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EC98-766 Farm*A*Syst Nebraska's System for Assessing Water Contamination Worksheet 3: Drinking Water Well Condition

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University of Nebraska Cooperative Extension EC 98-766-S

Farm•A•Syst

WORKSHEET 3

Nebraska's System for Assessing Water Contamination Risk

Drinking Water Well Condition

Why should I be concerned?

Essentially all of Nebraska's rural residents use groundwater to supply their drinking water and farm needs. Wells should provide clean water. If wells are improperly constructed or maintained, however, they can allow bacteria, pesticides, fertilizer, oil products, or other pollutants to contaminate groundwater. These contaminants can put family, pets and livestock health at risk.

There are documented cases of well contamination from activities near drinking water wells. The condition of your well and its proximity to contamination sources determine the risk it poses to the water you drink. For example, a cracked well casing allows bacteria, nitrates, oil, and pesticides to enter the well more easily. A spill of pesticides being mixed and loaded near the well could result in the contamination of your family's drinking water supply. Feedlots, animal yards, septic systems, fertilizer applications, and waste storage areas could release large amounts of nitrate that might contaminate your well since groundwater does move. All upslope activities can do the same.

Preventing well water contamination is very important because once the groundwater supplying your well is contaminated, it is very difficult to clean up. The only options may be to treat the water, drill a new well, or obtain water from another source. A contaminated well can pose a serious health threat to your family. The contaminated groundwater supplying your well may also affect your neighbors' wells.

The goal of Farm*A*Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step-by-step through your drinking water well condition and management practices.
- It will evaluate your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand "risk level scores" that will help you analyze the relative safety of your drinking water well condition and management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on page 4. It should take you 15 to 30 minutes to complete this worksheet and determine your risk level. Focus on the well that provides drinking water for your home or farm. If you have more than one drinking water well on your site, fill out a worksheet for each one. If you have additional active wells, other than irrigation wells, on your site, it will be wise to complete a worksheet on each well.

Information derived from Farm*A*Syst worksheets is intended only to provide general information and recommendations to farmers regarding their own farm practices. It is not the intent of this educational program to keep records of individual results.

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Elbert C. Dickey, Interim Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.

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Glossary

These terms may help you make more accurate assessments when completing *Worksheet 3*. They may also help clarify some of the terms used in *Fact Sheet 3*.

Abandoned well: A well, the use of which has been permanently discontinued and which has been decommissioned according to the rules and regulations of the Nebraska Department of Health and Human Services System Regulation and Licensure (Nebraska Title 178, Chapter 12) and the owner has filed a notice of abandonment with the Department of Water Resources.

Active well: A water well which is in use and is not an illegal well.

Air gap: An air space (open space) between a hose or faucet and the water level in a container, representing one way to prevent backflow of liquids into a well or water supply.

Annular space: The space between the wall of the drilled well and the outside of the well casing.

Anti-backflow (anti-backsiphoning) device: A check valve or other mechanical device to prevent unwanted reverse flow of liquids back through a water supply pipe into a well.

Aquifer: Saturated underground formations that will yield usable amounts of water to a well.

Backflow: The unwanted reverse flow of liquids in a piping system.

Backsiphonage: Backflow caused by formation of a vacuum in a water supply pipe.

Bentonite: A processed natural clay material that when hydrated will increase its volume more than seven times. Mixed with water, bentonite forms a grout used for sealing the annular space.

Casing: Steel or plastic pipe installed when drilling a well, to prevent collapse of the well bore hole and entrance of contaminants, and to allow placement of a pump or pumping equipment.

Cross-connection: A link or channel between pipes, wells, fixtures, or tanks carrying contaminated water and those carrying potable (safe for drinking) water. The contaminated water, if at higher pressure, enters the potable water system.

Decommissioning: The act of filling, sealing, and plugging a water well in accordance with the rules and regulations of the Department of Health and Human Services System Regulation and Licensure.

Domestic water well: A water well providing water to any water supply system furnishing water for human consumption other than a public water supply system, or for the watering of livestock, poultry, farm, and domestic animals used in operating a farm, and for irrigation of lands not exceeding a total of two acres in area.

Drilled wells: A well that is constructed with a rotating bit whose cuttings are continuously removed by a stream of drill mud, water, or air. These wells are normally 4 to 8 inches in diameter. Reverse rotary drilled wells can be 24-48 inches in diameter.

Drive-point (sand point) well: A well without casing, with the sandpoint or sand-screen attached directly to the pump suction line, resulting in less than atmospheric pressure in the well when pumped. They are constructed by driving or jetting a pointed well screen connected to a small diameter pipe into water-bearing sand or gravel. This type of well does not meet the requirements of the Department of Health and Human Services System Regulation and Licensure's water well construction, pump installation, and water well abandonment standards.

Dug wells: Large-diameter (typically 30 to 60 inches) wells often constructed by hand, and typically lined with brick, tile, or stone.

Groundwater: Water that occupies voids, cracks, or other spaces between particles of clay, sand, gravel, or rock within the saturated formation.

Grout: A fluid mixture of cement and water (neat cement), cement and sand (sand cement), cement, sand and coarse aggregate (concrete), or bentonite and water used to form a permanent impervious watertight seal in the annular space, or to seal an abandoned well.

Illegal water well: Any water well which has not been properly decommissioned and which meets any of the following conditions:

1. The water well is in such condition that it cannot be placed in active or inactive status.
2. Any necessary operating equipment has been removed, and the well has not been placed in an inactive status.
3. The water well is in such a state of disrepair that continued use for the purpose for which it was constructed is impractical.
4. The water well was constructed after October 1, 1986, but not constructed by a licensed water well contractor or by an individual on land owned by him or her and used by him or her for farming, ranching, or agricultural purposes or at his or her place of abode.
5. The water well poses a health or safety hazard.
6. The water well is an illegal water well as stipulated by Section 46-657 of the Nebraska Statutes which requires permits to drill and registration of a well.

Inactive water well: A water well that is in a good state of repair and for which the owner has provided evidence of intent for future use by maintaining the well in a manner that meets the following:

1. The well does not allow impairment of the water quality in the well or of the groundwater encountered by the water well.
2. The top of the well or well casing has a watertight welded or threaded cover or some other watertight cover with a means to prevent its removal without the use of equipment or tools to prevent unauthorized access, to prevent a safety hazard to humans and animals, and to prevent illegal disposal of wastes into the well.
3. The well is marked so as to be easily visible and located and is labeled or otherwise marked and identified as a water well.

Leaching: Movement of water soluble materials down through the soil with water.

Milligrams per liter (mg/l): The mass of a substance measured in milligrams contained in one liter. In water, 1 mg/l is equivalent to 1 part per million.

Nitrate (NO_3): A nitrogen compound that is soluble in water and is a major plant nutrient. The EPA maximum contaminant level (MCL) for nitrate-nitrogen (**NO_3-N**) in public water supplies is 10 mg/l. Nitrate occurs naturally, but where water exceeds the MCL, it is often because of contamination by fertilizer, animal wastes, or septic systems.

Parts per million (ppm): A measurement of concentration; one unit of material dissolved in one million units of another.

Recharge: Replenishing or building up of groundwater supplies by the seepage or percolation of water.

Water table: The upper level of a saturated formation where the water is at atmospheric pressure, fluctuates with climatic conditions on land surface, and with aquifer discharge and recharge rates.

Well cap (seal): A device used to cover the top of a well casing pipe.

Drinking Water Well Condition: Assessing the Risk of Surface Water and Groundwater Contamination

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your site, read across to the right and circle the statement that best describes conditions on your site. (Skip and leave blank any categories that don't apply to your site.)
3. Then look above the description you circled to find your "risk number" (1, 2, 3, or 4) and enter that number in the blank under "YOUR RISK."
4. Allow 15-30 minutes to complete the worksheet and figure out your risk for drinking water well management practices.

	HIGH RISK (risk 4)	HIGH-MODERATE RISK (risk 3)	MODERATE-LOW RISK (risk 2)	LOW RISK (risk 1)	YOUR RISK
LOCATION* **					
Position of drinking water well in relation to pollution sources.	Settling or depression near casing. Surface water runoff from livestock yard, pesticide and fertilizer mixing area, fuel storage, or dump reaches well.	Downslope from most pollution sources. Some surface water runoff may reach well.	Upslope from or at grade with pollution sources. No surface water runoff reaches well.	Upslope from all pollution sources. No surface water runoff reaches well. Surface water diverted from well.	
Separation distances between well and contamination sources.*	***Violates one or more minimum separation distances.*** ** Some evidence of spillage or leakage of contaminants.	***Violates one or more minimum separation distances.*** ** No evidence of spillage or leakage of contaminants.	Meets or exceeds state minimum required separation distances.*	Meets or exceeds all state minimum recommended and required separation distances.*	
Soil and / or sub-surface potential to protect groundwater.	Coarse-textured soils (sand, loamy sand) or water table or fractured bedrock shallower than 20 feet.	Coarse or moderately coarse textured soils (sandy loam). Water table or fractured bedrock deeper than 20 feet.	Medium-textured soils (loam, silt loam). Water table or fractured bedrock deeper than 20 feet.	Fine-textured soils (clay, clay loam, silty clay loam) and water table or fractured bedrock deeper than 20 feet.	
CONDITION* **					
Condition of casing and well cap (seal).	Holes or cracks visible. Cap loose or missing. Can hear water running.	No holes or cracks visible. Cap loose.	No defects visible. Cap tightly secured. Well vented but not screened.	No holes or cracks. Cap tightly secured. Screened vent.	
Casing depth	Casing does not extend to water level in well or no casing.	Casing extends to water level.	Casing extends to water level but less than 20 feet below the surface.	Casing extends below water level in well and more than 20 feet below surface.	
Annular space seal	***No grout seal.*** **	***Grout seal missing or less than required depth.*** **	_____	Required annular space grout seal is in place.	

Italic Boldface type: Besides representing a higher-risk choice, this practice also violates Nebraska regulations.

* See *Fact Sheet 3* for separation distance requirements.

** Illegal for new well construction, existing wells must meet requirements in effect at time of construction.

*** See *Fact Sheet 3* for Nebraska minimum construction requirements.

	HIGH RISK (risk 4)	HIGH-MODERATE RISK (risk 3)	MODERATE-LOW RISK (risk 2)	LOW RISK (risk 1)	YOUR RISK
CONDITION* (continued)**					
Casing height above land surface	***Below grade or in pit or basement.****	***At grade or up to 8 inches** above.***	***8-12 inches above grade.****	More than 12 inches above grade.	
Well age****	Constructed before 1930.	Constructed between 1930 and 1965.	Constructed between 1965 and 1988.	Constructed since 1988.***	
Well type	Dug well.	Driven-point (sand point).**	Drilled; irrigation, industrial, or unknown construction.	Drilled; drinking water well construction.	
MANAGEMENT					
Backflow prevention	No anti-backflow devices. Air gap not maintained. Cross-connections exist between water supplies.	No anti-backflow devices. Air gap maintained. No cross-connections between water supplies.	Anti-backflow devices installed on some faucets with hose connections. Air gap maintained. No cross connections between water supplies.	Anti-backflow devices (such as check valves) installed on all faucets with hose connections. Air gap maintained. No cross-connections between water supplies.	
Unused well	***Illegal water well at the homesite, not properly decommissioned and sealed.***	***Illegal water well in adjacent field/pasture or other property, not properly decommissioned and sealed.***	Unused wells decommissioned in accordance with Nebraska law, at the homesite or adjacent fields/pasture or other property. All inactive wells in usable condition and properly protected.	No known illegal or inactive water wells at the homesite or adjacent fields/pasture or other property.	
Water testing	No water tests done or tests indicate bacteria, nitrate, or other contaminants frequently above standards. Noticeable changes in color, clarity, odor, or taste after rainstorms, spring melt, or other times.	Irregular testing. Bacteria, nitrate and other tests do not meet standards some of the time.	Regular testing. Record of increased levels of nitrate and other contaminants, but still meet standards.	Regular testing (at least annual). Records indicate consistent, satisfactory water quality. Bacteria, nitrate, and other tests meet standards.	

IItalic Boldface type: Besides representing a higher-risk choice, this practice also violates Nebraska regulations.

* See *Fact Sheet 3* for separation distance requirements.

** Illegal for new well construction, existing wells must meet requirements in effect at time of construction.

*** See *Fact Sheet 3* for Nebraska minimum construction requirements.

**** See *Fact Sheet 3* for standards and regulations in effect when well was constructed.

Your groundwater vulnerability score from *Worksheet 2* was _____
Note: If the surface texture, subsurface texture, or depth to groundwater used to calculate this score are not characteristic of the site conditions present for the activities / practices discussed in this worksheet, calculate a new vulnerability score for this site.

If your groundwater vulnerability score is:
- 1 to 1.4: your site has a LOW VULNERABILITY to pollution reaching groundwater.
- 1.5 to 2.4: your site has a MODERATE-LOW VULNERABILITY to pollution reaching groundwater.
- 2.5 to 3.4: your site has a HIGH-MODERATE VULNERABILITY to pollution reaching groundwater.
- 3.5 to 4.0: your site has a HIGH VULNERABILITY to pollution reaching groundwater.

Your surface water vulnerability score from *Worksheet 2* was _____
Note: If the surface texture, slope toward surface water, or distance from surface water used to calculate this score are not characteristic of the site conditions present for the activities / practices discussed in this worksheet, calculate a new vulnerability score for this site.

If your surface water vulnerability score is:
- 1 to 1.4: your site has a LOW VULNERABILITY to pollution reaching surface water.
- 1.5 to 2.4: your site has a MODERATE-LOW VULNERABILITY to pollution reaching surface water.
- 2.5 to 3.4: your site has a HIGH-MODERATE VULNERABILITY to pollution reaching surface water.
- 3.5 to 4.0: your site has a HIGH VULNERABILITY to pollution reaching surface water.

Look over your worksheet scores for individual activities:

- **Low risk** practices (1's): are ideal and should be your goal regardless of your site's vulnerability to pollution reaching ground or surface water. Cost and other factors may make it difficult to achieve a low risk rating for all activities.

- **Moderate-low risk** practices (2's): provide reasonable water quality protection unless your site's vulnerability to pollution reaching ground or surface water is moderate-high or high.

- **High-moderate risk** practices (3's): do not provide adequate protection in many circumstances, especially if your site's vulnerability to pollution reaching ground or surface water is high or high-moderate. They may provide reasonable water quality protection if your site's vulnerability to pollution reaching ground or surface water is low to moderate-low.

- **High risk** practices (4's): pose a serious danger of polluting water, especially if your site's vulnerability to pollution reaching ground or surface water is high, high-moderate, or moderate-low. Some high risk activities may not immediately threaten water quality if your site's vulnerability to pollution reaching ground or surface water is low, but still pose a threat over time if not corrected.

Read ***Fact Sheet 3 Improving Drinking Water Well Condition*** and consider how you might modify your practices to better protect your drinking water supply and other ground and surface water supplies. Some concerns you can take care of right away; others could be major or costly projects requiring planning and prioritizing before you take action.

Summary Evaluation for Drinking Water Well Condition Worksheet

Summarize your potential high risk activities in the following table and consider the response options you can take to reduce the potential for water quality contamination.

High Risk Activities and Activities Impacted by Site Vulnerability	Response Options (Check One)		Taking Action For "immediate action possible" items, note practices and when each will occur. For issues "requiring further planning," note estimates, consultations, or other activities necessary and when each will occur. Establish a target date for making necessary changes.
	Immediate Action Possible	Further Planning Required	

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