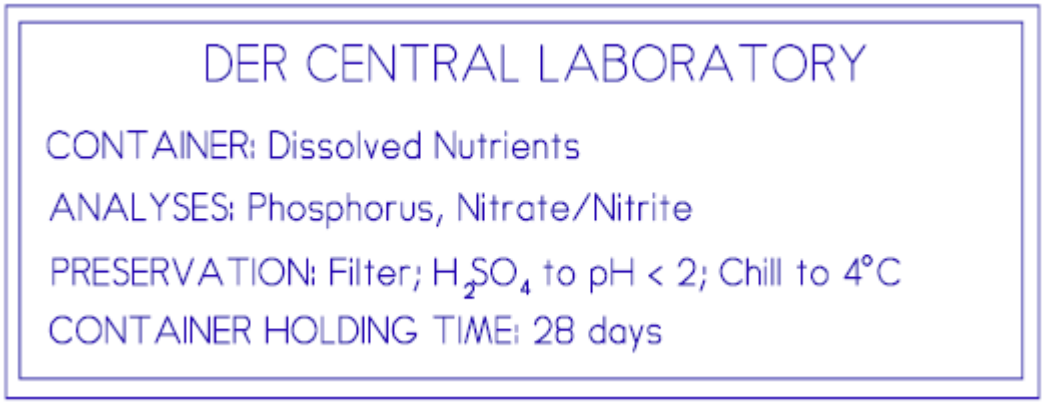

FIGURE 7.5 EXAMPLE OF FIELD LOG

FLORIDA AMBIENT MONITORING NETWORK
GROUND WATER SAMPLING FIELD LOG SHEET

SAMPLING AGENCY:	COUNTY:
STATION ID:	STATION:
OWNER:	PROJECT:
CASING DIAMETER:	CASING MATERIAL:
LAND SURFACE ELEV. (LSE):	TOTAL DEPTH:
MEASURING POINT ELEV. (MPE)	WATERBODY:

DATE/TIME ON SITE:_____ DATE/TIME OFF SITE: _____

SAMPLER: _____ LAB(s):_____

SAMPLER: _____ FIELD ID:_____

HELD AT WETTED AT DEPTH TO WATER (DTW)

1. _____ - _____ = _____ (feet from MPE)

2. _____ - _____ = _____ (feet from MPE)

(SU=MPE-LSE): _____ ft DTWLSE (DTW-SU) = _____ ft WLE (MPE-DTW) _____ ft
(stickup) (depth to water from lse) (water level elevation)

MIN. PURGE VOLUME: _____ - (_____ - _____) x ___ x ___ x 0.1224 = _____ gal
(DW DTW SU D D

PURGE RATE: _____ gal/min PURGE PUMP ID:_____

MIN. PURGE TIME: (MIN. PURGE VOLUME/PURGE RATE) _____ min.

DATE/TIME PURGE BEGIN:_____ DATE/TIME PURGE STOP:_____

TOTAL PURGE TIME: _____ min

TOTAL PURGE VOLUME: (PURGE RATE x TOTAL PURGE TIME) _____ gal

FUEL-POWERED UNITS USED ON SITE: _____

SULFUR ODOR:_____ COLOR: _____

DATE/TIME SAMPLING BEGIN: _____ DATE/TIME SAMPLING STOP:_____

SAMPLING DEVICE ID: _____

SAMPLING FLOW-RATE (IF IN-PLACE PLUMBING): _____

Analytical Procedures

All analytical work for the Ambient Monitoring Network will be performed by the DEP Central Analytical Laboratory. Lists of analyses and methods requested by the AM Network are given in tables 3.1(a-d).

Currently, all organic analyses and inorganic analyses are performed by the DEP Central Laboratory.

Further discussion of analytical procedures is given in the section 8 of the Lab QA Plan (#870688G-DEP).

Calibration Procedures and Frequency

Temperature, pH, conductivity, Eh, and DO measurements all require regular equipment calibration. Refer to the sampling agency QA supplement for information on standards traceability, storage, and frequency of preparation. Specific procedures for calibration and documentation are discussed in the DEP Sample Collection Activities SOP, revision September/December, 1993.

Temperature:Calibration procedures will be in accordance with DEP SOP, section 7.5.3.

pH: Calibration procedures will be in accordance with DEP SOP, section 7.5.2. However, the required calibration checks will precede every sample taken in the field, rather than at the prescribed four-hour interval.

Conductivity: Calibration procedures will be in accordance with DEP SOP, section 7.5.5. However, required calibration checks will precede every sample taken in the field, rather than at the prescribed four hour interval.

DO:Calibration procedures will be in accordance with DEP SOP, section 7.5.4.

Eh: Calibration will be checked against Zobell solution at sample temperature prior to measuring. If the observed potential is within 10 millivolts of the theoretical potential, then the meter is considered calibrated.

An agency-specific table listing standards, sources, storage, and replacement frequencies will be provided in the QA supplement.

For information regarding calibration of laboratory equipment, refer to the DEP Central Laboratory QA Plan (#870688G).

Preventive Maintenence

Because sampling equipment and maintenence schedules vary from agency to agency, the sampling agency QA supplement will contain exact information regarding preventive maintenence of sampling equipment. Table 10.1 illustrates the format for the preventive maintenence table which must be provided in the QA Supplement.

Refer to DEP Central Laboratory QA Plan (#870688G) for preventive maintenence of analytical equipment.

TABLE 10.1 PREVENTATIVE MAINTENANCE ACTIVITIES

EQUIPMENT	ACTIVITY	FREQUENCY
thermometers/thermisters	replacement	
pH meter	battery check probe cleaning electrolyte replacement probe replacement	
conductivity meter	battery check probe cleaning probe replacement	
Eh meter	battery check probe cleaning probe replacement	
DO meter	battery check probe inspection membrane replacement electrolyte replacement	
other preventative maintenance activities		

Quality Control Checks, Routines to Assess Precision and Accuracy

Field Quality Control Checks

Field Blanks: Field blanks are taken on an as-needed basis. This consists of filling on-site the suite of sample containers with analyte-free water, preserving as with actual samples, sealing the containers, documenting it as a QA sample, and shipping as with actual field samples.

Equipment Blanks: One equipment blank on clean equipment will be taken and submitted for analysis for every 20 samples taken in the field. The blank is prepared in the field prior to sampling by filling the precleaned equipment with analyte-free water and filling the appropriate containers as if an actual sample. If the analytes are normally field-filtered, the equipment blank should be filtered as well. Preservation is performed as with actual samples. If equipment is cleaned on site, additional equipment blanks must be collected at a rate of 5 percent.

Trip Blanks: Trip blanks are provided by the laboratory for all coolers which will carry VOC samples. The trip blank resides undisturbed in the cooler during the sample collection for that cooler. It will accompany the samples on the return trip to the laboratory and will then be analyzed as any other sample.

Duplicate Samples: One duplicate is taken for every 10 samples. The duplicate is given a pseudo-identifier so that it can be submitted blind for analysis. Duplicates are defined as sequential samples with different sample times. One complete sample is collected, then using a new set of pre-cleaned equipment, another is collected immediately afterward. A second complete set of field measurements is collected, which are used in the routines to calculate precision discussed below.

Routines to assess Accuracy and Precision

Field Reference Samples: Reference samples for pH and specific conductance are specially prepared for the AM Program by the USGS Lab in Ocala. Samples with a variety of pH and specific conductance are submitted to over

60 participating analysts. The values for each sample are reported to the USGS, where the results are evaluated. Mean (or most probable) values are determined for each sample, and the standard deviation is calculated. These statistics are then used to evaluate field measurement performance. Reference samples are distributed to each sampling agency and analyzed (single-blind) in the field, at a minimum rate of one for every 10 actual samples. The results are supplied to AM staff, along with the analyst name, intrument make, model, sample id, etc. Results are evaluated immediately. In case of unsatisfactory or marginal performance, a follow-up reference sample is analyzed. If the result is still unsatisfactory, corrective action will ensue immediately (see section 13).

Reference sample accuracy is determined by dividing the difference between the reported reading and the most probable value by the standard deviation, or

$$\frac{x - X}{s.d.}$$

where: x = reported value
X = most probable value
s.d.= standard deviation

Marginal or unsatisfactory accuracy for pH and specific conductance is recognized when the reported value differs from the mean (or most probable) value by two or three standard deviations, respectively. In order to relate reference sample accuracy to sample measurement accuracy, the reported value is divided by the most probable value and multiplied by 100 to express the percent accuracy:

$$\text{Accuracy} = \frac{\text{Value}_{observed}}{\text{Value}_{standard}} * 100$$

In general, when the reference sample accuracy is within three standard deviations of the most probable value, the percent accuracy is within the range of the manufacturer's specifications for the meter. If, at any time, the accuracy estimates for a particular instrument do not meet the targets listed in section 4 of this plan, the meter must be recalibrated. If recalibration does not correct the problem, specific manufacturer's maintenence instructions are followed to correct the problem.

Duplicate field measurements are taken at a rate of 10 percent for the purpose of assessing field meter precision. For every duplicate sample taken in the field, duplicate field measurements are recorded. Relative percent difference (RPD) is calculated for each field parameter using the following expression:

$$RPD = \frac{(x_1 - x_2) \times 100}{(x_1 + x_2)/2}$$

where: x_1 = first observation

x_2 = second observation

Average RPDs and standard deviations will be calculated for various parameter value ranges, using data from all sampling teams. From these data, acceptable RPDs will be established for each parameter value range. Once these precision targets are obtained, incoming field duplicate data will be checked against these data quality statistics. See section 13 for discussion on corrective action in the event of poor duplicate sample performance.

Calibration Checks

Prior to taking every sample, the pH meter is checked against the pH=7 buffer. The value must be with 0.1 standard units of the actual buffer value, or the meter must be re-calibrated. The conductance meter will be checked against a conductance standard within the range of the actual sample's expected value prior to actual sample measurement. The standard used should not be one used in the initial calibration. The measured value must be within 5 percent of the standard value, or the meter will be recalibrated or set aside for maintenence, if necessary. Thermisters will be continually checked against a field-grade thermometer. Readings should be within 0.1 C degree.

Other Checks

The Eh meter is checked at every site with ZoBell solution. If the Eh reading does not agree within + 10 mv of the theoretical Eh of ZoBell solution, specific manufacturer's maintenence instructions are followed to correct the problem.

The DO meter is checked daily with an oxygen-free solution (1 g sodium sulfite and 1 mg cobalt chloride dissolved in 1 liter of deionized water). If the reading exceeds 0.2 mg/L, the membrane needs replacing or the probe is in need of repair.

Laboratory Quality Control Checks

Please refer to section 11 of the DEP Laboratory QA Plan (#870688G) for discussions of laboratory quality control checks.

Data Reduction, Validation, and Reporting

Data Reduction

Values for conductivity, pH, temperature and depth to water are transferred directly from the instrument to the sampler's field log. These values are then entered directly into a computer file by the sampling agency data manager. Values for water elevation are calculated from depth to water and land surface elevation data. DO values are given a salinity correction when conductivity is greater than 2000 microsiemens. The correction factor is read from salinity tables and applied in the field. Eh values are recorded in field logs relative to the silver, silver-chloride electrode and must be reported relative to the standard hydrogen electrode. This is done within the data entry program using the following equation:

$$Eh_H = Eh_{Ag/AgCl} + 223 - (0.95 \times T°C)$$

Data Integrity

Raw field data are reviewed by the agency data manager. As data are entered into a preliminary data file, the data entry program will automatically flag values outside a given control range. For example, if a pH value is entered outside of its control range, the data entry program will ask the data entry operator to input the value again. If the same value is entered, the value will be flagged for further review. Control ranges are given in table 12.1. After all field data are entered, a report lists values in need of further review. For these data, calibration procedures and internal instrument checks are reviewed. This is done by reviewing field logs for obvious problems and by reviewing previously collected field data. If no reason can be found to invalidate these data, they will be entered into the AM database.

Data Validation

Review of QAQC samples is the first step of data validation. Field blanks and equipment blanks are examined for parameter values which exceed the MDL. When exceedances are found, the relevant parameters are marked questionable for the samples associated with them, if their concentration is measured to be within 5 times the detected concentration.

Duplicate results for major ions, nutrients, and trace metals are plotted. Values which fall outside the targets published in the labs' QA Plan(s) will cause parameters analyzed during that time period to be labeled as "exceeding precision targets."

Reference samples results are examined for values deviating from the most probable value in excess of 3 standard deviations. Parameters which exhibit poor reference sample results will marked in the samples data base as "exceeding accuracy targets."

A number of validation procedures are used by the AM Network data managers for both field and analytical data. Parametric and nonparametric outlier tests with comparison populations of historical data from proximal wells tapping the sample aquifer provide rough checks on data validity. Several outliers in a single well indicate a possible sample custody problem. Custody sheets are reviewed, and if necessary, raw data print-outs are reexamined for data confirmation.

Another validation criterion for analytical data is the charge balance error. Charge balance assumes electroneutrality and is calculated using concentrations of the major ions Na, Mg, K, Ca, SO4 ,Cl, HCO3. Charge balance error (CBE) is given by:

$$CBE\% = \frac{A - B}{A + B} * 100$$

where $A = (Na^{+}) + 2(Mg^{2+}) + (K^{+}) + 2(Ca^{2+})$
$B = (Cl^{-}) + 2(SO_4^{2-}) + (HCO_3^{-})$

Charge balance errors should be less than 10% except in cases where TDS is less than 100 mg/L in which case CBE should not exceed 30%.
A TDS check is also done by summing the concentrations of dissolved constituents and comparing the sum to the value for total filterable residue or to specific conductance. This ratio of TDS (measured) to TDS (calculated) should be between 0.8 and 1.2 to be considered a valid analysis. Specific conductance is related to TDS and/or the sum of dissolved constituents by the following:

$$TDS = A*C$$

where $0.55 < A < 0.75$, C is specific conductance in siemens/cm and TDS is in mg/L. This relationship used in evaluating analytical results where the specific conductance is less than 1400 siemens/cm.
Finally, lab conductance is routinely measured and compared to field conductance.

Data Storage

Data storage is both by physical hard-copy library and by computerized relational databases. For each sampling project, hard copies and/or originals of field log sheets, field custody sheets, carrier receipts, project maps, container inventory sheets, and laboratory reports are organized by well into loose-leaf notebooks and will be kept both by the sampling agency and the AM for a minimum of 3 years. However, data storage is primarily electronic. The laboratory initially stores the data on its LIMS System. This data is downloaded into microcomputer-based DBASE files. The archival files are separated by project (sampling event) and are

subject to a detailed data management SOP. Storage media include data diskettes, Bernoulli cartridges, and hard disk storage. Data will also be archived on the DEP Bureau of Information Systems' central computer. Sampling agencies store data in their own internal information systems, in addition to using the microcomputer-based data files.

Please refer to section 12 of the DEP Laboratory QA Plan (#870688G) for specific information regarding laboratory data validation, etc.

TABLE 12.1

Field Parameter	Lower Limit	Upper Limit
depth to water	0 feet	500 feet
pH	4.0 s.u.	8.5 s.u.
Conductivity	50 umhos	2000 umhos
DO	0 mg/L	7 mg/L
Eh	-500 m.v.	500 m.v.
Temperature	15º C	30º C

Corrective Action

Network personnel responsible for assessing each QC measure and initiating corrective action are the desgnated QA Officers for the AM, the DEP, the analytical laboratory, and the sampling agency. Specific types of corrective action taken for quality control measures are listed in table 13.1. External quality control measures that initiate corrective action are also listed in table 13.1.

Notification of network personnel of problems and corrective action can be on several levels. Most often, oral communication among QA Officers initiates corrective action. In the event a problem fails to be remedied, written communication among the QA Officers will serve official notice of the need for corrective action. Official memoranda between project managers, who are also the contract managers, may occur in the event that corrective action is not being implemented.

Adherence to this Quality Assurance Plan is a contractual agreement; problems which go unresolved more than two quarters will be viewed as incomplete tasks. Quality assurance reports are submitted quarterly, along with progress reports and invoices. These reports, discussed in section 15, help to identify existing problems, as well as document corrective procedures.

Reviews and audits of sampling operations by DEP personnel are welcome. Corrective action recommended by DEP personnel, depending on its nature, may be implemented immediately or at the beginning of a new contract year.

Please refer to section 13 of the DEP Central Laboratory QA Plan (#870688G) for laboratory guidelines concerning corrective action.

TABLE 13.1 CORRECTIVE ACTION

QAQC MEASURE	CRITERIA FOR CONCERN	CORRECTIVE ACTION
Trip blank	any value > MDL	sample custody review sample dispatch equipment storage review of lab blanks (?)
Field blank	any value > MDL	DI source and storage equipment storage sample custody
Equipment blank	any value > MDL	cleaning procedure DI source and storage equipment storage sample custody
Duplicate performance	see Table 5 of lab QA plan(s) for precision targets	lab notification sample collection sample custody
Performance audit (field)	values > 2 standard deviations from most probable value	calibration procedure reagents equipment repair
Field audit	deviations form QA plan	see section 4 see section 13
Performance (laboratory)	values > 3 std. dev.	lab notification

Performance and Systems Audits

Performance and systems audits are conducted periodically to ensure that both sample collection and analysis are done in a reproducible manner without systematic bias. Results of audits are made known to both laboratory and sampler so that corrective action may be taken in the event it is needed.

Systems Audits

External audits of each sampling agency are conducted by the DEP AM QA Officer and the Project Manager at a frequency two per year. In general, this audit consist of an on-site review of sample custody practices, purging methods, field measurement procedures, inorganic sampling, and sampling for organic compounds (please see appendix for audit checklist). The results of such audits are discussed with the QA officer of the sampling agency and areas in need of improvement are noted. These areas will be documented in the quarterly QA report, along with descriptions of any corrective action taken as a result. Future external audits will focus on these areas to ensure that corrective action has been taken.

Internal audits by sampling agency QA officers of sampling agency field personnel will be made during alternate quarters. The findings of these audits will be documented in the quarterly QA report.

For information regarding laboratory systems audits, please refer to the DEP Central Laboratory QA Plan (#870688G).

Performance Audits

Historical data regarding water quality provide a crude method of assessing the overall reproducibility of results. Computer checks for outlier values will reveal gross inadequacies in either the sampling process or the sample analysis.

Duplicate samples comprise 10% of samples collected. The relative percent differences are plotted for selected parameters to yield estimates of overall sampling and analytical precision. Because precision of measurement is most often concentration-dependent, the standard error and thus the control limits, are also concentration-dependent. Thus, the proper creation of precision control charts requires the use of regression techniques. Instead, precision will be evaluated relative to the precision targets published in the analytical laboratory QA Plan. Both the laboratory and the sampling agency will be notified when the measured precision systematically exceeds targets for precision and the source of error will be investgated.

Field reference samples are prepared for the AM by the USGS laboratory in Ocala for pH and conductivity. Most-probable values and standard deviations are established for each sample by multiple-lab analysis. These samples are carried into the field and analyzed at a rate of one for every 5-10 actual samples. Data are tabulated by analyst and instrument. Results which are greater than 2 standard deviations from the most probable value initiates immediate reanalysis. If results continue to be unsatisfactory, the project managers are notified and the problem is investigated and corrected. These knowns are also carried into the field during performance audits to assess the accuracy of field instruments and field analysts.

Analytical reference samples are prepared for the AM by USGS laboratories in Denver and Ocala. These samples are analyzed by several laboratories to obtain mean values and standard deviations for major ions and trace metals. The samples are then submitted “blind” to the analytical laboratotory monthly. Laboratory performance will be monitored by both the AM QA Officer and the laboratory QA Officer to determine if corrective action is required.

The laboratories are also voluntary participants in the USGS-sponsored Standard Reference Sample program, in which samples similar to those mentioned above are submitted to the laboratory as known reference samples. The performance is reviewed by the USGS, and laboratory audits are conducted as needed.

Refer to section 14 of the DEP Laboratory QA Plan (#870688G) for further information.

Quality Assurance Reports

Quality Assurance reports will be prepared by the QA Officer of the sampling agency and submitted quarterly. These reports will include a title page, a discussion of performance and systems audits performed during the quarter, a discussion of any significant QA problems encountered during the quarter, and a discussion of action taken to correct these problems. The reports will be submitted to the Contract Manager who will forward the reports to the AM section QA Officer and the DEP QA officer. Quarterly QA reports will be in the format specified in Attachment A this plan. In addition, a list of quality control samples taken during the quarter will constitute a sixth section of the quarterly report.

Please refer to section 15 of the DEP Central Laboratory QA Plan (870688G) for information concerning laboratory quality assurance reports. Reports are kept on file with the DEP AM Section for documentation of significant QA problem. Please note, all Quarterly QA Reports should be received by the AM Section within 30 days after the end of the specific quarter (exception for counties). The begining month of each quarter is defined as 1st quarter October, 2nd quarter January, 3rd quarter April, and the 4th quarter July.

Resumes

Resumes for the AM Administrator and QA Officer are included in this section. Resumes of sampling agency personnel will be included in the QA supplement submitted by the sampling agency.

Resumes of laboratory personnel are found in section 16 of the Laboratory QA Plans (#870688G - DEP).

QA Plan Supplement

Sampling agencies choosing to adopt the AM QAPP must provide a supplement containing the following information:

Signatures Page

The individuals who sign the QA plan shall be those people with the authority and responsibility for assuring that the plan is being followed by the organization.

a) Those individuals should be the Contract Manager and QA Officer for the Sampling Agency.
b) The appropriate titles and names of each signator must be typed under the signature line.
c) The signatures must be original.

Statement of Understanding and Intent

A statement of understanding and intent with respect to the AM Network Quality Assurance Project Plan will be included (see page 2).

Project Organization

The project organization of the sampling agency should be shown in an organizational chart showing lines of responsibility. Names and titles of the following personnel must be included: Project Manager, QA Officer, Data Manager, and sampling personnel.

Sampling Equipment List

Provide a table listing all equipment to be used for purging, sampling, and field measurements. The list should specify equipment manufacturer, model number, number of units, and constructional details, if relevant.

Calibration Standards

Provide a table showing standards used to calibrate field instruments. Indicate sources of standards, how standards are stored and replacement frequencies.

Preventive Maintenence

Provide a list of the routine maintenance activities for field instruments and sampling equipment listed above. Include the frequency of these activities.

Resumes

Brief resumes must be provided for all sampling agency personnel listed in the organizational chart.

Other

Provide detailed descriptions of any intended deviations from the AM QA Plan. Each deviation should be titled with the section and page number from the plan where the procedure to be deviated from is described. Figures should be included where relevant.

Statement of Intent

In accordance with DER Rule 62-160.300, all organizations in direct contract with the Department of Environmental Protection for sample collection are required to submit to the DEP for review a Quality Assurance Project Plan (QAPP). The purpose of the QAPP is to ensure that organizations submitting data to DEP are generating data of a known precision, accuracy, and comparability. A Quality Assurance Project Plan has been written to address all sampling performed for the Ambient Monitoring Network (AMN). Signatures on this Quality Assurance Plan Supplement indicate as per contract that all sampling done by

_____
sampling agency

under contract _____
contract number

will be performed in a manner consistent with the procedures described in the AMN QAPP.

FIELD AUDIT

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
AMBIENT MONITORING PROGRAM
2600 BLAIR STONE ROAD
TALLAHASSEE, FL 32399-2400
Telephone (850) 922-5820

Instruction for use of this form: This short form should be used for external and internal audits when there are no known problems. The information requested here is the minimum needed for a successful audit, therefore all items should be completed with a "Y", "N" or n/a. A detailed explanation should be provided in the summary comment section for items marked "N", and please make sure that the proper item number is indicated. Additional information not listed is also welcome, use additional sheets if necessary. Please note: this form is to be used for both surface and ground water audits.

SAMPLING AGENCY _____
PROJECT NAME _____
FIELD PERSONNEL _____
_____

AUDIT TYPE: Internal _____ **Announced** _____ **Surface Water** _____
External _____ **Unannounced** _____ **Ground Water** _____
Both SW & GW _____

AUDITOR NAME(S) _____
_____

AUDIT DATE _____

SECTION 1
GENERAL INFORMATION

(1)	Field QA manual & instrument service manual in field vehicle	Y/N_____
(2)	Reagents, instrument calibration and maintenance records up-date	Y/N_____
(3)	Blank water should be analyte-free (Di-water), check source of water	Y/N_____
(4)	Knowledgeable of troubleshooting procedures (PM)	Y/N_____
(5)	Adequate and proper storage of all reagents and equipment	Y/N_____
(6)	Knowledgeable of safety plan and procedures (OSHA/RCRA)	Y/N_____
(7)	All sampling equipment precleaned & cleaning log up-to-date	Y/N_____
(8)	Record for historic project results available in the field	Y/N_____
(9)	Field notebook & chain of custody forms and filled out properly	Y/N_____

SECTION 2
FIELD PROCEDURE GROUND WATER

(10)	Were well measurements taken properly	Y/N_____
(11)	Was DEP procedure used for taking well purged volume	Y/N_____
(12)	Were bailers used for sampling	Y/N_____
(13)	Was purge and rinse water disposed of properly away from the well	Y/N_____
(14)	Were all samples properly preserved and pH tested	Y/N_____
(15)	Were all chemicals properly handled	Y/N_____
(16)	Waste materials disposed of or stored properly in field	Y/N_____
(17)	Was ground cover used at well	Y/N_____
(18)	Was wellhead properly labeled	Y/N_____

SECTION 3
FIELD PROCEDURE SURFACE WATER

(19) Was water depth taken properly Y/N_____
(20) Water body type (i) stream_____(ii) lake_____(iii) river_____or (iv) other_____
(21) Was a sample profile of system conducted Y/N_____
(22) Was sampling technique (i) grab___(ii) composite____or integrated composite _____
(23) Were flow measurement taken Y/N_____

SECTION 4
SAMPLE ANALYSIS

(24) Instrument calibrated properly & adequately bracket expected range Y/N_____
(25) Was DEP procedure for duplicates adhered to Y/N_____
(26) Field reference sample analyzed under field conditions Y/N_____
(27) Field reference sample results provided by auditor acceptable (pass) Y/N_____
(28) Documentation of QA information on other field parameters (temp etc) Y/N_____
(29) Were duplicates taken in parallel, and field value recorded Y/N_____

SECTION 5
CHAIN-OF-CUSTODY

(30) Were all samples properly labeled, id, date, time, preservative Y/N_____
(31) Was equipment stored in such a way as to avoid contamination Y/N_____
(32) Were samples immediately placed on ice Y/N_____
(33) Were samples protected from melted ice in shipping container Y/N_____

SECTION 6
MISCELLANEOUS

(34) In general, were the samples obtained in a reproducible manner Y/N_____
(35) Were there anomalous conditions or deviations from usual sampling Y/N_____
(36) Was GPS used to determine site location Y/N_____
(37) Was equipment checklist used Y/N_____
(38) Were microland use forms completed in the field Y/N_____
(39) Has sampler attended AM Section training in past 5 years Y/N_____

(40) WAS OVERALL SAMPLING PERFORMANCE ACCEPTABLE Y/N_____

SECTION 7
SUMMARY COMMENTS

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