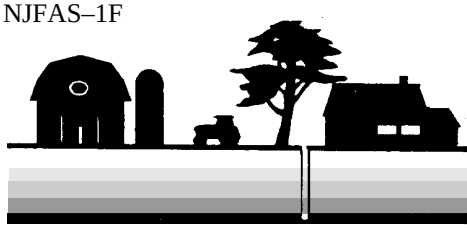


NEW JERSEY
FARM-A-SYST
A FARMSTEAD WATER QUALITY ASSESSMENT SYSTEM

#1 Fact Sheet: Reducing the Risk of Groundwater Contamination by Improving Drinking Water Well Condition

1. Well location

Whether a well taps water just below the ground or hundreds of feet deep, its location on top of the ground is a crucial safety factor. Locating a well in a safe place takes careful planning and consideration of such factors as where the well is in relation to surface drainage and groundwater flow. A well downhill from a livestock yard, a leaking oil storage tank or a failing septic system runs a greater risk of contamination than a well on the uphill side of these sources of contamination.

Surface slope does not always indicate the direction a contaminant might flow once it gets into the ground. In shallow aquifers, groundwater flow is often in the same direction as surface water flow. If the aquifer supplying water to your farmstead well is deep below the surface, though, its slope may be different than that of the land surface. Finding out about groundwater movement on your farm (see Contacts and References) may require special monitoring equipment.

Separation distances

Many states encourage proper well location by requiring minimum separation distances from sources of potential pollution, thus using the natural protection provided by soil. However, state well codes may not mention some farmstead activities and structures. For example, in New Jersey, private well regulations ignore pesticide mixing, pesticide and fertilizer storage not occurring in tanks, vehicle maintenance and farm waste disposal areas. Milkhouse wastewater is not addressed unless it is handled in a soil absorption system or manure storage facility. When no distances are specified, provide as much separation as possible between your well and any potential contamination source—especially if your farmstead is on highly permeable soils or thin soil overlying limestone bedrock, or if the contamination source or activity presents a high risk of contamination.

Minimum separation distances regulate new well installation. Existing wells are required by law only to meet separation requirements in effect at the time of well construction. Make every effort, however, to exceed "old requirements," and strive to meet current regulations whenever possible.

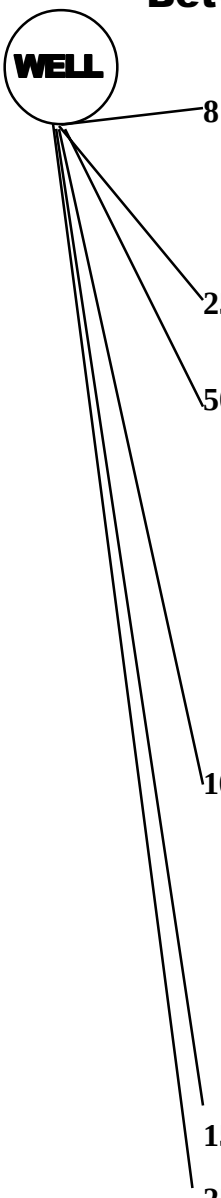
Both soil and slope can make siting a well a tricky business. Keep in mind that separation distances required by the state are minimums. You may want to choose greater separation distances in some cases, depending on factors at your site. This will help provide reasonable assurance that your well will not be polluted by farmstead activities in the future. Also consider contamination sources on adjacent properties.

Changing the location of your well in relation to contamination sources may protect your water supply, but not the groundwater itself. Any condition likely to cause groundwater contamination should be improved, even if your well is far away from the potential source. Whether or not drinking water is affected, groundwater contamination is a violation of New Jersey law.

For glossary, see page 2 of Worksheet #1.

Simply separating your well from a contamination source may reduce the chance of pollution, but it does not guarantee that the well will be safe. Stormwater and groundwater can carry bacteria, oil products and pesticides from one place to another. Wells located in the path of polluted water run a risk of contamination from overland flow washing into an improperly sealed well. Some wells become contaminated through polluted recharge at great distances, depending on the depth of the aquifer and the well intake.

Figure 1: Minimum Separation Distances Between Well and Potential Farmstead Sources of Contamination for New Well Installation



8 feet
- •pesticide or fertilizer storage tank (less than 1500 gallons; nonpotable wells only)
- •silage storage and transfer tube (plastic)
- •nonpotable well
- •cistern

25 feet
- •animal barn pen with concrete floor
- •sewage holding tank

50 feet
- **•septic tank**
- **•building sewer**
- **•distribution box**
- **•dry well**
- •animal shelter or yard
- •feed storage facility, glass-lined
- •manure hopper or reception tank, liquid-tight
- •silo with pit
- •silo without pit, but with concrete floor and drain
- •soil absorption unit (less than 8000 gallons/day)
- •filter strip

100 feet
- **•disposal field**
- **•seepage pit**
- •gasoline and other liquid petroleum products
  - •underground
  - •surface (more than 1500 gallons)
- •fuel oil tanks
  - •underground
  - •surface (more than 1500 gallons)
- •manure storage structure, fabricated, liquid-tight
- •pesticide or fertilizer storage tank (more than 1500 gallons)

150 feet
- **•cesspools**

250 feet
- •liquid waste disposal system
- •manure stack
- •manure storage structure, earthen or excavated
- •silage storage, earthen trench or pit

For sources not addressed: Provide as much separation as possible from well. These are distances in the well code. Local waste storage ordinances may require different separation distances.

General Reference: New Jersey Safe Drinking Water Act, NJ Administrative Code 7:10-12.1 et seq.
*(**boldface type**: represents standards of the New Jersey Safe Drinking Water Act)*

2. Well construction

Poor well design can allow groundwater contamination by allowing rain or snowmelt to reach the water table without filtering through soil. Wells located in pits, or without grout or a cap, can allow surface water to carry bacteria, pesticides, fertilizer or oil products into your drinking water supply. Proper well design reduces the risk of pollution by sealing the well from anything that might enter it from the surface.

The way in which a well was constructed, even if the design is sound, affects its ability to keep out contaminants. Several things that should be checked are described in the following sections. Well construction information may be available from the person who drilled your well, from the previous owner, or from the well construction report.

The construction of wells in New Jersey is affected by the geologic region in which the well is located. Figure 2 lists well construction requirements by region.

Region One (Coastal Plain) includes all of New Jersey south and east of a line drawn between Trenton and New Brunswick. Aquifers in this region are generally sand and/ or gravel, semiconsolidated rock, or shell beds.

Region Two (Piedmont) includes the part of New Jersey extending northwest of a line drawn between Trenton and New Brunswick and a line drawn between Clinton and Suffern, New York. Aquifers in this region are generally sandstone, argillite, shale, diabase, basalt, and sand and/or gravel.

Region Three (Highlands) is the part of New Jersey northwest of Region Two. Aquifers here are generally creviced granite, gneiss, schist, phyllite, limestone, dolomite, shaly limestone, creviced sandstone, shale and siltstone, and sand and/or gravel.

Figure 2: Summary New Jersey Well Construction Requirements (N.J.A.C. 7:10-12.15)

	Oversize Drill Hole		Casing		
	Diameter	**Depth**	**Diameter**	**Depth**	**Screen**
Region 1					
Water Table Well	Casing plus 4" (1)	Min. 10 ft.	Min. 2"	Preferable 50 ft. Minimum 15 ft.	Min. 1 1/4
Artesian Well	Casing plus 4" (1)	To base of confining layer immediately above aquifer used Minimum 30 ft.	Min. 2" (2)	To base of confining layer immediately above aquifer used Minimum 30 ft.	Min. 1 1/4
Region 2					
Water Table and Artesian Well	Casing plus 4"	Min. 20 ft. into unweathered rock	Min. 6"	Min. 20 ft. into unweathered rock	Not normally used
Region 3					
Water Table and Artesian Well	Casing plus 4"	Min. 20 ft. into unweathered rock	Min. 6"	Min. 20 ft. into unweathered rock	Not normally used
Cavernous Limestone	Casing plus 4"	Min. 50 ft.	Min. 6"	Min. 50 ft.	None

1. Except when casing is driven into an undersize hole. (See Section 7:10-12.16(a)1.i(1))

2. If the static level is greater than 25 feet below ground surface and/or the pumping level is greater than 150 feet below ground surface, a minimum casing diameter of 4 inches is required.

This overview of well construction and inspection can help you understand your drinking water contamination risk ranking. For more information, contact a registered well driller. Your local health department can help interpret construction requirements of the private well code.

Casing and well cap

The well driller installs a steel or plastic pipe called casing during construction to prevent collapse of the borehole. The space between the casing and the sides of the hole provides a direct channel for surface water (and pollutants) to reach the water table. To seal off that channel, the driller fills the space with grout (cement, concrete or a special type of clay called bentonite, depending on the geologic materials encountered). Both grout and casing prevent pollutants from seeping into the well.

You can visually inspect the condition of your well casing for holes or cracks at the surface, or down the inside of the casing with a light. If you can move the casing around by pushing against it, you may have a problem with your well casing's ability to keep out contaminants. In areas of shallow (less than 20 feet from surface) fractured bedrock, check on the condition of your well casing by listening for water running down into the well. (Pump should not be running.) If you do hear water, there could be a crack or hole in the casing, or you are not cased down to the water level in the well. Either situation is risky.

To prevent contaminants from flowing down inside of the well casing, the driller installs a tight-fitting, vermin-proof well cap to prevent easy removal by children, and entry by insects or surface water. The cap should be firmly installed, with a screened vent incorporated into it so that air can enter the well. Check the well cap to see that it's in place and tightly secured. Wiring should be in the conduit. If your well has a vent, be sure that it faces the ground, is tightly connected to the well cap or seal, and is properly screened to keep insects out. The well code requires a vermin-proof cap or seal for all private wells. (Not all wells have caps. Some may have pumping equipment attached at the surface.)

Casing depth and height

The depth of casing required by the state private well code for your well depends on the nature of the subsurface geologic materials. See Figure 2 for minimum casing depth requirements for wells in each geologic region. Meeting well code minimums does not, however, guarantee a safe water supply; you may want to exceed minimum casing depth.

Wells cased below the water level in the well can afford greater protection from contamination. Well casing extending at least 30 feet below the water level in your well can ensure that surface water is filtered through soil and geologic materials before entering the well. Deeper cased wells can provide greater sanitary protection but can also result in aesthetic water problems caused by dissolved solids, such as hardness and iron. Typically, the casing extends one to two feet above surrounding land, preventing surface water from running down the casing or on top of the cap and into the well. The private well code requires that at least 12 inches of casing pipe extend above the final grade of the land (N.J.A.C 7:10-12.22).

Well age

Well age is an important factor in predicting the likelihood of high nitrate concentrations. A well constructed more than 70 years ago is likely to be at the center of the farmstead; it may be a shallower well and is probably surrounded by many potential contamination sources. Older well pumps are more likely to leak lubricating oils, which can get into the well. Older wells are also more likely to have thinner casing that is corroded through. Even wells with modern casing that are 30 to 40 years old are subject to corrosion and perforation. If you have an older well, you may want to have it inspected by a qualified well driller.

Well depth

Shallow wells draw from the groundwater nearest the land surface, which may be directly affected by farmstead activities. Depending on how deeply the well casing extends below the water table, rain and surface water soak into the soil and may carry pollutants with it.

Local geologic conditions determine how long it takes for this to happen. In some places, this process happens quickly, in weeks, days or even hours. Areas with thin soil over fractured bedrock or sand and gravel aquifers are particularly vulnerable. Even thick sands over fractured bedrock represent a site vulnerable to contamination.

On the other hand, thick clay soils don't allow contaminants to reach the water table. They may prevent contamination or delay the day when a well "turns bad." If you have a deep well (more than several hundred feet below the water table), the groundwater supplying your well may have traveled a considerable distance underground over a long time, offering greater protection to the well.

3. Managing and maintaining existing wells

You wouldn't let a tractor run too long without an oil change. Your well deserves the same attention. Good maintenance means testing the water every year, keeping the well area clean and accessible, keeping pollutants as far away as possible, and periodically having a qualified well driller or pump installer check the well mechanics.

Better management of your existing well

Existing wells were most likely located according to traditional practice or regulations in place at the time of construction. While these wells are still legal, you may want to consider how well yours conforms to current standards, which incorporate new knowledge about groundwater contamination and well water. These standards can be found in the state private well regulations (N.J.A.C. 7:10-12.1 et seq.).

You should move such activities as pesticide mixing, tank rinsing or gasoline storage further from your well. You might want to upgrade wells, get rid of well pits, install caps or extend casings.

Changing the location of other practices may prove expensive. (You can't move a livestock yard or a silo overnight.) Until you can meet minimum separation distance requirements, change the way you manage such structures to control contaminants.

If your silo is too close to your well, for example, you may want to install a system for collecting any liquid draining from freshly ensiled forage. You could install concrete curbs to direct livestock yard runoff away from the well.

Short-term manure stacks are another example. They pose a risk of well contamination by bacteria or nitrates. Locate them on clay soil or, better yet, a concrete slab to reduce the chance of polluting your drinking water. Also, protect them from rain.

Other management changes you may want to consider include moving traffic areas and chemical or gasoline storage areas away from the well, and upgrading or better management of your septic system.

Backflow prevention

Backflow or backsiphoning from pesticide mixing tanks allows chemicals to flow back into the well through the hose. New Jersey law requires the use of an anti-backflow device when filling pesticide sprayer tanks to prevent the chemical mixture from flowing back into the well and contaminating groundwater. Inexpensive anti-backflow

devices for hoses used to fill farm sprayers may be available from irrigation or spray equipment suppliers.

> Consider purchasing an inexpensive plastic nurse tank. A nurse tank is filled with water at the well and then used to fill the sprayer away from the farmstead—and away from the well. (For more information about preventing well contamination from pesticide mixing and loading practices, see Worksheet and Fact Sheet #2, *Pesticide Storage and Handling*.)

You should also consider anti-backflow devices on all faucets with hose connections or maintain air gaps between hoses or faucets and the water level. Otherwise, you risk having contaminated water in laundry tubs, sinks, washing machines, pressure washers, outside hydrants and swimming pools flow back through plumbing to contaminate your water supply.

> Water supplies that have cross-connections between them (connections between two otherwise separate pipe systems, such as potable and non-potable) also put your drinking water at risk.

All backsiphon and spill events must be reported to the State Government. To report, and to receive advice and assistance in remedying backsiphonage, call the 24-hour Emergency Hotline of NJ Department of Environmental Protection, at (609) 292-7172.

Water testing

Keep an eye on water quality in existing wells by testing them annually. Although you cannot have your water tested for every conceivable pollutant, some basic tests can indicate whether or not other problems exist.

For existing wells, at a minimum, test your water annually for coliform bacteria, lead, and nitrate. Also consider tests for lead, volatile organic chemicals, hardness, sodium, corrosivity, radioactivity, mercury, and radon, depending on geologic conditions and local problems.

For new wells under New Jersey regulations and under local authority, a sample of raw water must be tested for coliform bacteria, nitrates, iron, manganese, and pH. It may also be advisable to include tests for lead, volatile organic chemicals, hardness, sodium, corrosivity, radioactivity, mercury, and radon. Additional testing may be required by the local board of health having jurisdiction. New Jersey regulations mention that local authorities may want to require testing for volatile organic chemicals and/or radon. The local board of health may also require additional treatment of the water. For example, residents of Ocean County should be aware of a County Board of Health regulation which requires additional testing before final certification of new wells. Other counties may have similar regulations. Testing must be done in a laboratory certified by NJDEP.

These test do not include contaminants that could be near your farm—the most commonly used pesticides in your area, for example. Test for contaminants that are most likely at your farmstead. Test for volatile organic chemicals (VOCs) if there has been a nearby use or spill of oil, petroleum or solvent. While testing for pesticides can be very expensive, the expense may be justified if:

- your well has nitrate levels over 10 mg/l (reported as nitrate-nitrogen, NO_3-N)
- a pesticide spill has occurred near the well, or backsiphonage has occurred
- your well is shallow, has less than 15 feet of casing below the water table, or is located in sandy soil and downslope from irrigated crop lands where pesticides are used

You can seek further advice on appropriate tests to run from your county Extension office (ask for Extension bulletin E185 "Interpreting Drinking Water Quality Analysis, What Do the Numbers Mean? 4th Edition") or local health department.

You should test your water more frequently if:

- there are unexplained illnesses in the family
- there are pregnancies in the family
- there are noticeable changes in livestock or poultry performance
- your neighbors find a particular contaminant in their water
- you note a change in water taste, odor, color or clarity
- you have a spill or backsiphonage of chemicals or petroleum products near your well or on your farmstead
- your well is near seawater, road salt storage or a heavily salted roadway
- your well is near a dump, junkyard, landfill, industry, or drycleaner
- you apply chemicals, manure or whey to your fields within 100 feet of your well
- your livestock operation inspectors require it

You can have your water tested by both public and private laboratories. A list of certified labs is available from Rutgers Cooperative Extension (see What to Read About section).

Follow the lab's instructions for water sampling to assure accuracy of results. Use only the container provided, and return samples promptly. Bacteria sample bottles are sterile and must be returned within specified time limits.

Because many materials, including bacteria and nitrate-nitrogen, are naturally present in minor amounts in groundwater or can vary seasonally, you may want to contact a specialist for help in interpreting test results.

Bacteria and nitrates are two important indicators. At excessive levels, they can cause health problems themselves and also may suggest problems with the well's location or construction. Hardness and pH indicate how corrosive the water may be to your plumbing system.

The chloride level also may indicate other problems. In New Jersey, most chloride comes from such human activities as road salts, salt water intrusion, and waste disposal.

Keep in mind that activities off your farm can affect your groundwater. Chemical spills, changes in land use and the presence of landfills can increase the chance of pollutants getting into your water. If your water has a high nitrate or bacteria level, you may want to talk with a specialist about the need for additional testing.

It is also important to record test results and to note changes in water quality over time. In addition to water analysis test results, you should keep records of a few other things to tell what is happening with your water system. These include well construction details, and dates and results of maintenance intervals for the well and pump.

Well maintenance

Well equipment doesn't last forever. Every 10 to 20 years, your well may require mechanical attention from a qualified well driller or pump installer. Follow these additional maintenance practices:

- Do not use gasoline or lawn and agricultural chemicals near your well.
- Do not mix pesticides, rinse sprayer equipment or discard empty pesticide containers near your well.
- Protect wells from household wastewater treatment systems that may back up.

4. New wells

New wells are expensive—but they are a good investment for the future. Getting the most from such an investment means locating the well away from contamination sources and working to maintain the quality of the well. Some simple principles:

- Follow the state recommended minimum separation distances. New Jersey Administrative Code 7:10-12.1 contains these separation distances and other requirements for drinking water wells. See Figure 1 for details.
- Locate your well on ground higher than such surrounding pollution sources as fuel tanks, livestock yards, septic systems or pesticide mixing areas. Where practical, locate the well as far as possible from pollution sources, but no closer than the minimum separation distances required by law.
- If necessary, build soil up around the well so that all surface water drains away from it.
- Avoid areas that are prone to flooding.
- Groundwater flow generally follows surface drainage patterns. Unless you know the exact direction of groundwater flow on your property, locate the well so that pollution sources are between the well and the nearest creek, river or lake. Groundwater generally flows from upland areas and discharges in a surface water body. In all cases, locate your well on ground higher than surrounding pollution sources such as fuel tanks, livestock yards or pesticide mixing areas.
- Make the well accessible for pump repair, cleaning, testing and inspection.
- Hire a competent, licensed well driller and pump installer. Make sure the driller disinfects the well with chlorine after construction and tests the water for bacteria after drilling (as required by state law), and provides you with detailed information about the well's depth and construction.

5. Unused wells

Most farms have unused wells. Old home sites or shallow wells once pumped by windmills are common. No one knows how many abandoned wells there are in New Jersey.

If not properly filled and sealed, these wells can provide a direct conduit for surface water carrying pollutants to groundwater without filtering through soil, or allow contaminant movement from one aquifer to another. One improperly sealed well was buried, and only a stone covered the top of the casing. This well allowed severe contamination of drinking water from a well on the same property. The unused well was near a livestock yard and an absorption field. It provided direct access for the entrance of animal wastes into the groundwater. In addition to these wells being a threat to groundwater, large open wells pose safety hazards for small children and animals.

New Jersey laws (N.J.S.A. 58:4A-4.1 et seq.) and governing regulations (N.J.A.C 7:9-9.1 et seq.) require property owners to seal wells upon abandonment. A licensed well driller who is certified to seal wells must be hired to seal such wells, since effective well plugging calls for experience with well construction materials and methods, as well as a working knowledge of the geology of the well site.

Special equipment is often required to remove old pumps and piping and to properly install sealing material inside the well. Use of inappropriate materials and methods can lead to well settling, collapse and continued groundwater contamination. If plugging materials are improperly installed in a well, patching up defective work is nearly impossible.

Pipes sticking out of the ground around the farmstead, or in an area where a farmstead used to be, or under an old windmill are the most obvious places for finding unused wells.

You may not know the history of your property, however, and unused well locations may not be obvious. A depression in the ground may indicate an old well. Also, wells were often drilled in basements of houses, or under front steps, or near old cisterns.

State well regulations (N.J.A.C. 7:9-9.1 et seq.) also require the well driller to submit reports of well plugging. These regulations also explain well-closing requirements.

Proper well closing takes time and money. Costs will vary with the well depth, diameter and geology of the area. Spending a few hundred dollars plugging an unused well near your home may prevent contamination of your drinking water.

CONTACTS AND REFERENCES

Who to call about...

General Contact

See Introductory Sheet

Certified well water testing laboratories

A listing is available (FS#343: Where to Get Your Drinking Water Tested in New Jersey) from your county Rutgers Cooperative Extension office or the Publications-Distribution Center at Cook College, Rutgers University, (908) 932-9762.

Interpreting well water test results

Your municipal or county health official or county Extension agent.

Drinking water quality standards

U.S. Environmental Protection Agency's Safe Drinking Water Hotline. Call toll free 1(800) 426-4791 from 8:30 A.M. to 5:00 P.M. Eastern time.

A listing is available from your county Rutgers Cooperative Extension office or the Publications-Distribution Center at Cook College, Rutgers University, (908) 932-9762.

Your municipal or county health officials.

Approved water treatment devices

A list is available from your county Extension agent.

Requirements for installation of treatment devices

Before installing treatment devices on water supplies contaminated with nitrates, heavy metals, VOCs, pesticides, microorganisms and other health-related contaminants in excess of enforcement standards, contact your municipal or county health department.

Well construction or inspection

Your local or county health department or registered well drillers (see telephone yellow pages).

Well abandonment (sealing)

Contact NJ Department of Environmental Protection's Bureau of Water Allocation, CN 426, 401 E. State Street, 3rd Floor, Trenton, NJ, 08625-0426 at (609) 292-2957.

What to read about...

Publications are available from sources listed at the end of the reference section. (Refer to number in parentheses after each publication.)

Groundwater, groundwater flow

New Jersey's Water (Clean Water Information Series). 1992. NJ Department of Environmental Protection and Energy. (1)

How To Determine Groundwater Flow Direction. 1991. (4)

Wells, private water systems

Private Water Systems Handbook. 1979. Fourth Edition. 72 pages. MWPS-14. Includes information on wells, ponds, springs and other water supply systems; pumps, piping and water treatment. (Recommendations may not meet New Jersey codes.) (5)

Maintaining Your Home Well Water System. G3399. (2)
Provides a folder for keeping well condition, construction and maintenance records.

Water From Home Wells - Problems and Treatment. 1985. C594. (1)
Recommends water treatment methods that will help you provide palatable water and protect your distribution system.

Home Water Treatment. 1995. NRAES-48. (6)
A reference for common home water treatment devices.

Potable Water: Directions for Disinfecting a Well. 1980. C598. (1)
Describes procedures to disinfect a well with chlorine bleach.

Contamination, testing and interpretation

Interpreting Drinking Water Quality Analysis - What Do the Numbers Mean?. 1994. E185. (1)
Where to Get Your Drinking Water Tested in New Jersey. 1993. Fact Sheet # 343. (1)
Drinking Water Standards. 1994. Fact Sheet #433. (1)
Drinking Water: What Tests Do I Need? 1992. Fact Sheet #434 (1)
Drinking Water Treatment and Conditioning. 1989. Fact Sheet #435. (1)
Nitrates and Groundwater: A Public Health Concern. 1988. (3)

Well abandonment

New Jersey Administrative Code 7:9-9.4. (7)

Publications available from...

1. Your county offices of Rutgers Cooperative Extension (found in the blue pages of the phone book) or the Publications Distribution Center, Cook College, Rutgers University, PO Box 231, New Brunswick, NJ 08903, (732) 932-9762.

2. Agricultural Bulletin, Room 245, 30 N. Murray Street, Madison, Wisconsin 53715, (608) 262-3346. There may be charges for publications, postage and sales tax.

3. Freshwater Foundation at Spring Hill Center, 725 County Road 6, Wayzata, Minnesota 55391, (612) 449-0092.

4. Nutrient and Pest Management Program, 1575 Linden Drive, Madison, Wisconsin 53706, (608) 262-5200.

5. Midwest Plan Service Secretary, Agricultural Engineering Department, 460 Henry Mall, University of Wisconsin, Madison, Wisconsin 53706, (608) 262-3310.

6. Northeast Regional Agricultural Engineering Service, Cooperative Extension, 152 Riley-Robb Hall, Ithaca, NY, 14853-5701.

7. Your public library.

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The New Jersey Farmstead Assessment System is a cooperative project of Rutgers Cooperative Extension, the USDA Natual Resources Conservation Service, and New Jersey Department of Environmental Protection.

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While technical reviewers provided guidance in copy revisions and assisted in assuring accuracy of content, the views expressed in this publication are those of the author and do not necessarily reflect the views of either the technical reviewers or the agencies they represent.

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NJFAS–1F *Reducing the Risk of Groundwater Contamination by Improving Drinking Water Well Condition* 10/95

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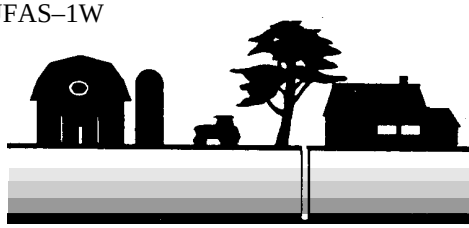

NEW JERSEY
FARM-A-SYST
A FARMSTEAD WATER QUALITY ASSESSMENT SYSTEM

#1 Worksheet: Assessing the Risk of Groundwater Contamination from

Drinking Water Well Condition

Why should I be concerned?

About 95 percent of this country's rural residents use groundwater to supply their drinking water and farmstead needs. Wells are designed to provide clean water. If improperly constructed and maintained, however, they can allow bacteria, pesticides, fertilizer or oil products to contaminate groundwater. These contaminants can put family and livestock health at risk.

There are documented cases of well contamination from farmstead 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 right 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, contaminating your well.

Preventing well water contamination is very important. 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 also affect your neighbors' wells, posing a serious health threat to your family and neighbors.

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 rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" 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 the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Focus on the well that provides drinking water for your home or farm. If you have more than one drinking water well on your farmstead, fill out a worksheet for each one.

Glossary

Drinking Water Well Condition

These terms may help you make more accurate assessments when completing Worksheet #1. They may also help clarify some of the terms used in Fact Sheet #1.

Abandoned well: An unused well that has been permanently closed according to New Jersey regulations.

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

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

Aquifer: Zone in which readily extractable water saturates the pores of the geologic formations.

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

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

Casing: Steel or plastic pipe installed while 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. Contaminated water, if at higher pressure, enters the potable water system.

Drilled wells: Wells not dug or driven, including those constructed by a combination of jetting or driving. These wells are normally 4 to 8 inches in diameter.

Driven-point (sand point) wells: Wells constructed by driving assembled lengths of pipe into the ground with percussion equipment or by hand. These wells are usually smaller in diameter (2 inches or less), less than 50 feet deep, and can be installed in areas of relatively loose soils, such as sand.

Dug wells: Large-diameter wells often constructed by hand.

Groundwater: Subsurface water in a zone of saturation.

Grout: Slurry of cement or clay used to seal the space between the outside of the well casing and the bore hole, or to seal an abandoned well.

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

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

Water table: The upper level of groundwater in a zone of saturation. 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.

Worksheet #1

Drinking Water Well Condition: Assessing Drinking Water Contamination Risk

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

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION					
Position of drinking water well in relation to pollution sources	Upslope from all pollution sources. No surface water runoff reaches well. Surface water diverted from well.	Upslope from or at grade with pollution sources. No surface water runoff reaches well.	Downslope from most pollution sources. Some surface water runoff may reach well.	Settling or depression near casing. Surface water runoff from livestock yard, pesticide and fertilizer mixing area, fuel storage or farm dump reaches well.	____
Separation distances between well and farmstead contamination sources*	Meets or exceeds all state minimum required separation distances.	Meets most minimum separation distances.	Meets minimum separation distances only for sources required to be at least 100 feet from well.	**Does not meet all minimum separation distances for sources required to be at least 100 feet from well.****	____
Soil and/or subsurface potential to protect groundwater	Fine-textured soils (clay loams, silty clay). Water table or fractured bedrock deeper than 20 feet.	Medium-textured soils (silt loam, loam). Water table or fractured bedrock deeper than 20 feet.	Medium- or coarse-textured soils. Water table or fractured bedrock deeper than 20 feet.	Coarse-textured soils (sands, sandy loam). Water table or fractured bedrock shallower than 20 feet.	____
CONDITION***					
Condition of casing and well cap (seal)	No holes or cracks. Cap tightly secured. Screened vent.	No defects visible. Well vented but not screened.	No holes or cracks visible. Cap loose.	Holes or cracks visible. Cap loose or missing. Can hear water running.	____
Casing depth	Cased more than 100 feet below water level in your well.	Cased 31–100 feet below water level in your well.	Cased 10–30 feet below water level in your well.	Cased less than 10 feet below water level in your well. No casing.	____

Boldface type: Besides representing a higher-risk choice, this practice also violates New Jersey law.

*See page 2 of Fact Sheet #1, *Improving Drinking Water Well Condition.*

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

***See page 3 of Fact Sheet #1 for New Jersey's minimum construction requirements.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Casing height above land surface	More than 18 inches above grade.	12–18 inches above grade.	At grade or up to 12 inches above.	Below grade or in pit or basement.	____
Well age	Less than 20 years old.	21–50 years old.	51–70 years old.	More than 70 years old.	____
Well type	_____	Drilled	Driven-point (sand point)	Dug well	____
MANAGEMENT					
Backflow prevention	Anti-backflow devices (such as check valves) installed on all faucets with hose connections. No cross-connections between water supplies.	Anti-backflow devices installed on some faucets with hose connections.	No anti-backflow devices. Air gap maintained.	No anti-backflow devices. Air gap not maintained. Cross-connections between water supplies.	____
Unused well	No unused, unsealed wells.	Unused wells capped and protected.	Unused, unsealed well in field. Not capped or protected.	Unused, unsealed well in farmstead. Not capped or protected.	____
Water testing	Consistent satisfactory water quality. Bacteria, nitrate and other tests meet standards.	Occasional deviation from standards with bacteria, nitrate and other tests.	Bacteria, nitrate and other tests mostly do not meet standards.	No water tests done. Water discolored after rainstorms or during spring melt. Noticeable changes in color, clarity, odor or taste.	____

TOTAL ☐

Use this total to calculate risk ranking on back page of worksheet.

What do I do with these rankings?

Step 1: Begin by determining your overall well management risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals [ ]*
total of rankings; # of categories ranked; risk ranking

*Carry your answer out to one decimal place.

3.6–4=low risk, 2.6–3.5=low to moderate risk, 1.6–2.5=moderate to high risK, 1-1.5=high risk

This ranking gives you an idea of how your well management practices **as a whole** might be affecting your drinking water. This ranking should serve only as a **very general guide, not a precise diagnosis.** Because it represents an **averaging** of many individual rankings, it can mask any **individual** rankings (such as 1's or 2's) that should be of concern. (See Step 2.)

Enter your boxed well management risk ranking on page 1 of Worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you identify your farmstead's site conditions (soil type, soil depth and bedrock characteris tics), and Worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities:
- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection
- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of Worksheet #12.

Step 3: Read Fact Sheet #1, *Improving Drinking Water Well Condition,* and consider how you might modify your farmstead practices to better protect your drinking water.

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While technical reviewers provided guidance in copy revisions and assisted in assuring accuracy of content, the views expressed in this publication are those of the author and do not necessarily reflect the views of either the technical reviewers or the agencies they represent.

This publication is available from your New Jersey county Extension office or from the Publications-Distribution Center, Cook College, Rutgers University, PO Box 231, New Brunswick, NJ 08903, (732) 932-9762.

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