GEORGIA
FARM *A*SYST/HOME *A*SYST

FARM ASSESSMENT SYSTEM

IMPROVING DRINKING WATER WELL CONDITION

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PRE-ASSESSMENT:

Why Should I Be Concerned?

About 95 percent of Georgia's rural residents depend on *ground water* to supply their drinking water and farm needs. Wells are designed to provide clean water. If improperly constructed and maintained, however, they can allow bacteria, nitrates, pesticides, or petroleum products to contaminate *ground water*. These contaminates can put family and livestock health at risk.

There are many documented cases of well contamination from farm 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* can allow bacteria, nitrates, oil, and pesticides to enter the well more easily. A spill of fertilizers of pesticides mixed and loaded near the well could contaminate your family's drinking water supply. Feedlots, fertilizer application, animal yards, septic systems, and waste storage areas could release nitrates and bacteria in amounts that could contaminate your well.

Preventing contamination of your well is very important. Once the *ground water* supplying your well is contaminated, it is very difficult and costly to clean. 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 and pose a health threat to your family and neighbors.

How Does This Assessment Help Protect Drinking Water and the Environment?

- This assessment allows you to evaluate the environmental soundness of your farm and operational practices relating to your drinking water well condition.
- You are encouraged to work through the entire document and use all eight areas when completing the assessment.
- The assessment asks a series of questions about your well condition and location.
- The assessment evaluation uses your answers (rankings) to identify practices or structures that are at risk and should be modified to prevent pollution.
- The well condition facts provide an overview of sound environmental practices that may be used to prevent pollution caused directly by well condition or location.
- You are encouraged to develop an action plan based on your needs as identified by the assessment. The well condition facts, reference and publication list can provide alternatives to current practices as well as structural modifications that can prevent pollution on your farm.
- Farm *A*Syst is a voluntary program.
- The Assessment should be conducted by you for your use. If needed, a professional from the Georgia Cooperative Extension Service or one of the other partnership organizations can provide assistance in completing the assessment or action plan.
- No information from this assessment needs to leave your farm.

** Words found in italics are defined in the glossary.*

ASSESSMENT:

Assessing Your Well Condition

For each category listed on the left, read across to the right and circle the statement that best describes conditions on your farm. If a category does not apply, for example, it asks about the separation distance of your livestock facilities and you don't have any livestock, then skip the distance question. Once you have decided on the most appropriate answer, look above that description to find your rank number (4,3,2 or 1) and enter that number in the "RANK" column. The entire assessment should take less than 30 minutes. A glossary is on page 12 to clarify words found in italics throughout this assessment.

DRINKING WATER WELL CONDITION					
	LOW RISK (rank 4)	**LOW-MOD RISK (rank 3)**	**MOD-HIGH RISK (rank 2)**	**HIGH RISK (rank 1)**	**RANK**
WELL LOCATION					
Position of drinking water well in relation to potential sources	Up slope from all pollution sources. No surface water runoff enters well. Surface water diverted from well.	Up slope from most pollution sources. No surface water runoff enters well. .	Down slope from most pollution sources. Some surface water runoff may enter the well.	Low area near *casing*. Surface water runoff from barnyard, pesticide mixing area, fuel storage, or farm dump enters well.	
Separation distances between well contamination sources *(See table 1)*	Meets or exceeds all state minimum required separtion distances.	Meets or most minimum separtion distances.	Meets minimum separtion distances only for sources required to be at least 100 feet from well.	***Does not meet all minimum separation distances from sources required to be at least 100 feet from well.****	
Soil and/or subsurface potential to protect *groundwater*	Fine-textured soils (clays or clay loams). Water table or lime stone deeper than 20 feet.	Medium-textured soils (silt loam, loam). Water table or lime stone deeper than 20 feet.	Medium- or coarse-textured soils (sands, sandy loams). Water table or lime stone deeper than 20 feet.	Coarse-textured soils (sands, sandy loams). Water table or lime stone shallower than 20 feet.	
CONDITION					
Condition of casing* and *well cap (seal)	No holes or cracks visible. *Cap (seal)* tightly secured. Screened vent.	No defects visible. *Well cap* vented but not screened.	No holes or cracks visible. *Cap (seal)* loose.	Holes or cracks visible. *Cap (seal)* loose or missing. Can hear falling water in well.	
***Casing* depth**	Cased more than 50 feet below water level in well.	Cased 31-50 feet below water level in well.	Cased 10-30 feet below water level in well.	Cased less than 10 feet below water level in well or no *casing*.	
***Casing* height above land surface**	More than 12 inches above grade.	8-12 inches above grade.	At grade or up to 8 inches above.	Below grade or in pit or basement. No concrete curbing around well casing.	

***These conditions are in violation of State and/or Federal law.**

DRINKING WATER WELL CONDITION					
	LOW RISK (rank 4)	**LOW-MOD RISK (rank 3)**	**MOD-HIGH RISK (rank 2)**	**HIGH RISK (rank 1)**	**RANK**
Concrete Curbing	Four inch thick concrete curbing extending at least 2 feet in all directions from well casing and sloping away from casing.	Four inch thick concrete curbing extending at least 2 feet in all directions. Curbing may contain cracks but no more than 1/2 inch wide.	Four inch thick concrete curbing extending at least 2 feet in all directions. Curbing may contain cracks wider than 1/2 inch and/or water channeling under curbing.	No concrete curbing around well casing.	
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) or bored.	Dug well.	
MANAGEMENT					
Backflow prevention	*Anti-siphon devices* installed on all faucets with hose connections. No *cross connections* between water supplies.	*Anti-siphon devices* installed on some faucets with hose connections.	***No anti-siphon devices. Air gap maintained.*****	***No anti-siphon devices. Air gap not maintained. Cross connections between water supplies.*****	
Unused well	No unused, unsealed wells.	Unused wells capped and protected.	Unused well in field. Not capped or protected.	Unused well on farm. Not capped or protected.	
Water testing	Consistent satisfactory quality. Bacteria, nitrate, and other tests meet standards.	Bacteria, nitrate, and other tests occasionally below standards.	Bacteria, nitrate, and other tests rarely meet standards.	No water tests done. Water discolored after rainstorms. Noticeable changes in color, clarity, odor, and taste.	
Maintenance	Well is inspected regularly. Leaks are immediately repaired.	Well is inspected occasionally. Leaks are repaired when needed.	Well is not regularly inspected. Only large leaks are repaired.	Well or piping is leaking.	

*****These conditions are in violation of State and/or Federal law.***

Number of Areas Ranked _____
(Number of questions answered. There are a total of 13 questions.)

Ranking Total _____
(Sum of all numbers in the "RANK" column)

ASSESSMENT EVALUATION:

What Do I Do with These Rankings?

STEP 1: Identify Areas that Have Been Determined to Be at Risk

Low risk practices (4's) are ideal and should be your goal. Low to moderate risk practices (3's) provide reasonable protection. Moderate to high risk practices (2's) provide inadequate protection in many circumstances. High risk practices (1's) are inadequate and pose a high risk for causing environmental, health, economic, or regulatory problems.

High risk practices, rankings of "1" require immediate attention. Some may only require little effort to correct, while others could be major time commitments or costly to modify these may require planning or prioritizing before you take action. All activities identified as "high risk" or "1's" should be listed in the action plan. Rankings of "2's" should be examined in greater detail to determine the exact level of risk and attention given accordingly.

STEP 2: Determine Your Well Risk Ranking

The Well Risk Ranking provides a general idea of how your well condition and farm practices might be affecting your ground and surface water or contaminating your soil.

Use the Ranking Total and the Total Number of Areas Ranked on page 3 to determine the Well Risk Ranking.

RANKINGS TOTAL	÷	TOTAL NUMBER OF AREAS RANKED	=	WELL RISK RANKING
_____	÷	_____	=	_____

WELL RISK RANKING	LEVEL OF RISK
3.6 to 4	Low Risk
2.6 to 3.5	Low to Moderate Risk
1.6 to 2.5	Moderate Risk
1.0 to 1.5	High Risk

This ranking gives you an idea of how your well condition and location might be affecting your drinking water. This ranking should serve only as a very general guide, and not as a precise diagnosis since it represents the average of many individual rankings.

STEP 3: Read the Information/Fact Section on Improving Your Well Condition and Farm Practices

While reading think about how you could modify your practices to address some of your moderate and high risk areas. If you have any questions that are not addressed in the well condition facts portion of this assessment, consult the references in the back of this publication or contact your county Extension agent for more information.

STEP 4: Transfer Information to the Total Farm Assessment

If you are completing this assessment as part of a "Total Farm Assessment," you should also transfer your Well Risk Ranking and your identified high risk practices to the overall farm assessment.

WELL LOCATION

Well location is very important in avoiding drinking water contamination. A well's location is crucial whether it taps water from just below the ground surface or from several hundred feet deep. Locating a well in a safe place takes careful planning and consideration of factors such as the flow of surface water and ground water. A well downhill from animal enclosures, a leaking fuel tank, or a failing septic system is at greater risk of contamination than a well located uphill from these pollution sources.

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

Separation Distance

Requiring minimum separation distance from potential pollution sources encourages good well location, thus using the soil as natural protection. In sandy soils with low organic content, these separation distances may not offer adequate protection. State well codes may not mention all farm activities and structures. For example, in Georgia, the Water Well Standards Act of 1985 does not specifically acknowledge such potential pollution sources as pesticide mixing, pesticide and fertilizer application, vehicle maintenance and waste-disposal areas. For animal husbandry operations, the only specified requirement is that the well shall be not less than 100 feet from an animal or fowl enclosure. Other required setbacks are listed in **Table 1.**

Greater setback distances may be required based on hydrogeology and soil type. When no distances are specified, provide as much separation as possible between your well and any potential contamination source. This is especially important if your farm is on highly permeable soils or thin soil overlying limestone bedrock, or if the contamination source or activity presents high risk of contamination.

Table 1: Minimum Separation Distance Between Well and Potential Farm Sources of Contamination

Separation Distances Required by Georgia Water Well Standards Act of 1985

Distance from Well	
10 feet	Sewer Line
50 feet	Septic Tank
100 feet	Septic Tank Adsorption Field
100 feet	Animal or Fowl Enclosure
150 feet	Cesspool or Seepage Pit

Separation Distances Recommended for Other Farm Sources of Contamination

Distance from Well	
150 feet	Waste Lagoon
150 feet	Dead Animal Burial Pits
100 feet	Pesticide Storage, Mixing, & Loading Facilities
100 feet	Fertilizer Storage
500 feet	Petroleum Tanks

Minimum separation distances are regulated for new well installation. Existing wells are required by law only to meet separation requirements effective at the time of well construction.

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 depending on factors at your site. This and proper well construction help provide reasonable assurance that your

well will not be polluted by farm activities in the near 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 ground water itself. Any condition likely to cause ground water contamination should be addressed, even if your well is far away from the potential source. Ground water contamination is a violation of Georgia law, even if the drinking water is not immediately affected.

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. Storm water and ground water can carry bacteria, nitrates, oil products, pesticides, and other contaminates from one place to another. Wells located in the path of polluted water may be contaminated by surface water washing into an improperly sealed well. Although less likely, some wells may become contaminated through polluted recharge at great distances, depending on the depth of the aquifer and the well intake.

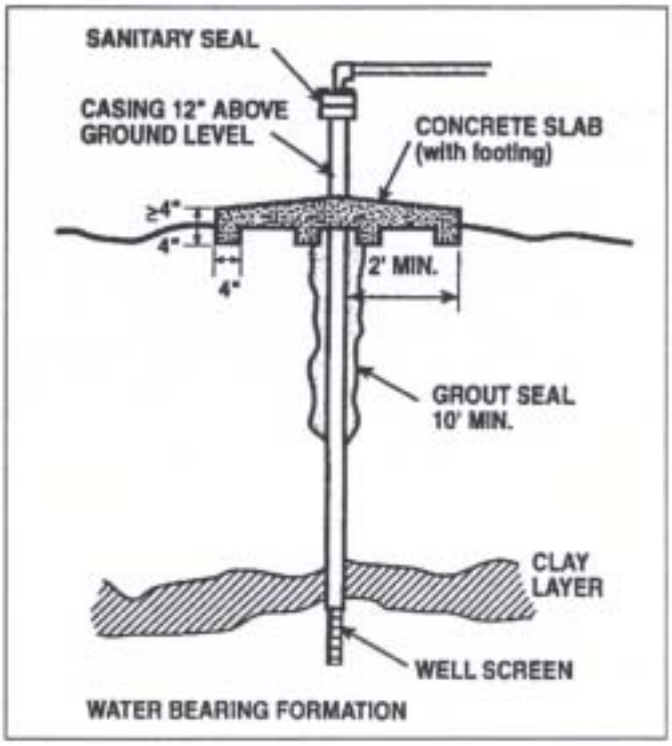

Figure 1: Typical Well Showing Proper Construction to Prevent Contamination

WELL CONSTRUCTION

Poor well design can allow *ground water* contamination by surface water reaching the water table without filtering through soil. Wells located in pits, or constructed without grout or a cap, can allow surface water to carry bacteria, nitrates, pesticides, fertilizer, or oil products into the drinking-water supply. Proper well design and construction reduce pollution risk by sealing the well from anything that might enter it from the surface. **(Figure 1).**

The way in which a well is constructed, even when the design is sound, affects its ability to keep out contaminates. You should check the casing and cap, casing depth and height; and well age, type and depth.

The following overview of well construction and inspection can help you understand your drinking water contamination risk ranking.

Casing and Well Cap

The licensed water well contractor installs a steel or plastic pipe called *casing* during construction to prevent collapse of the borehole. Left unsealed, 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 licensed water well contractor fills the space with grout (i.e., cement, concrete or a special type of clay called bentonite, or a mixture of Portland cement and water, depending on the geologic materials encountered). Both grout and casing prevent pollutants from seeping into the well.

Georgia law requires that, "A well having an open annular space between the casing and borehole shall be grouted and shall be filled with neat or sand cement or other impervious materials to prevent the entrance of pollutants or contaminates." The minimum depth of seal for individual wells is 10 feet. It is preferred, however, that the well grout extends all the way from the ground surface to the water-bearing formation.

With a light you can visually inspect your well casing for holes or cracks at the surface or down the inside of the casing. If you can move the casing around by pushing against it, you may have a problem with your well's ability to keep out contami-

nates. You can check the well casing by listening for water running down into the well when the pump is not running. If you hear running water, there could be a crack or hole in the casing, or the well may not be cased down to the water level. Either situation is risky and reasons not to drink the water until the situation is corrected.

To prevent contaminates from flowing into the top of the well casing, the licensed water well contractor installs a tight-fitting, tamper-resistant, vermin-proof well cap. This also prevents the entry of insects, small animals or surface water. The cap should be firmly installed and include a screened vent so that air can enter the well. Vents should face the ground, be tightly connected to the *well cap* or *seal,* and be properly screened to keep insects out.

Casing Height and Concrete Curbing

In order to prevent surface water contamination from entering the well the upper terminal of the well casing should extend at least 12 inches above ground level. All Georgia wells located in areas subject to flooding shall have a well casing that extends at least two feet above the level of the highest known flood of record.

The Georgia Water Well Standards Act of 1985 also states that "All individual and non-public wells shall be curbed at the surface by the owner with a watertight curbing of concrete at least four inches all directions from the well casing and sloping away from the casing."

Well Age

Well age is an important factor in predicting the likelihood of contamination. A well constructed more than 70 years ago is likely to be at the center of the farm; it may be shallower 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 *casings,* which may be corroded through or improper *grouting*. Even wells with modern *casings* that are 30 to 40 years old are subject to corrosion and perforations. If you have an older well, you may want to have it inspected by a water well specialist or a licensed water well contractor.

Well Type

- **Dug wells** - pose the highest risk of allowing drinking water supply contamination because they are shallow and often poorly protected from surface water. A dug well is a large diameter hole (usually more than 2 feet wide), which is often built by hand.
- **Bored wells** - are constructed using an earth auger, usually up to two feet in diameter. Concrete is the most common casing material. These wells are typically shallow (less than 60 feet) and thus tend to be susceptible to surface contamination. These wells pose a moderate to high risk of contamination.
- **Driven point (sand point) wells -** which pose a moderate to high risk, are constructed by driving assembled lengths of pipe into the ground. These wells are normally smaller in diameter (2 inches or less) and less than 50 feet deep. They can only be installed in areas of relatively loose soils, such as sand.
- **Drilled wells -** cover all other types of wells, including those constructed by a combination of jetting and driving. Drilled wells for farm use are commonly 4 to 8 inches in diameter and when properly constructed pose a relatively low to moderate risk of contamination.

Well Depth

Shallow wells draw from the *ground water* nearest the land surface, which may be directly affected by farm activities. Depending on how far the well *casing* extends below the *water table*, rain, surface water, and irrigation water soak into the soil and may carry pollutants with them.

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

On the other hand, thick clay soils retard the movement of contaminates. These soils prevent contamination, delay the day when a well "turns bad" or change the problem to runoff. If you have a deep well (more than several hundred feet below the *water table*), the *ground water* supplying your well may have traveled a considerable distance underground over a long time, offering greater protection to the well.

MANAGING AND MAINTAINING EXISTING WELLS

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 licensed water well contractor check the well's 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 the degree to which your well water conforms to current drinking water standards. Current standards incorporate new knowledge about *ground water* contamination and well water.

You should move or upgrade management of such activities as pesticide mixing, tank rinsing, or fuel storage if they are within 100 feet of the well. You might want to upgrade wells, get rid of well pits, install caps or concrete curbing or extend casings. In Georgia, well repair and abandonment and new well construction requires a licensed water well construction contractor.

Changing the location of other practices may prove difficult. (You can't move a livestock yard or a silo overnight.) Until you can drill a new well and plug the old one so that you meet minimum separation distance requirements, change the way you manage such structures to control contaminants. For instance, 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, on concrete slab to reduce the chance of polluting your drinking water. Also, protect them from rain that could promote leaching.

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 managing your septic system.

Backflow Prevention

Backflow, or *back siphonage*, from pesticide mixing tanks allows chemicals to flow back into the well through the hose. Use an *anti-siphon device* when filling pesticide spray tanks to prevent the chemical mixture from flowing back into the well and contaminating *ground water*. Inexpensive anti-backflow devices for hoses to fill farm sprayers may be available from irrigation or spray equipment suppliers, but are not reliable protection. An *air gap* should be maintained in systems where feasible. Keep the hose out of the tank when filing the pesticide sprayer.

A better alternative to filling spray tanks at the well is to use a nurse tank and mix and load pesticides in the field.

According to the Rules of Georgia Department of Agriculture, *Prevention of Ground and Surface Water Contamination,* Chapter 40-23-2, all irrigation systems designed or used for the application of fertilizer or chemicals other than pesticides must be equipped with a *backflow* preventer consisting of a functional check valve, low pressure drain, and vacuum breaker. Certain pesticide labels may require additional safety precautions.

You should also consider anti-siphon devices on all faucets with hose connections or maintain *air gap*s between hoses or faucets and the water level. Otherwise, water from laundry tubs, sinks, washing machines, pressure washers, outside hydrants, and swimming pools could flow back through plumbing to contaminate your water supply.

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 other problems exist.

At a minimum, test your water annually for bacteria and nitrate. Testing once for corrosivity is also important. A good initial set of tests for a private well also includes hardness, pH, chloride, and other minerals such as iron and manganese.

The results may not include contaminates that could be near your farm, such as commonly used pesticides in your area, Test for contaminates that are most likely at your farm. Test for lead if you have lead pipes or soldered copper joints. If possible, replace lead pipes. Test for *volatile organic chemicals (VOC's)* if there has been a nearby spill or storage of oil, petroleum or solvent.

While testing for pesticides can be very expensive (often $80-$100 per compound analyzed) the expense may be justified if:

- Your well has nitrate levels over 10mg/1 (Reported as nitrate-nitrogen, NO3-N).
- A pesticide spill has occurred near the well or *back siphonage* 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 croplands where pesticides are used.

Get further advise on appropriate tests to run from your county Extension office or 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 contaminate in their water.
- You note a change in water taste, odor, color or clarity.
- You have a spill or *back siphonage* of chemicals or petroleum products near your well or on you farm.
- You apply chemicals or manure to your fields within 500 feet of your well.
- Your livestock operation inspectors require it.

You can have your water tested by either public or private laboratories. Contact you local county Extension office or health department for water testing information. 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 *ground water* or can vary seasonally, you may want to contact a specialist for help in interpreting test results.

Bacteria and nitrates are two important indicators of *ground water* contamination. 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 our plumbing system.

The chloride level may also indicate other problems In Georgia, chloride in wells may indicate saltwater intrusion into the *aquifer*.

Keep in mind that activities off your farm can affect your *ground water*. 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 note changes in water quality over time. In addition to water analysis test results, you should keep records of a few other things to determine what is happening with your water system. These records would include well construction details, and dates and results of well and pump maintenance.

WELL MAINTENANCE

Well equipment doesn't last forever. Every 10 to 20 years, your well may require mechanical attention from a licensed well contractor. 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.
- Never store fuel, pesticides, empty containers, fertilizers or other potential pollutants near your well.

New Wells

New wells are expensive, but they are a good investments for the future. Getting the most form such an investment means locating the well away from contamination sources and maintaining the quality of the well.

Some simple principles:

- Follow the state-recommended minimum separation distance from potential contamination sources. **See Table 1.**
- Locate your well on ground higher than surrounding pollution sources such as fuel tanks, livestock yards, septic systems or pesticide mixing areas. **See Table 1.**
- Where practical, locate the well as far as possible from pollution sources, but no closer than the minimum separation distances listed above.
- If necessary, build up soil around the well so that all surface water drains away from it and install concrete curbing.
- Avoid areas that are prone to flooding, or extend well *casing* at least two feet above the highest water level on record.

Shallow *ground water* flow generally follows surface drainage patterns. Unless you know the exact direction of *ground water* 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 into 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 using areas.

- Make the well accessible for pump repair, cleaning, testing and inspection.
- Hire a licensed water well contractor. Make sure the contractor disinfects the well with chlorine after construction, testing the water for bacteria after drilling and gives you detailed information about the well's depth and construction.

Unused Wells

Many farms in Georgia have old abandoned wells which are no longer in use. These wells represent a potential threat to other operating wells in the area because they can serve as a conduit for contaminants at the surface to enter the *aquifer*. Never use an *abandoned well* to dispose of garbage or any other material which could contaminate *ground water*.

The "Water Well Standards Act of 1985" requires that all abandoned wells in the state must be "filled, sealed and plugged." In order to legally seal and *abandoned well*, the work must be performed by a licensed water well contractor.

NOTES:

GLOSSARY:

Drinking Water Well Condition

Abandoned well: A well that is no longer used or a well that has been permanently closed according to Georgia 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-siphon device: A safety device used to prevent *backflow* of a mixture of water and chemicals into the water supply.

Aquifer: A subsurface zone or strata of sand, gravel, or fractured rock that is used as a water source.

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

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

Bedrock: The solid rock that is under all soil, sand, clay, gravel and loose material on the earth's surface.

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 4-8 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 and sediments, such as sand.

Dug wells: Large diameter wells often constructed by hand.

Ground Water: 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 borehole, or to seal and *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 *ground water* in a zone of saturation. Fluctuates with climatic conditions on land surface, and with *aquifer* discharge and recharge rates.

Volatile organic compounds (VOC): Chemical release of vapors that escape into the air from certain activities such as burning fuels or opening paint cans. These chemicals contribute to air quality problems and respiratory related illnesses.

ACTION PLAN:

An action plan is a tool that allows you to take the needed steps to modify the areas of concern as identified by your assessment. The outline provided below is a basic guide for developing an action plan. Feel free to expand your plan if you feel the need for detail or additional areas not included. Consult the list of references at the end of this publication if additional assistance is needed to develop a detailed action plan.

Area of Concern	Risk Ranking	Planned Action to Address Concern	Time Frame	Estimated Cost

REFERENCES:

CONTACTS AND REFERENCES			
Organization	**Responsibilities**	**Address**	**Phone Number**
Georgia Department of Agriculture, Pesticide Division	Questions regarding anti-siphon requirements for irrigation systems.	Agriculture Building 19 Martin Luther King Jr. Dr. Atlanta, GA 30334	404-656-4958 www.agr.state.ga.us
Geologic Survey Branch, Environmental Protection Division	Regulations concerning water well drinking standards.	Georgia DNR 19 Martin Luther King Jr. Dr., Suite 400 Atlanta, GA 30334	404-656-4807 (Drinking Water Compliance Program) 404-656-3214 www.state.ga.us/dnr/environ "Geologic Survey Branch"
Biological & Agricultural Engineering Department, University of Georgia	Questions related to wellhead protection or ground water on a farm.	Extension Unit Landrum Box 8112, GSU Statesboro, GA 30460	912-681-5653 www.engr.uga.edu
Drinking Water Program, Environmental Protection Division	Questions regarding public drinking water.	Georgia DNR 205 Butler Street, SE Floyd Towers East, Suite 1152 Atlanta, GA 30334	404-651-5157 www.state.ga.us/dnr/environ "Water Resources Branch"
Safe-Drinking Water Hotline, U.S. Environmental Protection Division	General drinking water questions. 8:30 a.m. - 5:00 p.m. EST	401 M Street SW (Mail Code 4604) Washington, DC 20460	1-800-426-4791 www.epa.gov/safewater
U.S. Environmental Protection Agency	General drinking water questions.	U.S. EPA Region IV 61 Forsyth Street, SW Atlanta, GA 30303	404-562-9424 www.epa.gov/region4
Water Protection Branch, Environmental Protection Division	General water quality questions.	Georgia DNR 4220 International Parkway Suite 101 Atlanta, GA 30354	404-675-6240 or 404-675-1664 www.state.ga.us/dnr/environ "Water Protection Branch"
Pollution Prevention Assistance Division	Pollution prevention references	Georgia DNR 7 Martin Luther King Jr., Dr. Suite 450 Atlanta, GA 30334	404-651-5120 or 1-800-685-2443 www.p2ad.org

PUBLICATIONS:

Environmental Protection Agency (EPA)
National Service Center for Environmental Publications
U.S. EPA/NSCEP
P.O. Box 42419
Cincinnati, Ohio 45242-0419
Phone: 1-800-490-9198 or
1-513-490-8190
M-F 7:30 a.m. - 5:30 p.m. EST
(www.epa.gov/ncepihom)

- Drinking from Household Wells, EPA 570/9-90-013
- LEAD in Your Drinking Water, EPA 810-F-93-001
- Protecting Our Ground Water, EPA 813-F-95-002
- Citizens Guide to Pesticides, EPA

University of Georgia, Cooperative Extension Service
Ag Business Office
Room 203, Conner Hall, UGA
Athens, GA 30602
Phone: 706-542-8999
(www.ces.uga.edu/pubs)

- Water Quality for Private Water Systems, Bulletin 939
- Water Quality Problems: Health and Household, Circular 819-A
- Your Drinking Water: Lead, Circular 819-4
- Your Drinking Water: Pesticides, Circular 819-6
- Well head Protection for Private Domestic Wells, Circular 819-12
- Wellhead Protection for Farm Wells, Circular 819-13
- Water Resource Management in Georgia, Bulletin 206
- Georgia's Ground Water Resources, Bulletin 1096
- Shock Chlorination of Home Wells, Springs and Cisterns, Miscellaneous Publication ENG93
- Ornamental and Turf Pest Control, Special Bulletin No. 10
- Right-of-Way Pest Control, Special Bulletin No. 13
- Public Health Pest Control, Special Bulletin No.11

Northeast Regional Agricultural Engineering Service, Cooperative Extension
Cornell University
152 Riley-Robb, Ithaca, NY 14853-5701
Phone: 607-255-7654
(www.osp.cornell.edu/vpr/outreach/programs/ageng.html)

- Home Water Treatment, NRAES-48. Includes water-treatment basics, physical and chemical treatments, USEPA Primary Drinking Water Standards and health advisories, and pesticide products that contain USEPA drinking-water contaminants. (120pp.)

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