

**Nebraska Department of Environment and Energy
Standard Operating Procedure (SOP)**

**Water Quality Division
Water Quality Assessment Section – GW**

SOP Number: GW-060

Title: Groundwater Sampling – Nitrates, Pesticides, and Inorganics

Written Date: July 2024

Purpose: To sample groundwater from a variety of wells for nitrate, pesticides, and inorganic constituents in a consistent manner so as to provide accurate and reliable results.

Equipment/Materials Needed:

- See list of sampling equipment and materials, SOP # GW-030, Appendix A

Procedures:

1. Upon arrival at the site, begin filling out inventory sheet as per SOP # GW-110. Prelabel three (3) plastic sample bottles in the manner illustrated in Appendix A.
2. Inspect the well and site for any obvious hazards as per SOPs # GW-110 and 170.
3. Locate a sampling access point as near to the wellhead as is possible.
 - 3.1. Irrigation wells:
 - 3.1.1. In most cases, the well will have been running for a significant period before you arrive onsite. If it is just being started, allow the well to run for at least 15 minutes before initiating sampling. This will typically provide adequate purging of the system (Zlotnik *et al.*, 1995).
 - 3.1.2. Open discharge: for systems that discharge to an open ditch, sampling can be performed at the end of the discharge pipe.
 - 3.1.3. Faucet: On many closed systems, there is a faucet attached to the discharge pipe, usually very close to the wellhead. Some farmers leave a hose attached to this faucet and leave it open slightly. If this is the case, locate the end of the hose for sampling. If there is no hose and the faucet is closed, open it and make sure that there are no accumulations of foreign matter (e.g. leaves, insects/nests, etc.) in the faucet. In some cases, the faucet is stuck or has no handle on it; you may need a pair of pliers to open it. Be sure not to force it. Allow the faucet

to run for several seconds/minutes until the discharge water is clean.

- 3.1.4. Gated pipe: On gated pipe systems, if there is no faucet, locate an accessible gate as close to the wellhead as possible. In many cases, gates are already open or leaking and provide suitable sampling points. If not, open an appropriate gate and make sure that there is no foreign matter within the gate and opening. Especially if the gate is close to the wellhead, pressure within the pipe sometimes makes it difficult or impossible to open the gate, and in many cases the water comes out under high pressure. Be sure not to force the gate. If one gate is too difficult, move downstream (away from the wellhead) until you find one which you can successfully open.
- 3.1.5. No direct access point (blank pipe/center pivots/etc.): On some systems, there are no faucets or gates from which to sample. If this is the case, inspect the system (especially joints or couplings) for leaks or drips from which to obtain a sample. On center pivots, the large union at the top of the riser pipe often leaks; you must climb up the pivot enclosure to access this area. Use great caution in this case (see SOP # GW-170). In some cases, it is necessary to set a container (either the sample bottle or a wide-mouth glass jar) below a leak for several minutes to obtain an adequate sample amount. If there is no place from which to sample, note this instance on the field map and well list, remove the well from further consideration, and move on.

3.2. Domestic wells:

- 3.2.1. Turn on the faucet closest to the well and allow it to run for a period sufficient to purge the pressure tank and lines. In most cases, 15-20 minutes is sufficient for this purpose. If this amount of discharge is likely to cause a mess, attach the garden hose to the faucet and route the discharge to a more convenient or appropriate place.

3.3. Stock wells:

- 3.3.1. If the well is constructed like a typical domestic well, follow Section 3.2.1. If you are sampling a windmill or similar stock well, ensure that the well has been running for a minimum of 15 minutes before sampling, and that the discharge is free of feed, animal waste, or other contaminants.

3.4. Public water supply wells

- 3.4.1. Before sampling a public water supply (PWS) well, contact the supplier for permission and instructions. In many cases, a PWS staff member will need to accompany you in order to unlock gates, wellhouses, etc.

- 3.4.2. Some sampling ports (e.g. faucets) for PWSs are system ports (points of entry); that is, they draw water from several wells. Ensure that the port that you are utilizing is dedicated to only one well.
 - 3.4.3. In many cases, PWS wells are running for a significant period before you arrive onsite (this is especially true in the summer). If this is the case, proceed with sampling. If for some reason the wells have not been running for an extended period of time, make your best attempt at purging the well and/or lines. This may be difficult if the sampling port produces only a small flow.
- 3.5. Monitoring wells
- 3.5.1. If wells are locked or otherwise secured, be sure to obtain keys or other opening devices (e.g. wrenches, etc.) from the appropriate people before leaving on the sampling run.
 - 3.5.2. Open the well (in order to do this, you MUST have a DHHS Water Well Monitoring Supervisor's certificate. If this is not the case, obtain your certification or contact one of the certificate holders in the Section to assist in sampling).
 - 3.5.3. Assemble sampling apparatus. The most common sampling devices are:
 - 3.5.3.1. Bailer: a rigid length of tube with a ball check valve at the bottom, usually lowered into the well via a rope. Bailers are commonly constructed of PVC, Teflon, or stainless steel.
 - 3.5.3.2. Submersible pump: a small pump attached to an electric cable and discharge line via which the pump is lowered into the well. Typical submersible pumps require power from either a 12-volt DC battery or a gas-powered 110- or 220-volt AC generator.
 - 3.5.3.3. Suction pump: a small pump utilizing centrifugal, peristaltic, or diaphragm motion to move water. Suction pumps typically also require a separate power source as in Section 3.5.3.2.
 - 3.5.4. Decontaminate the sampling apparatus. Repeat necessary decontamination between each sampled well.
 - 3.5.4.1. For nitrates and other ions typically documented in the ppm or mg/l range: triple rinse all sampling apparatus with deionized or tap water.
 - 3.5.4.2. For pesticides and other compounds typically documented in the ppb or ug/l range: immerse and scrub all sampling apparatus which comes in contact

with sample water in cleansing solution (Alconox or equivalent); triple rinse with deionized water.

- 3.5.5. Purge the well. The default minimum for purging is three (3) well volumes. Calculate the well volume using the following formula:

$$V = 7.48\pi r^2 d$$

where:

V	=	well volume, in gallons
7.48	=	gallons/cubic foot
r	=	well radius, in feet
d	=	depth of water column in well, in feet

Catch purge water in a 5-gallon bucket or other container of known volume to calculate purge volume. When done purging, dispose of purge water in an appropriate manner.

NOTE: While purging of 3 well volumes is the default methodology, any means which ensure that formation water is sampled with a minimum of disturbance are or may be acceptable. Examples of such methodologies include but are not limited to low-flow sampling and purging to stabilization of pH and conductivity (e.g. to 3 successive readings within 10%). If such methodologies are used, be sure to document them adequately.

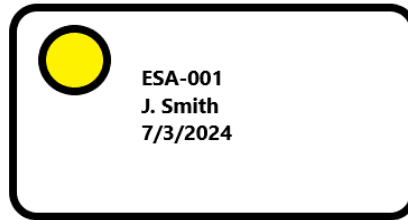
4. Take GPS and field water quality measurements as per SOPs GW-090 and 070, respectively.
5. Obtain groundwater samples, placing them in plastic bottles prelabelled as per Appendix A.
 - 5.1. Nitrate (yellow label/cap): fill the bottle approximately 1/4 full; replace the cap; shake the bottle vigorously; empty; refill the bottle almost full; replace the cap tightly.
 - 5.2. Metals/cations (multi-use, "temporary" bottle): same procedure as Sec. 5.1. The water in this "temporary" bottle will be filtered for total metals and placed in the bottle with the green label/cap as per SOP # GW-080.
 - 5.3. Bicarbonate/anions (plain label/cap): fill the bottle approximately 1/4 full; replace the cap; shake the bottle vigorously; empty; refill the bottle to overflowing and with as little trapped air as possible; replace the cap tightly. To reduce air content further, turn the bottle cap side down and tap on the cap and lower portions of bottle to bring air bubbles to the top. Then, manipulate the bottle until all air bubbles are consolidated. Turn the bottle cap side up and squeeze gently so that the air bubble goes under the cap. Carefully loosen the cap about 1/8 turn so that the air and a small amount of water squirts out. Replace the cap tightly. Repeat as necessary to evacuate as much air as possible.

- 5.4. Pesticides (if indicated by triazine field test as per SOP GW-130; this will be a brown glass 1 l jar with Teflon septum and appropriate lid): DO NOT RINSE; fill the jar almost full; replace the cap tightly. Precleaned pesticide sample jars contain a small amount of preservative, therefore it's important NOT to rinse them out. NOTE: if you are sampling at a remote location (e.g. a center pivot point) far from the sampling vehicle, take one or two extra plain bottles and fill them with sample water as well. This water will serve for nitrate and triazine field tests when you return to the vehicle and can be used to fill a pesticide sample jar if so indicated. Do not carry a pesticide jar into a remote sampling location.
6. Turn off the faucet or shut the gate; collect all samples and equipment. BEFORE LEAVING THE WELLHEAD, MAKE SURE EVERYTHING IS JUST AS YOU FOUND IT.

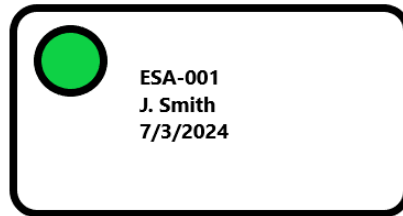
REFERENCE

Zlotnik, V.A., M.E. Burbach, M.E. Exner, and R.F. Spalding. 1995. Well sampling for agrichemicals in high capacity systems. *Journal of Soil and Water Conservation*, vol. 50, no. 1, p. 95-101.

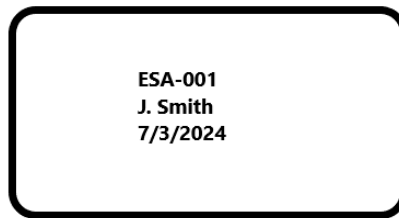
APPENDIX A. Examples of sample container labels (ESA-Example Study Area).



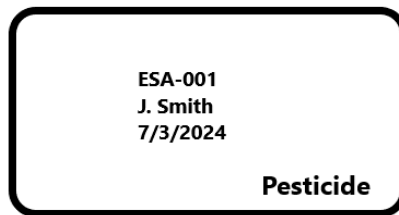
Label for nitrate sample.



Label for metals/cations sample.



Label for bicarbonate/anions sample.



Label for pesticide sample.