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WORKSHEET 15

Nebraska's Farm Assessment System for Assessing the Risk of Water Contamination

Irrigation Wellhead Protection

Why should I be concerned?

Nebraska's 80,000+ irrigation wells can provide a direct conduit for contaminants to reach groundwater supplies unless properly located, constructed, and protected. Groundwater is the source of drinking water for essentially all of Nebraska's rural residents and most residents of our towns and cities. It is critical that every effort be made to protect groundwater quality. Irrigation wells can be constructed and maintained to assure that groundwater quality is protected. Improperly constructed or maintained wells can allow bacteria, pesticides, fertilizers, oil products, or other pollutants to contaminate groundwater.

Several factors make irrigation wells vulnerable to potential contamination. Wells are located adjacent to or in cropland areas. This means that there is a high probability agricultural chemicals, pesticides, and fertilizers will be applied near the well. It is important that the well construction be such that agricultural chemicals cannot reach the aquifer directly down the well or around the well casing. Past irrigation well construction methods have not been as protective of water quality as provided by current construction regulations.

Many irrigation wells are pumped using an internal combustion engine which means fuel and oil products are used at the well site. A spill of petroleum products at the well site could result in significant groundwater contamination. Application of chemicals through the irrigation water (chemigation) has become a common practice. Backflow or backsiphonage during chemigation without the proper safety equipment can allow chemicals to flow down the well directly into the groundwater.

There are many potential sources of contamination at an irrigation well site. Preventing contamination at an irrigation well is important. Once groundwater is contaminated, it is very difficult and costly to clean up. Contamination will move with groundwater and can eventually reach your or a neighbor's domestic water supply well. Contaminated water can pose a serious health threat for those who use the water.

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 water quality?

1. It will take you step-by-step through an evaluation of the condition of your irrigation well and current irrigation well site management.
2. It will evaluate your activities at the irrigation well site according to how they might affect groundwater quality.
3. It will provide you with "risk level rankings" to help you analyze the relative risk to groundwater quality

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based on the condition of your irrigation well and your activities at the irrigation well site.

4. It will help you determine if your irrigation well is adequately protecting groundwater quality or if some repair and maintenance is needed to help better protect water quality.
5. It will help you determine which of your practices at the irrigation well site are reasonably safe and effective and which practices might require modification to better protect groundwater quality.

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. If you have more than one irrigation well on your farm, fill out a worksheet for 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.

Glossary

These terms may help you make more accurate assessments when completing WORKSHEET 15.

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 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.

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.

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. It is commonly used in a mixture with water as a grout for sealing the annular space of a well.

Casing: Pipe (steel, plastic, or fiberglass) installed when a well is drilled to prevent collapse of the well bore hole and entrance of contaminants, and to allow placement of a pump or pumping equipment.

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 Regulation and Licensure.

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 of an active well 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 a permit to drill and registration of a well.

Inactive Water Well: Any 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 which meets the following requirements:

1. The water well does not allow impairment of the water quality in the water well or of the groundwater encountered by the water well.
2. The top of the water well or water well casing has a water-tight welded or threaded cover or some other water-tight 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 or contaminants into the water well.
3. The water well is marked so as to be easily visible and located and is otherwise marked so as to be easily identified as a water well and the area surrounding the water well is kept clear of brush, debris, and waste material.

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farm, read across to the right and circle the statement that best describes conditions on your farm. (Skip and leave blank any categories that don't apply to your farm.)
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 about 15-30 minutes to complete the worksheet and figure out your risk for irrigation wellhead protection practices.

	HIGH RISK (risk 4)	HIGH-MODERATE RISK (risk 3)	MODERATE-LOW RISK (risk 2)	LOW RISK (risk 1)	YOUR RISK
WELL LOCATION					
Position of well in relation to pollution sources.	Downslope from known significant pollution sources.	Downslope from potential pollution sources.	Slightly upslope or at same grade as potential pollution sources.	Upslope from all known pollution sources.	
Topography of site.	Surface water can reach the well site. Well is located in a depression.	Some surface water may reach well site.	Surface water unlikely to reach site.	Surface water cannot reach or is diverted from site.	
Well location in relationship to cropland.	Located within cropland on which ag chemicals are applied.	Immediately adjacent to cropland on which ag chemicals are applied.	Immediately adjacent to cropland but a chemical non-application buffer zone is maintained at well site.	Location outside cropped area and no chemicals used adjacent to well.	
Type of cropping system used at well site.	Monoculture with intensive pesticide and nutrient application.	Some crop rotation with intensive pesticide and nutrient application or monoculture with integrated pest management and good fertility management.	Crop rotation used, integrated pest management and good fertility management practiced.	Crop rotation with little or no ag chemicals used (nutrients and pesticides).	
Soil and / or subsurface potential to protect groundwater.	Coarse-textured soils (sands, sandy loam). Water table or fractured bedrock shallower than 20 feet.	Medium- to coarse-textured soils. Water table or fractured bedrock deeper than 20 feet.	Medium-textured soils (silt loam, loam). Water table or fractured bedrock deeper than 20 feet.	Fine-textured soils (clay loams, silty clay). Water table or fractured bedrock deeper than 20 feet.	

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

	HIGH RISK (risk 4)	HIGH-MODERATE RISK (risk 3)	MODERATE-LOW RISK (risk 2)	LOW RISK (risk 1)	YOUR RISK
WELL CONSTRUCTION					
Surface completion of well bore.	***Gravel packed to the surface.***	***Annular space grouted but less than 2 feet in depth.***	Annular space grouted for a vertical thickness of at least 2 feet at the 10 foot depth or static water level, whichever is less.	Annular space grouted from a depth of at least 10 feet or static water level, whichever is less, to the ground surface.	
Surface protection at well site.	No wellhead platform.	Platform in place but is cracked.	Platform in place but does not extend beyond bore hole diameter.	Reinforced concrete platform around casing extends at least one foot beyond bore hole diameter. No cracking in platform.	
Type of casing.	No casing.	Concrete casing, joints not sealed.	_____	Steel welded, PVC, solvent welded or gasketed. Asbestos cement with sealed joints. Fiberglass with sealed joints.	
Type of well construction	Dug	Driven	Drilled	_____	
POWER UNIT AND PUMP					
Type of lubrication for turbine pump.	_____	Petroleum-based oil lubrication.	Soybean-based oil lubrication.	Water lubrication.	
Type of energy.	Diesel Gasoline	LP-propane Natural gas	_____	Electric	
FUEL MANAGEMENT FOR INTERNAL COMBUSTION ENGINE POWER UNITS					
Fuel storage tanks at well site.	Obvious leaks and spills, fuel on soil surface, no vegetative growth. No secondary containment.	No obvious leaks, but evidence of past leaks and spills. No secondary containment.	Inspection indicates no evidence of leaks or spills. No secondary containment.	Regular fuel tank maintenance, secondary containment provided, inspection indicates no leaks or spills.	

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	HIGH RISK (risk 4)	HIGH-MODERATE RISK (risk 3)	MODERATE-LOW RISK (risk 2)	LOW RISK (risk 1)	YOUR RISK
FUEL MANAGEMENT FOR INTERNAL COMBUSTION ENGINE POWER UNITS (continued)					
Fuel tank location.	Less than 10 feet from well.	10-50 feet from well.	50-100 feet from well.	More than 100 feet from well.	
Handling of used oil and filters.	Disposal at site on land surface.	_____	_____	Used oil collected and recycled. Filters properly disposed.	
CHEMICAL STORAGE AND HANDLING IN RELATION TO WELL SITE					
Chemical storage and handling at well site.	Chemicals stored at the well site. Mixing is done at the site; no backflow preventors on water supply.	No storage at site. Mixing occurs at the site.	No storage at site. A mixing pad with containment is located at the site.	No chemical storage or handling at well site. (Skip the next question.)	
Chemical mixing and handling location in relationship to well site.	Less than 30 feet from well site.	30 to 50 feet from well site.	50 to 100 feet from well site.	Greater than 100 feet from well site.	
CHEMICAL APPLICATION					
Method of chemical application at well site.	***Chemigation without anti-pollution equipment.***	Chemigation with anti-pollution equipment in place and operable.	Ground application with no buffer area around well. (Skip the next three questions.)	Ground application with buffer area around well or well outside of chemical application area. (Skip the next three questions.)	
Chemigation injection equipment and chemical storage tank location.	Less than 30 feet from well.	30 to 50 feet from well.	50 to 100 feet from well.	Greater than 100 feet from well.	

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

	HIGH RISK (risk 4)	HIGH-MODERATE RISK (risk 3)	MODERATE-LOW RISK (risk 2)	LOW RISK (risk 1)	YOUR RISK
CHEMICAL APPLICATION (continued)					
Condition and monitoring of chemigation system (tanks, hoses, connections, etc.)	Not regularly inspected. Current inspection indicates obvious leaks. No secondary containment.	Not regularly inspected. Current inspection indicates repairs needed and evidence of past leaks. No secondary containment.	Not regularly inspected. Current inspection indicates no obvious past leaks. No secondary containment.	Equipment is inspected before each application. Secondary containment provided for tanks.	
Chemigation anti-pollution equipment.	***No equipment in place or equipment is inoperable.***	***Some equipment is in place*** but not inspected before each application.	All equipment required by regulation or recommended is in place and inspected before each application.	_____	
OTHER CONSIDERATIONS					
Well age	Constructed before 1965.	Constructed after 1965 but not using recommended construction practices or following regulations.	Constructed between 1965 and 1988 following recommended construction practices.	Constructed since 1988 following Nebraska well construction regulations.	
Unused wells	***Illegal water well (unused, unsealed well) near irrigation well site not decommissioned and sealed.***	Unused well(s) near irrigation well site not sealed and decommissioned or placed into inactive status in accordance with Nebraska law. (See glossary for inactive status requirements.)	Unused wells near irrigation well site decommissioned in accordance with Nebraska law. All inactive wells near irrigation well site in usable condition and properly protected.	No known illegal or inactive water wells near irrigation well site.	

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

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.

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 groundwater. 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 groundwater 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 groundwater is high or high-moderate. They may provide reasonable water quality protection if your site's vulnerability to pollution reaching groundwater 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 groundwater 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 groundwater is low, but still pose a threat over time if not corrected.

Consider how you might modify your farm practices to better protect your drinking water supply and other groundwater 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.

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.

Summary Evaluation for Irrigation Wells 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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