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Louisiana State University
Agricultural Center
Louisiana Cooperative Extension Service

WATER WELL PROTECTION

FACTSHEET 1

Assessing the Risk of Groundwater Contamination from Drinking Water Well Condition

1. WELL LOCATION

Whether a well taps water just below the ground or hundreds of feet deep, its location at the ground surface is a crucial safety factor. A well downhill from a livestock pen, a leaking fuel tank or a failing septic system runs a greater risk of contamination than a well on the uphill side of these pollution sources.

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

Separation Distances

Regulatory agencies encourage good well location by requiring minimum separation distances from sources of potential pollution. However, state well codes may not mention some farmstead activities and structures. When no distances are specified, provide as much separation as possible between well and any potential contamination source --- especially if farmstead is on highly permeable soils, the well is shallow 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. Keep in mind that separation distances required by the state are minimums. Greater separation distances are advisable in some cases, depending on factors at your site. Also consider contamination sources on adjacent properties and possible future pollution sources. Soils and site conditions are considered in more detail in Worksheet 11. See Table 1 for specified minimum separation distances required by the Louisiana Department of Transportation and Development (DOTD), Water Resources Section.

Separating well from a contamination source reduces 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 surface 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.

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

WELL

25 feet 1/	• Another water well
50 feet	• Septic tanks
50 feet 2/	• Storm or sanitary sewer
50 feet 3/	• Drainage canal, ditch or stream
100 feet 4/	• Cesspools • Outdoor privies • Oxidation ponds • Subsurface absorption fields • Pits, etc. • Sanitary landfills • Feed lots • Manure piles • Solid waste dumps and similar installations

1/ This minimum distance requirement does not take into consideration the effects of interference from pumping nearby wells in the same aquifer.

2/ This distance may be reduced to thirty (30) feet if the sewer is of cast iron with leaded joints or Schedule 40 plastic pipe with water-tight joints.

3/ Horizontally measured from the water edge to the well at the highest water level which may have occurred in a ten (10) year period.

4/ For domestic water wells, this distance may be reduced to fifty (50) feet.

Sources: Water Well Rules, Regulations and Standards, State of Louisiana (November 1985).

2. WATER WELLS

The following is an overview of well construction and inspection, which will help you understand your drinking water contamination risk if you are using Worksheet 1. For more detailed information, contact a licensed well driller or contractor. Your parish extension agent or your district DOTD water well technician can help interpret construction requirements of the DOTD regulations.

Water Well Registration

Legislation has been enacted to establish rules, regulations and standards for water well construction. The water well registration is implemented to:

- Help assure the safety of home water supplies.
- Provide data on
    - well construction and drilling practices, and
    - Louisiana's water resources.

The agency responsible for the program's administration is the Water Resources Section of the DOTD.

Registration Forms

Short Form: The short form is used for registering domestic wells, heat pump supply wells, heat pump holes (closed loop systems), abandoned pilot holes, rig-supply wells and monitoring wells.

Long Form: The long form is used for registering irrigation/agricultural wells, power generation wells, observation wells, dewatering wells, test holes, industrial wells and community and non-community supply wells.

Registration Procedures

New Wells: Registration is completed by a licensed contractor or driller.

Wells Constructed prior to 1985: Registration procedure for older wells depends on whether or not a well has been previously inventoried by the DOTD.

If the well has been previously inventoried by the DOTD, the owner can request registration and in doing so enables DOTD to check the inventory record. The owner then confirms and/or updates information and is issued a registration number for the well by DOTD.

If the well has previously not been inventoried by DOTD, the owner should submit the short form. After a DOTD site visit confirms the information, the owner, upon request, is issued a registration number by DOTD.

Submit forms to: Louisiana DOTD
Chief, Water Resources Section
P. O. Box 94245
Baton Rouge, LA 70804-9245

Why register older wells? Remember, it is your water supply! Registration of the well can verify the condition of the well:

- To help protect the health of your family and that of your neighbors, and
- To safeguard against contamination of the well and the supplying groundwater aquifer.

For more information, contact DOTD, Water Resources Section at (504) 379-1434, for registration forms and/or more information on the Water Well Registration Program. Copies of the Louisiana Water Well Rules and Regulations are available on request. A wide variety of water well data is available from DOTD. Contact DOTD for a fee schedule, which outlines the information available, format request and fees.

Pumping

Pumps move water by suction and by pressure. The suction comes when your pump draws water into it from your water source. It pushes with pressure when water passes through the pump and your plumbing system.

Pump selection depends on the capacity and pressure needed to supply uses, the rate of water yield from the aquifier, the depth to the water, and the pump location. With these data, selection of the type, class and size of pump can be made.

Pumps may be classified as shallow-well or deep-well or an air-lift pump.

A shallow-well pump is one that can pull water from a depth of up to 25 feet. Shallow-well pumps depend on atmospheric pressure to force water into the vacuum that the pump develops within a suction pipe. Shallow-well pumps are also used to pump water from tanks, containers and other storages. An example of a shallow-well pump is a centrifugal pump.

A deep-well pump is used to obtain water from any depth, depending on the pump design. These pumps push the water up by using a jet or a submersible pump. Jet

or ejector pumps are widely used on farms. A jet is simply a nozzle supplied with water under pressure. As water passes through the jet, water speed is greatly increased. This causes suction to form around the jet nozzle, pulling more water from the aquifer (see Figure 1).

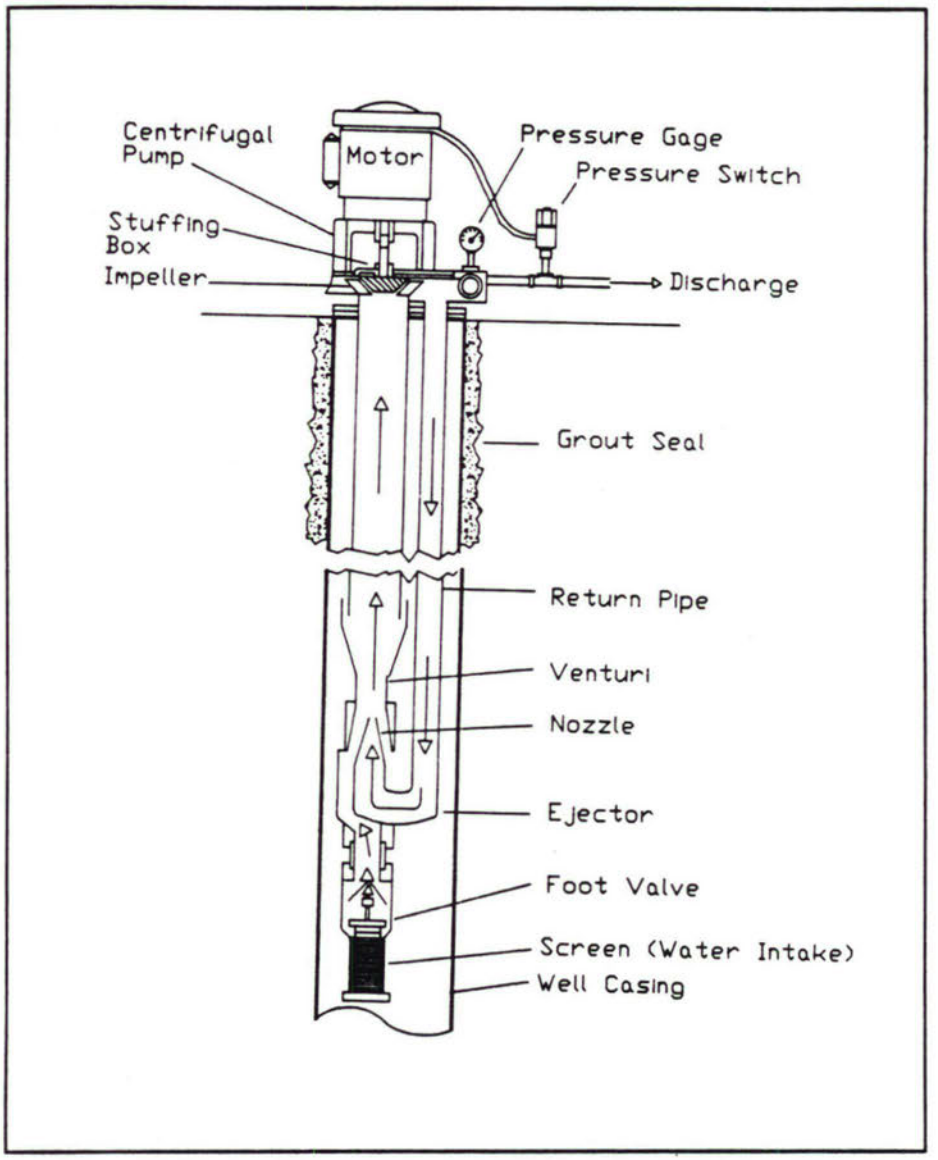


Figure 1: *Schematic of a jet pump installation for a drilled well.*

Submersible pumps are used in deep wells on farms. The whole assembly, including the motor, is let down into the well on the end of a drop pipe. In this way the pump is always filled with water and simply pushes water to the surface. Figure 2 illustrates a schematic of a submersible pump.

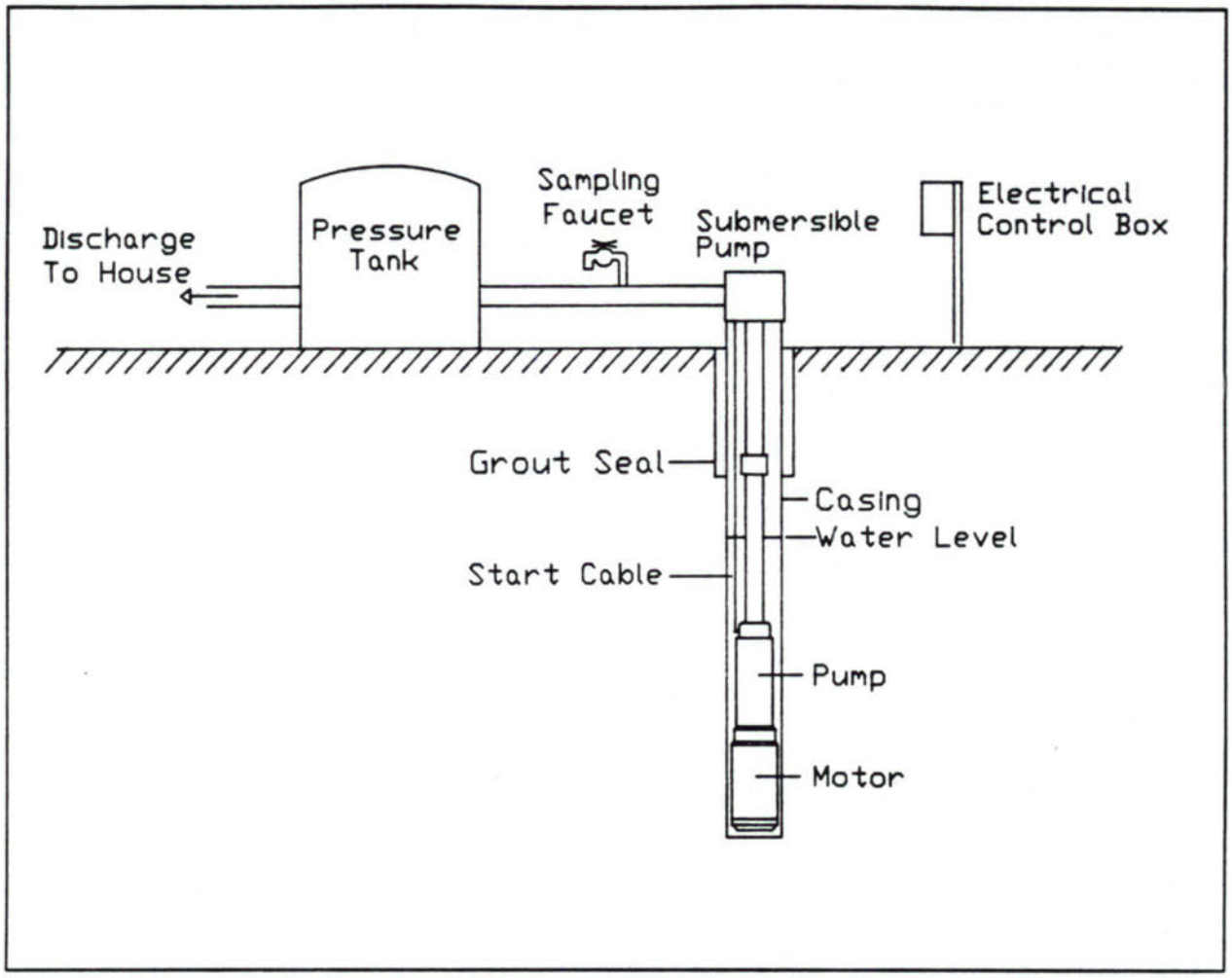


Figure 2: *Schematic of a submersible pump installation for a deep well.*

An air-lift pump releases compressed air into a discharge (eductor) pipe lowered into the well. Air bubbles mix with the water and this reduces the specific gravity of the column of water enough to lift it to the surface (see Figure 3). Air-lift pumps may be used with development and preliminary tests of wells. They are also used in special cases where there is need for aeration to remove an objectionable gas or dissolved solid such as iron, or a highly corrosive, or abrasive water which could be destructive to pump parts submerged in it.

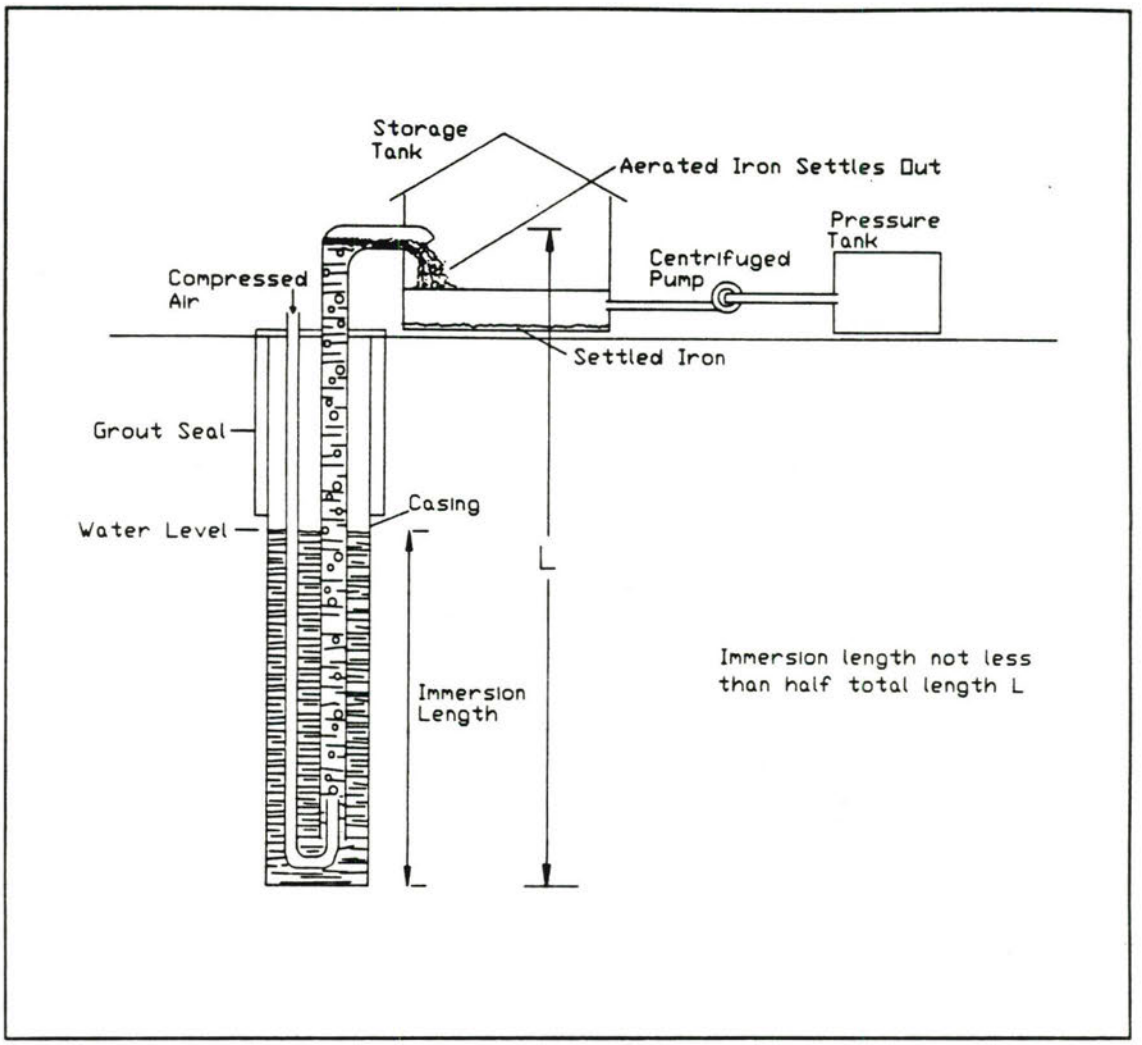


Figure 3: *Schematic of an air lift pump design.*

When planning housing for a pump and/or tank, many farmers have in mind protection from heat, cold and rain. Other factors include meeting the requirements of the Louisiana Sanitary Code; the Water Well Rules, Regulations and Standards; the need for drainage, ventilation, ease of cleaning and servicing equipment and well; and durability of pump and water system.

Well Construction

Poor well design can allow groundwater contamination by allowing rain or flood water to reach the water table without filtering through soil. Wells located in pits or flood-prone areas, or without a proper seal, 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 is constructed affects its ability to keep out contaminants.

Well construction information may be available from the person who drilled your well from the previous owner, or from the DOTD.

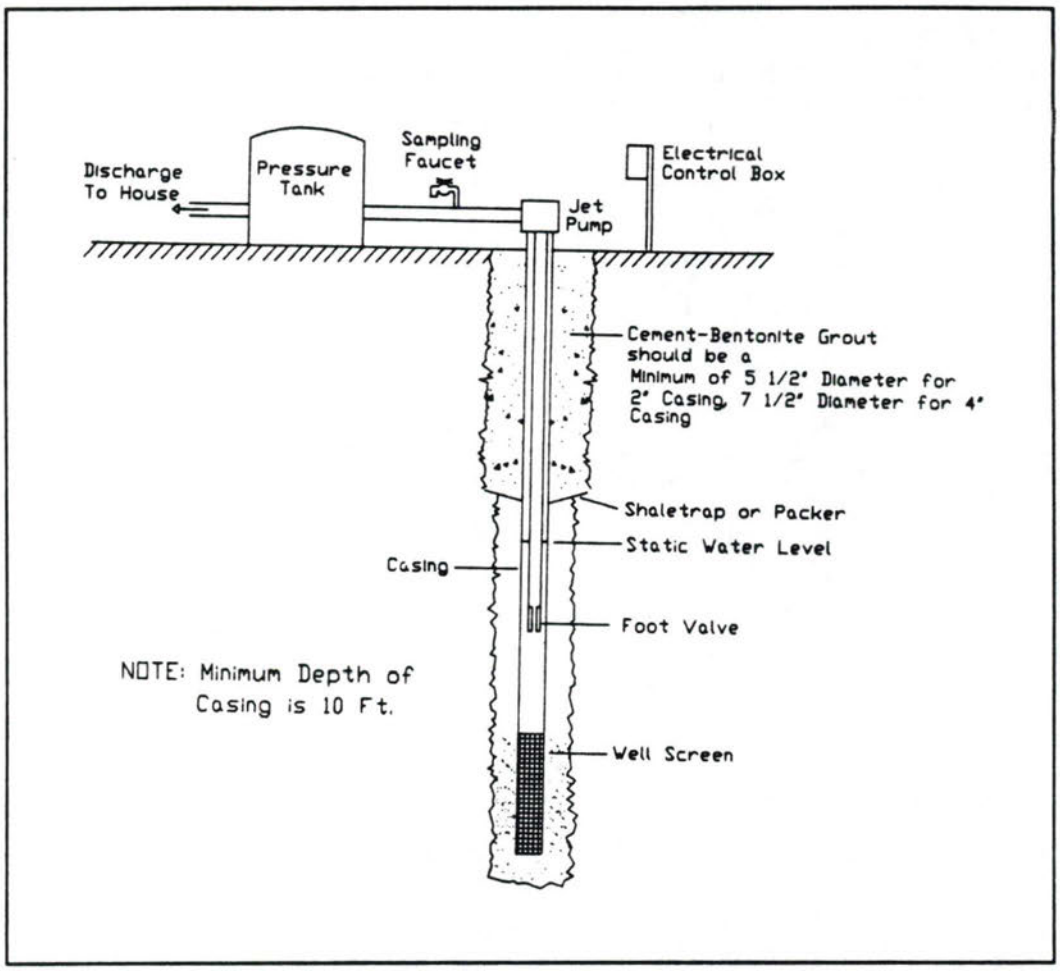


Figure 4: *Schematic overview of a typical private well design and pump installation in accordance with the rules and regulations of the Louisiana Department of Transportation and Development (DOTD).*

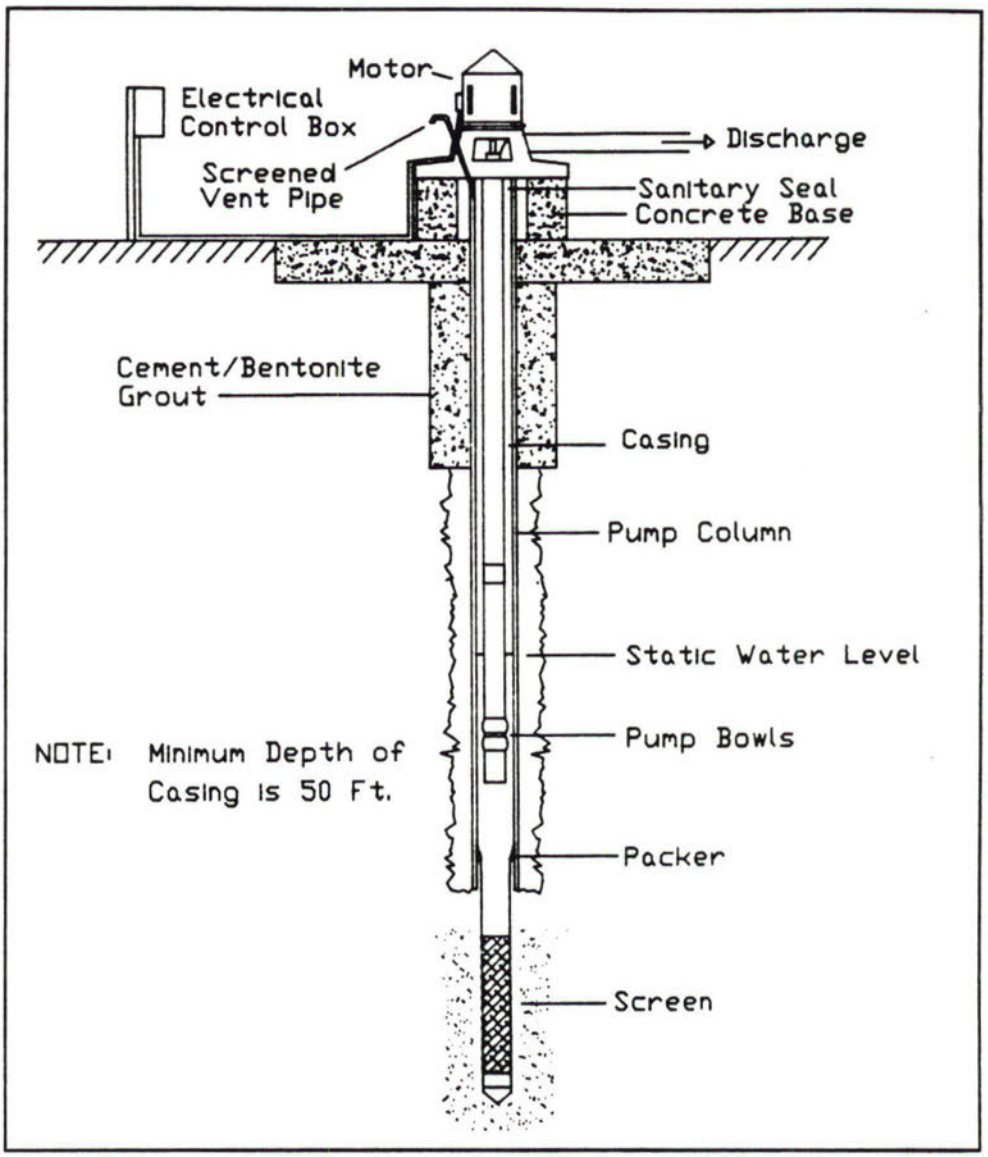


Figure 5: *Schematic overview of a typical deep well design (irrigation) and pump installation in accordance with the rules and regulations of the Louisiana Department of Transportation and Development (DOTD).*

Casing and Well Seal

During construction, the well driller installs a steel or plastic pipe called casing to prevent collapse of the borehole, seal out contaminants and hold the pump and conduct water to it from the aquifer. 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 or cement mixed with a special type of clay called bentonite, depending on the types

of soil encountered). See figure 4 and figure 5 for illustration of a household well and a larger irrigation well.

You can 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 see into it. 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.

Casing Depth and Height

The depth of casing required by the Louisiana Water Well Rules, Regulations and Standards for your well depends on the nature of the subsurface soils and area of the well. Minimum requirements for wells in sand and gravel are that the casing should extend to a depth of 10 feet. Your parish sanitarian or your area DOTD water well technician can advise you on these minimum requirements. Meeting well code minimums does not, however, guarantee a safe water supply; you may want to exceed minimum casing depth.

Typically, the casing extends 1 to 2 feet above surrounding land, preventing surface water from running down the casing or onto the cap and into the well. The Water Well Rules, Regulations and Standards require that at least 12 inches of casing pipe extend above the final grade of the land.

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 farmstead; it may be a shallow well and is probably surrounded by many potential contamination sources. Older well pumps are more likely to leak lubricating oils, which can get into wells. Older wells are also more likely to have thinner casing that may be corroded. 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 licensed well driller or contractor.

Well Types

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 hole (usually more than 2 feet wide), which is often constructed by hand.

Driven wells or drive-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 be installed only in areas of relatively loose soils, such as sand.

All other types of wells, including those constructed by a combination of jetting and driving, are **drilled wells**. Drilled wells for farmstead domestic use are commonly 2 to 4 inches in diameter.

Well Depth

Shallow wells draw from the groundwater nearest the land surface, which is more likely to be affected by farmstead activities. 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 shallow or sand and gravel aquifers are particularly vulnerable, because of the increased risk of leaching of contaminants into the aquifer.

Thick clay soils greatly reduce the possibility of contaminants reaching the aquifer. They may prevent excessive 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 great distance underground over a long time, offering more protection from surface contaminants.

3. MANAGING AND MAINTAINING EXISTING WELLS

You would not 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 area surrounding the well clean and accessible, keeping pollutants as far away as possible, and periodically having a licensed well driller or contractor check the well, pump and pressure tank.

Better Management of your Existing Well

Existing wells were most likely located according to practice or regulations in place at the time of construction. You may want to consider how your well conforms to current standards, which incorporate new knowledge about groundwater contamination. These standards can be found in the Water Well Rules, Regulations and Standards (see Contacts and References) or by contacting your parish extension agent, parish sanitarian or your area DOTD water well inspector.

You might want to move such activities as pesticide mixing and tank rinsing further from your well. You might want to upgrade wells by getting rid of well pits, installing caps or extending casings.

Changing the location of structures may prove expensive. Until you can meet minimum separation distance requirements, you can change the way you manage

such structures to reduce contamination.

If a silo is too close to your well, for example, you may want to install a system for collecting juices draining from freshly ensiled forage.

You could install concrete curbs to direct livestock yard runoff away from the well. Manure or bedding or litter 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 household septic system.

Backflow Prevention

Backflow or backsiphoning from pesticide mixing tanks may allow chemicals to flow back into the well when the water pressure drops because of power failure or a line break. Use an anti-backflow device or air gap 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. If you do not have such a device, always keep the hose out of the tank and maintain an air gap of at least twice the hose diameter when filling the pesticide sprayer.

Consider purchasing an inexpensive 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 USDA Bulletin 2370 and Factsheet 2.

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 in the tank you are filling. Otherwise, you risk having contaminated water in laundry tubs, sinks, washing machines, pressure washers, 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 nonpotable) also put your drinking water at risk and are in violation of the Sanitary Code. Examine your plumbing system carefully to ensure that no cross-connections exist.

Pesticide spills near wells, streams or other water resources must be reported to the local fire department, the Louisiana State Police at (504) 925-6595, the Department

of Environmental Quality at (504) 342-1234 and the Louisiana Department of Agriculture and Forestry at (504) 925-3763.

Water Testing

Ensure 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 may exist. At a minimum, test your water annually for coliform bacteria, an indicator of outside contamination. This test costs about $25-$35 if you take the sample and deliver it to a lab.

Water samples for bacteria tests must be collected in a sterile container. Take the sample from an inside faucet with the aerator removed. Sterilize by flaming the end of the tap with a disposable butane lighter. Run the water for five minutes to clear water lines and bring in fresh water. Do not touch or contaminate the inside of the sample bottle or cap. Carefully open the sample bottle and hold the outside of the cap. Fill the container until overflowing, and replace the top. Refrigerate the sample and transport it to the testing laboratory within six (6) hours (in an ice chest) or in accordance with the lab instructions. Many labs will not accept bacteria samples on Friday, so check the lab's schedule. If your parish sanitarian or a commercial lab will take the sample, the costs will be about $75-$100.

In addition, you should:

Test for lead if your household plumbing contains lead pipe fittings or solder joints and if a young child or expectant mother consumes the water. Test for fuel components or volatile organic compounds (VOC's) if your water smells like gasoline or fuel oil and your well is located near an operating or abandoned gas station or buried fuel tanks.

Test for nitrate if your well is located next to a poultry or livestock barn, if you have an infant under 6 months in age, or an expectant mother in the house who would consume the water.

Test for a pesticide if a spill has occurred near the well, backsiphonage has occurred, or your well is shallow, has less than 15 feet of casing below the water table, or is located in sandy soil and downslope next to irrigated cropland where pesticides are used. Testing for pesticides can be very expensive (often $80-$100 per compound analyzed). There are inexpensive ($15-$20) screening tests for some families of pesticides. Your parish Farm Bureau may be sponsoring such a test. The expense will be much less if you know which pesticide to test for.

It is best to test for contaminants during the spring or summer after a rainy period. Tests should also be conducted after repairing or replacing an old well or water line and after installing a new well or pipe.

You can seek further advice on appropriate tests to run from the office of your parish extension agent, parish sanitarian or your family doctor.

You may need to test your well water if:

- There are unexplained illnesses in the family (check with your doctor)
- There are pregnancies in the family (check for nitrate and lead)
- 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
- You apply chemicals, manure or other organic waste to your fields or gardens within 100 feet of your well

Special Situations

Where you live, or what you are living next to, can sometimes affect the quality of your well water.

If your well is in an area of intensive agricultural use:

Test for pesticides commonly used in the area, coliform bacteria, nitrate, pH and Total Dissolved Solids (TDS).

If you live near a coal or other mining operation:

Test for iron, manganese, aluminum, pH or corrosion index.

If your well is near a gas drilling operation:

Test for chloride, sodium, barium or strontium.

If your water smells like gasoline or fuel oil, and your well is located near an operating or abandoned gas station or buried fuel storage tanks:

> **Test** for volatile organic chemicals (such as gasoline components like benzene and cleaning solvents), pH, TDS, chloride, sulfate and metals.

If your well is in an area where shallow salt water is known to occur or near seawater, and you notice the water tasting salty or signs of corrosion appear on pipes:

> **Test** for chloride, TDS and sodium.

A partial list of private labs is available from your parish Extension agent and the parish sanitarian will know of labs in your area. The Department of Health and Hospitals and the Department of Agriculture and Forestry test well water under certain conditions.

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. Some samples should be put on ice. Some require preservatives such as sulfuric acid which will already be in the sample bottle. Be sure to ask the lab if there are any special sampling requirements.

Because many contaminants, including sodium and nitrate-nitrogen, are naturally present in minor amounts in groundwater or can vary over time, you may want to contact a water quality specialist for help in interpreting test results.

> Bacteria and nitrates are two important indicators of surface contamination. At excessive levels, they can cause health problems 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 may indicate other problems. In Louisiana, most chloride comes from naturally occurring salt or salt water intrusion or oil and gas activities. A level of more than 250 milligrams per liter (mg/l) may indicate contamination or a naturally occurring salt.

Keep in mind that activities off your farm can affect your groundwater. Chemical spills, changes in land use and the presence of old dumps 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 other records to help explain what is happening with your water system. These include well construction details and dates and results of maintenance done on the well and pump.

Well Maintenance

Well equipment does not last forever. Every 10 to 20 years, your well may require mechanical attention from a licensed well driller or pump installer. Follow these additional maintenance practices.

- Do not use or store 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.

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 recommended minimum separation distances and other requirements for drinking water wells. Where practical, locate the well as far as possible from pollution sources, but no closer than the minimum separation distances in the Louisiana Water Well Rules, Regulations and Standards. A full listing is also available from either your parish extension office, a well driller or DOTD.
- Locate your well on ground higher than surrounding pollution sources such as fuel tanks, livestock pens, septic systems or pesticide mixing areas.
- If necessary, build soil up around the well so that all surface water drains away from it.
- Avoid areas that are prone to flooding.
- 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 after construction, 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

Improperly maintained or abandoned wells create a direct channel for surface contaminants to move into aquifers. These aquifers provide water for drinking, irrigation and numerous other uses, and they need to be protected through proper well abandonment practices.

A well is considered abandoned if:

- Its use has been permanently discontinued.
- Its condition does not allow use as a water supply.
- It can potentially transmit surface contaminants into the aquifer.
- It poses a potential health or safety hazard.
- It cannot be restored to a useable condition.

The property owner is responsible for safe well closure and abandonment in accordance with DOTD standards.

Recommended Closure Procedures

Abandoned well closures should be performed by a licensed water well contractor/driller.

Closure Procedure:

1. Remove obstructions from well.
2. Cut off casing (in farming areas, 3 feet below ground surface).
3. Plug well screen.
4. Plug entire well.
5. Seal annular space, if <u>not</u> previously sealed.

Protect your drinking water supply. Have abandoned wells securely closed. It is far less expensive to close abandoned wells properly than to risk contamination of the

water supply and bear the added cost of remedial action. And, above all, never use an abandoned well for waste disposal!

For more information, contact your parish sanitarian, extension agent or contact DOTD at (504) 379-1434 (or at one of their district offices) for forms or additional information on abandoned wells.

GLOSSARY

Drinking Water Well Condition

These terms may help make more accurate assessments when completing Worksheet 1, and they may help clarify some of the terms used in this Factsheet.

Abandoned Well: A water well that has been permanently discontinued, has had its pumping equipment permanently removed, is in such a state of dispair that it cannot be used to supply water and/or has the potential for transmitting surface contaminants into the aquifer, poses potential health or safety hazards or the well is in such a condition that it cannot be placed in service.

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

Air-Lift Pump: Operates by the injection of compressed air directly into the water inside a discharge or eductor pipe at a point below the water level in the well. Injection of air results in a mixture of air bubbles and water. This compound fluid is lighter than water so that a heavier column of water on one side displaces a lighter mixture of air and water on the other side, forcing it upward and out of the discharge pipe.

Annulus: The space between the drill hole and the well casing.

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

Aquifer: Subsurface zone in which easily pumped water saturates the pores of the sand or gravel layers.

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

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

Borehole: A man-made hole in the earth.

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

Centrifugal Pump: A simple pump with an impeller wheel.

Coliform Bacteria: An indicator microorganism. Their presence in water indicates possible outside contamination, therefore, an increased probability of water-borne disease.

Cone of Depression: The area around a discharging well where the water level in the aquifer has been lowered by pumping. Also called cone of pumping.

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, can enter the potable water system through a cross-connection.

Drilled Wells: Wells not dug or driven, including those constructed by a combination of jetting or driving. These wells are normally 2 to 8 inches in diameter.

Drive-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: Wells of large diameter often constructed by hand.

Fecal Coliform: Group of bacteria used as an indicator of fecal contamination in water. It may indicate human, animal, wildlife or vegetative contamination of water.

Groundwater: Subsurface water in a zone of saturation.

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

Jet Pump: A pump that has the capability to force water through a nozzle and venturi tube and pull more water into the distribution system.

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

Nitrate (NO_3): A mineral form of the element nitrogen. Most soils hold nitrogen reserves resulting from organic buildup in the soil. New nitrogen comes into the soil from many different sources including plant decay, rainwater, animal wastes and commercial fertilizers. Nitrate formation occurs when nitrogen is broken down in the soil by bacteria.

Parts per Million (ppm): A measurement of concentration of one unit of material dispersed in one million units of another. 10,000 ppm is equivalent to 1%.

Potable Water: Water safe for drinking.

Submersible Pump: A pump and motor designed for underwater operation.

TDS: Total Dissolved Solids is measured in mg/l and refers to all particles (organic and inorganic) that are dissolved in water. TDS is extremely useful in determining water quality (salt, brackish or freshwater).

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 Seal: A device used to cover the top of a well casing pipe. A suitable threaded, flanged or welded, watertight cap or compression seal installed at the top of the well casing so as to prevent the entrance of contaminated water or other objectionable material into the well.

CONTACTS AND REFERENCES

Who to call about . . .

Certified Well Water Testing Laboratories

A directory is available from your parish extension agent. Check the yellow pages under **Laboratories - Testing** or with the parish sanitarian.

Pesticide Testing

Contact your parish extension agent or parish sanitarian or the Department of Agriculture and Forestry (see Fact Sheet 2 on pesticides).

Interpreting Well Water Test Results

Contact your parish extension agent or parish sanitarian.

Drinking Water Quality Standards

U. S. Environmental Protection Agency's Safe Drinking Water Hotline. Toll-free telephone number (800) 426-4791 from 8:30 a.m. to 5:00 p.m. EST.
Louisiana Department of Health and Hospitals, Office of Public Health, Health Standards Section, (504) 342-0138.

Approved Water Treatment Devices/Requirements for Installation of Treatment Devices

Contact your parish extension agent, parish sanitarian or local water supply retailer for information on performance standards and installation requirements of water treatment devices.

Locating Possible Sources of Contamination

Qualified plumbers, licensed water well drillers, pump installers or parish sanitarians. Besides locating contamination sources, they can also recommend improvements.

Well Construction, Registration, Inspection and Well Abandonment

Contact the Louisiana Department of Transportation and Development at the telephone numbers listed below in the district nearest to your residence.

Baton Rouge Headquarters	(504) 379-1434
Alexandria	(318) 443-2553, Ext. 104
Baton Rouge	(504) 925-8541, Ext. 104
Chase	(318) 435-5154
Hammond	(504) 345-7390, Ext. 104
Lafayette	(504) 233-7404, Ext. 104
Lake Charles	(318) 439-2406, Ext. 210
Monroe	(318) 343-2811, Ext. 104
New Orleans	(504) 283-3418
Shreveport	(318) 746-6100, Ext. 104

CONTACTS AND REFERENCES

What to read about . . .

Groundwater, Groundwater Flow

League of Women Voters' publication.

Protecting Groundwater from Pesticide Contamination. 1989. Louisiana Cooperative Extension Service (LCES), Pub. 2352.

Protecting Louisiana's Ground Water from Pesticide and Agricultural Chemical Contamination. 1991. LCES, Pub. 2453.

Private Water Systems, Well Abandonment, Construction

Sanitary Code. State of Louisiana. Chapter XII: Water Supplies. Division of Administration, Department of Health and Hospitals, Office of Public Health.

Water Well Rules, Regulations and Standards. State of Louisiana. 1985. Copies available from the Department of Transportation and Development, Water Resources Section.

Roster of Louisiana Water Well Contractors (Drillers) Licensed under R.S. 38:3098. 1992. Copies available from the Department of Transportation and Development, Water Resources Section.

Questions to Ask when Purchasing Water Treatment Equipment. 1989. Louisiana Cooperative Extension Service, Pub. 2364.

Contamination, Testing and Interpreting

Drinking Water Standards. 1989. Louisiana Cooperative Extension Service, Pub. 2368.

Home Water Testing. 1989. Louisiana Cooperative Extension Service, Pub. 2366.

Health Effects of Drinking Water Contaminants. 1989. Louisiana Cooperative Extension Service, Pub. 2366.

Drinking Water. 1989. Louisiana Cooperative Extension Service, Pub. 2365.

Water Testing and Interpretation: The Secondary Drinking Water Standards. 1989. Louisiana Cooperative Extension Service, Pub. 2367.

FARM*A*SYST
Farmstead Assessment System

Funding provided by the USDA Extension Service grant #91-EWQI-1-9310.

Project coordinated at the Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center.

Louisiana State University Agricultural Center, H. Rouse Caffey, Chancellor.
Louisiana Cooperative Extension Service, Bruce Flint, Vice-Chancellor and Director.
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Adapted from the Wisconsin Farm*A*Syst Program by Lydia Ori, Extension Associate, and John W. Branch, Specialist, Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center.

Farm*A*Syst team members: Jan Boydstun, Keith Casanova, and Linda Levy, Louisiana Department of Environmental Quality; David Horcasitas, Louisiana Department of Health and Hospitals; Butch Stegall, Louisiana Department of Agriculture and Forestry; Billy Moore and Emmett Wilson, Soil Conservation Service; J. B. LeRay, Agricultural Stabilization and Conservation Service; Gary Eldridge, Farmer's Home Administration; Wendell Miley, Louisiana Farm Bureau Federation; Clyde Carlson, Louisiana Department of Transportation and Development.

Technical reviews: Bo Bolourchi, Louisiana Department of Transportation and Development; George Cardwell, Capitol Area Groundwater Conservation Commission; Jerry Graves, Department of Entomology, Agricultural Center; and Robert Edling, Department of Biological and Agricultural Engineering, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center.

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Editorial assistance: Jane Honeycutt, and special thanks to Helen Rhodes and Jan Townley, Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center.

Louisiana State University
Agricultural Center
Louisiana Cooperative Extension Service

WATER WELL PROTECTION

FACTSHEET 2

Assessing the Risk of Groundwater Contamination from PESTICIDE STORAGE AND HANDLING

We will look at five areas of pesticide management on your farmstead: 1) pesticide storage practices, 2) mixing and loading practices, 3) spill cleanup, 4) container disposal practices and 5) other management practices.

When handling pesticides, wear proper protective clothing at all times. Personal protection is not addressed in this publication, because the focus is groundwater and drinking water protection. The Contacts and References section provides some safety information sources.

1. PESTICIDE STORAGE PRACTICES

If stored safely in a secure location, pesticides pose little danger to groundwater. Common sense suggests keeping them dry and out of the way of activities that might knock over a jug or rip open a bag.

If a spill does occur in a storage area, an impermeable (waterproof) floor, such as concrete, should minimize seepage of chemicals into the ground. Putting a curb around the floor will help contain the spilled chemicals.

Secondary containment provides an impermeable floor and walls around a storage area, which will minimize the amount of pesticide seeping into the ground if a bulk liquid pesticide storage tank should leak.

A mixing/loading pad provides for secondary containment during the transfer of pesticides to spraying equipment or nurse tanks.

Building a New Storage Facility

Building a new facility just for pesticide storage may be expensive, but generally it will be safer than trying to modify areas meant for other purposes.

When building a new facility, keep in mind a few principles of safe pesticide storage:

1. Locate the building downslope and at least 100 feet away from your well. Separation from the well should be greater if the site has sandy soils or gravel deposits near the land surface.

2. In the event of a fire, contaminated surface water should drain to a confined area.

3. The mixing and loading area should be close to your storage facility, to minimize the distance that chemicals are carried.

4. The building foundation or secondary containment floor should be well drained and high above the water table. The finished grade outside the building should be at least 3 inches below the floor elevation and sloped to provide surface drainage away from the building. The subsoil should have a low permeability.

5. Provide pallets to keep large drums or bags off the floor. Shelves for smaller containers should have a lip to keep the containers from sliding off. Steel shelves are easier to clean than wood if a spill occurs. Store dry products above liquids to prevent wetting from spills.

6. If you plan to store large bulk tanks, provide a containment area large enough to confine 125 percent of the contents of the largest bulk container, plus the displaced volume of any other storage tanks inside the containment area.

7. A locked storage cabinet or building provides security. Preventing unauthorized use of pesticides reduces the chance of accidental spills or theft. Provide signs or labels identifying the cabinet or building as a pesticide storage area. Signs on the outside of the building should give fire fighters information about pesticides during an emergency response for fire or a spill.

8. Provide adequate road access for deliveries and emergency equipment.

9. Keep pesticides separate to prevent cross-contamination. Herbicides, insecticides and fungicides should be kept on separate shelves or areas.

10. For information on other factors to consider in the design of a storage facility - such as ventilation, water shower access, temperature control and other worker safety features - contact your parish extension office, the Soil Consevation Servic, the Louisiana Department of Agriculture and Forestry area office.

Modifying an Existing Storage Facility

If you decide to improve your current storage building, applying the above principles can be expensive. Compared to the cost of a major accident or a lawsuit, however, storage improvements are a bargain (items 5-10 above are important points to remember for existing storage).

The cheapest alternative you may have is to cut back on the amounts and types of pesticides stored. If that is not practical, consider how you can protect the pesticides you must keep in storage. Sound containers are your first defense against a spill or leak.

If a container is accidentally ripped open or knocked off a shelf, the spill should be confined to the immediate area and cleaned up promptly. The building should have a solid floor and, for liquid pesticides, a curb. The secondary containment space should be large enough to hold 125 percent of the contents of the largest full container, plus the displaced volume of any other storage tanks in the area.

Remodeling existing facilities that serve other uses may be less expensive than building a new facility, but remodeling can be complicated. When existing buildings must accommodate other activities, using them also to store pesticides could compromise the safety of people and the environment. Storing chemicals in a separate facility reduces the risk associated with fire or accidental spills. Never store pesticides inside a wellhouse or a facility containing an abandoned well.

You can reduce damages by anticipating emergencies. Fires in a storage area present a special hazard to people and the environment. If containers are damaged, the stored chemicals may be carried away by water and spread over a large area.

Windows and doors can be labeled to alert fire fighters to the presence of pesticides and other products stored in the structure. It is a good idea to keep a separate list of the chemicals and amounts stored. Keep a copy of the list in the house or away from the storage area.

If a fire should occur, consider where the surface runoff water will go and where it might collect. For example, a curb around a floor can help confine contaminated water.

In making the storage area secure, also make it accessible, to allow getting chemicals out in a hurry.

2. MIXING AND LOADING PRACTICES

Groundwater contamination can result even from small spills in the mixing and loading area. Small quantities spilled regularly in the same place can go unnoticed, but the chemicals can build up in the soil and eventually reach groundwater. By mixing and loading on an impermeable surface, such as concrete, you can contain and reuse most spilled pesticides.

A Mixing and Loading Pad

Containing pesticide spills and leaks requires an impermeable (waterproof) surface for mixing and loading. The pad should be large enough to contain leaks from bulk tanks, wash water from cleaning equipment, and spills from transferring chemicals to the sprayer or spreader (see Figure 1).

The size of the pad depends on the equipment you use. It should provide space around the parked equipment for washing and rinsing. Having several separate rinsate (rinse water) storage tanks allows you to keep rinsate from different chemicals separate. That way, it can be used as mixing water on subsequent loads.

Locate the pad next to the storage area. Make sure that any water from the pad moves away from the well. At sites where runoff water could reach the well, construct a diversion so runoff is directed to another area.

If you are considering constructing a mixing and loading pad, contact your parish extension office or the Soil Conservation Service district conservationist.

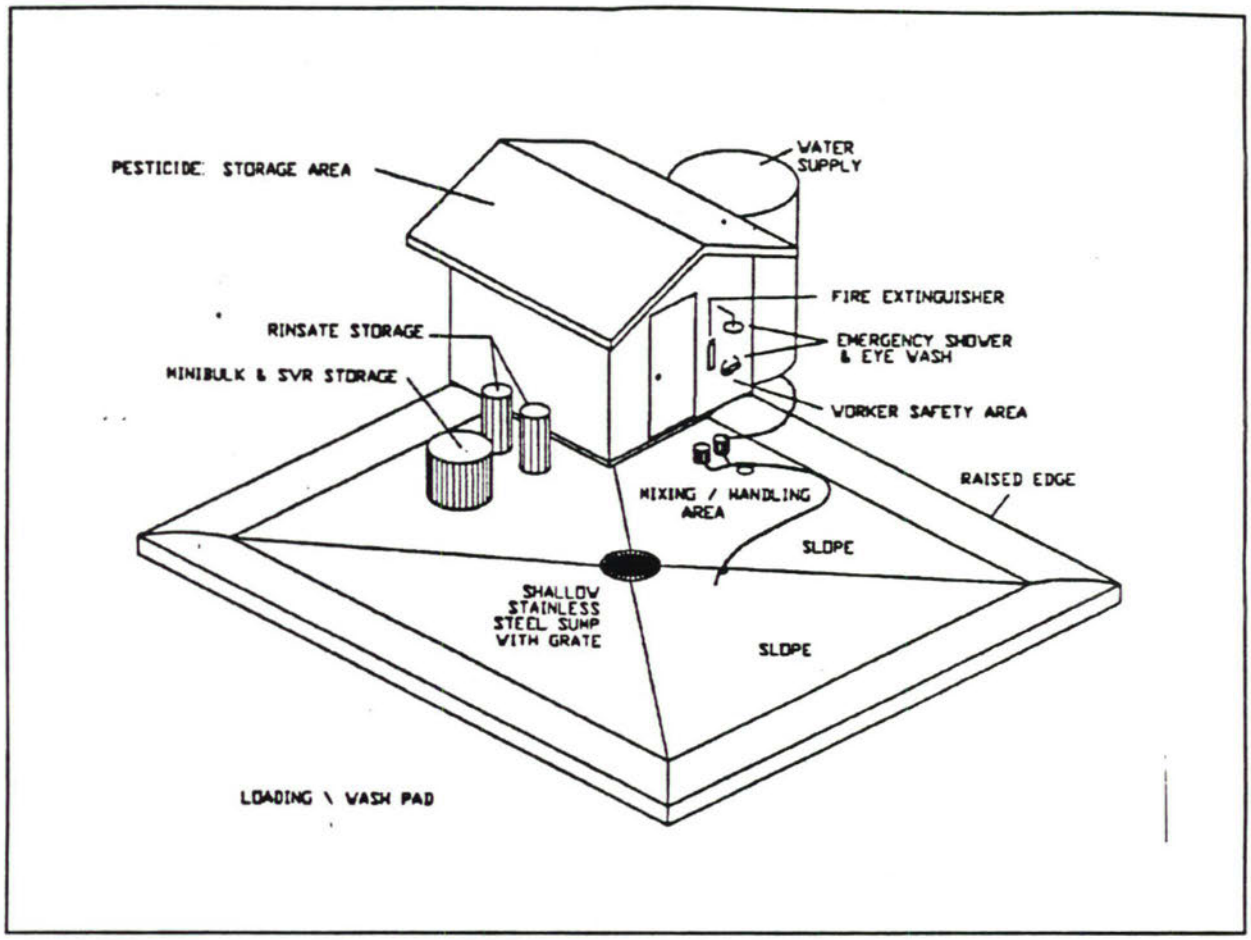


Figure 1: Farm-sized pesticide facility. *Source: Farm-Sized Mixing/Loading Pad and Agrichemical Storage Facility, by D. W. Kammel and D. O'Neil, presented at Summer Meeting of the American Society of Agricultural Engineers, June 24-27, 1990.*

Pesticide Management Practices

Pesticides spilled near wells, streams or other water sources have the potential of moving over or through the soil and reaching surface or groundwater.

Spills can occur from overfilling spray tanks or from poorly maintained application equipment. The valves and hoses on application equipment should be checked for leaks or damage, and replaced as necessary.

To prevent back-siphoning from spray equipment into the well, keep the end of the hose above water level in the spray tank at all times. Use an anti-backflow device when drawing mix water directly from a well, pond or stream. Inexpensive anti-backflow devices for filler hoses can be purchased from irrigation or sprayer equipment suppliers.

A well may act as a direct pipeline to groundwater. Groundwater can become contaminated if pesticides enter a well directly from the surface, through openings

in the well casing or through soil adjacent to the well.

New wells, if properly constructed, can prevent groundwater contamination. The tops of the wells must be sealed to prevent contaminants from moving down around the well casing. Proper maintenance of existing wells helps prevent groundwater contamination. Wells and pumps should be inspected regularly for leaks and to ensure that the seal is adequate to prevent pesticides from entering the groundwater. Irrigation pipes should also be checked for leaks that could lead to groundwater contamination.

As an added measure of protection: (1) Pesticides should not be handled, mixed or placed in spray tanks directly adjacent to wells (the Louisiana Sanitary Code suggests a 100 feet minimum distance); (2) Avoid mixing and loading on gravel or other surfaces that allow spills to sink quickly through the soil. A clay surface is better than sand; (3) Always supervise sprayer filling for restricted use pesticides. A trained and certified applicator must supervise operations and (4) Use rinsate for mixing subsequent loads (if you use a mixing or loading pad). Spray rinsate load on the labeled crop.

3. SPILL CLEANUP PROCEDURES

For dry spills, promptly sweep up and reuse the pesticide as it was intended. Dry spills are usually very easy to clean up.

For liquid spills, recover as much of the spill as possible, and reuse as it was intended. It may be necessary to remove and field-apply some contaminated soil.

The Department of Agriculture and forestry requires spills of any amount to streams and lakes to be reported.

> To report a spill, notify the local fire department, the Louisiana State Police at (504) 925-6595, the Louisiana Department of Environmental Quality at (504) 342-1234 or the Louisiana Department of Agriculture and Forestry at (504) 925-3763.
>
> Remove the spilled material and contaminated soil no matter what the quantity, and dispose of according to recommendations you receive when you report the spill.

Have an emergency response plan for the site. Know where the runoff water will go, how to handle your particular chemicals and whom to call for help (refer to Contacts and References, Pesticide Spills on who to call).

4. CONTAINER DISPOSAL PRACTICES

The law requires that pesticides must be stored in a safe, secure and well-identified location. Pesticides must always be stored in the original, labeled containers with the label clearly visible.

Significant groundwater contamination can occur if pesticide containers break from rough handling, weathering, corrosion or age. Proper storage can help avoid these problems. The label instructions for each registered pesticide contain brief but explicit instruction regarding storage and disposal.

Steps should be taken to minimize pesticide-related waste and to reduce disposal problems. Reduction in leftover pesticide solution, rinse water and the number of pesticide containers requiring disposal will enhance groundwater protection efforts. In all cases, pesticide label instructions should be followed carefully. Only the required amount of pesticide solution should be mixed, and equipment must be carefully calibrated. Rinse water can be sprayed on cultivated fields where feasible and consistent with label directions.

Federal law requires triple rinsing of pesticide containers or jet-spray cleaning before disposal. Rinsed containers should be stored securely prior to disposal to minimize the chance of inadvertent exposure to humans or the environment.

Metal containers may be recycled through scrap metal dealers; those not suitable for recycling or refilling by distributors may be disposed of in an approved sanitary landfill. Information on sanitary landfills suitable for disposal of triple-rinsed pesticide containers in Louisiana can be obtained from the Louisiana Department of Agriculture and Forestry in Baton Rouge, Louisiana, at (504) 925-3763 or from their area offices.

5. OTHER MANAGEMENT PRACTICES

Reducing pesticide waste makes financial as well as environmental sense, but it means more than just reducing spills. It also means not buying more than you need to apply, keeping records of what you have on hand and using older products first.

- Buying only what you need makes long-term storage unnecessary. In addition, you avoid cold weather problems, which can make some pesticides useless.

- Record keeping may seem like a task unrelated to groundwater contamination, but knowing what you have used in the past and what you have on hand allows you to make better purchasing decisions.

- Keep records of past field application rates and their effectiveness. Along with field records, you can add information such as the manufacturer's name and address, chemical types and handling precautions. This information can

be important if you must respond quickly to an accident.

- Using older products first keeps your inventory current and effective. Before using chemicals that have been stored for a few years though, check with your parish extension agent or DAF representative about possible restrictions on their use.

Storage and disposal of pesticides and containers on the farm, in the Contacts and References section, provides more information on this topic.

GLOSSARY

Pesticide Storage and Handling

These terms may help you make more accurate assessments when completing Worksheet 2. They may also help clarify some of the terms used in Factsheet 2.

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 the unwanted reverse flow of liquids back down a water supply pipe into a well.

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

Backflow Prevention Device: See **Anti-Backflow Device.**

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

Closed Handling System: A system for transferring pesticides directly from storage container to applicator equipment (through a hose, for example), so that humans and the environment are never inadvertently exposed to the chemicals.

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, can enter the potable water system.

Rinsate: Rinse water from pesticide or fertilizer tank cleaning.

Secondary Containment: Impermeable floor and walls around a chemical storage area that minimize the amount of chemical seeping into the ground from a spill or leak.

CONTACTS AND REFERENCES

Who to call about . . .

General Pesticide Information

National Pesticide Telecommunication Network, 1 (800) 858-PEST (7378). Answered 24 hours a day, 365 days a year. Provides information on recognizing and treating pesticide poisoning; pesticide products, cleanup and disposal; contacts for animal poison centers; certification and training programs; and pesticide laws.

Health Effects of Pesticides in Water

The Louisiana Department of Health and Hospitals, Division of Environmental Health Service at (504) 518-5181 or call your parish sanitarian.

Drinking Water Quality and Treatment and Health Advisories

EPA Safe Drinking Water Hotline, Monday through Friday, 8:30-5:30 p.m. Eastern Standard Time. Call 1 (800) 426-4791.

Health and Safety Information on Chemicals

Chemical Referral Center, sponsored by the Chemical Manufacturers Association. Call 1 (800) CMA-8200. The Center serves as a central contact point in non-emergency situations.

Plans and Recommendations for Pesticide Mixing and Loading Pads

Your parish Soil Conservation Service or extension office.

Pesticide Spills

Notify the local fire department, the Louisiana State Police at (504) 925-6595, the Louisiana Department of Environmental Quality at (504) 342-1234 or the Louisiana Department of Agriculture and Forestry at (504) 925-3763.

Proper Disposal of Soil Contaminated by a Pesticide Spill

Your parish extension agent or the Department of Agriculture and Forestry.

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 and Pesticides in Groundwater

Protecting Louisiana's Groundwater from Pesticide and Agricultural Chemical Contamination. 1991. Louisiana Cooperative Extension Service. Pub. 2453.

Protecting Groundwater from Pesticide Contamination. 1989. Louisiana Cooperative Extension Service. Pub. 2352.

Health Effects

Care of Pesticide Contaminated Clothing. 1987. Louisiana Cooperative Extension Service. Pub. 2335.

How to Read and Understand a Pesticide Label. 1991. Louisiana Cooperative Extension Service. Pub. 2416-B.

Pesticides - Proper Perspective: Some Facts to Help Us Keep "Toxic Things" in Proper Prospective. 1990. Louisiana Cooperative Extension Service. Pub. 2416A.

Understanding Pesticide Hazards. 1988. Louisiana Cooperative Extension Service. Pub. 2279.

Pesticide Handling and Management

Applying Pesticides Correctly: A Guide for Private and Commercial Applicators. Louisiana Cooperative Extension Service. Pub. 2374.

Homeowner's Guide to Pesticide Safety. 1992. Louisiana Cooperative Extension Service. Pub. 2416C.

Pesticide Container Disposal. 1992. Louisiana Cooperative Extension Service. Pub. 2416-F.

Safe Handling, Storage and Disposal of Pesticide Containers. 1982. Louisiana Cooperative Extension Services. Pub. 2146.

Spray Equipment Washwater Disposal. 1992. Louisiana Cooperative Extension Service. Pub. 2416-E.

Storage and Disposal of Pesticide and Containers on the Farm. 1987. Louisiana Cooperative Extension Service. Pub. 2145.

Transport Pesticide Safely. 1992. Louisiana Cooperative Extension Service. Pub. 2416-D.

Publications Available From . . .

Your parish extension office or directly from the Louisiana Cooperative Extension Service, Knapp Hall, Baton Rouge, Louisiana, 70803.

Video

Pesticide Container Disposal. To view this video, contact your parish extension office.

FARM*A*SYST
Farmstead Assessment System

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Project coordinated at the Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center.

Louisiana State University Agricultural Center, H. Rouse Caffey, Chancellor.
Louisiana Cooperative Extension Service, Denver T. Loupe, Vice-Chancellor and Director.
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Technical reviews: Jerry B. Graves, Department of Entomology, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center; and Darryl C. Rester, Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center.

Editorial assistance: Jane Honeycutt, and special thanks to Helen Rhodes and Jan Townsley, Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center.

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WATER WELL PROTECTION

FACTSHEET 3

Assessing the Risk of Groundwater Contamination from FERTILIZER STORAGE AND HANDLING

1. FERTILIZER STORAGE PRACTICES

If stored safely in a secure location, fertilizers pose little danger to groundwater. Common sense suggests keeping fertilizer dry and out of the way of activities that might rip open a bag or allow rain to enter a bulk container.

In the event of such an accident, an impermeable (waterproof) floor, such as concrete, helps to prevent fertilizer seeping into the ground and leaching to ground water. A curb built around liquid fertilizer storage areas will prevent contaminants from spreading to other areas.

Secondary containment provides an impermeable floor and walls around the storage area, which will minimize the amount of fertilizer seeping into the ground if a bulk liquid fertilizer storage tank should leak.

A mixing/loading pad provides for secondary containment during the transfer of liquid fertilizer to application equipment or nurse tanks. Store piles of dry bulk fertilizer on an impermeable surface under cover or in a building. Treat dry fertilizer impregnated with a pesticide as a pesticide. Store under cover or protected from rain.

Building a New Storage Facility

While a new facility just for fertilizer storage may be expensive, it may be safer than trying to adapt areas meant for other purposes. Keep these simple principles in mind:

1. Locate the dry storage building or liquid secondary containment downslope and at least 100 feet away from the well. Separation from the well should be greater in areas of sandy soils. Worksheet Nº 11, *Site Evaluation*, can assist you

in ranking your farmstead soils and geologic conditions according to their ability to keep contaminants out of ground water.

2. In the event of a fire, contaminated surface water should drain to a confined area.

3. The mixing and loading area should be close to your storage facility, to minimize the distance that chemicals are carried.

4. The building foundation or secondary containment slab should be in a well drained area. The finished grade outside the building should be 3 inches below the floor of the storage area and sloped away from the building to provide surface drainage. The subsoil should have a low permeability.

5. Provide pallets to keep bags off the floor. Store dry products separate from liquids to prevent wetting from spills.

6. If you plan to use large bulk tanks, provide a large-enough containment area to confine 125% of the contents of the largest bulk container, plus the displaced volume of any other storage tanks.

7. A locked storage cabinet or building provides security. Preventing unauthorized use of fertilizer reduces the chance of accidental spills or thefts. Provide signs or labels indicating that the cabinet or building is a fertilizer storage area. Labels on the outside of the building give fire fighters important information about fertilizers during an emergency response for a fire or spill.

8. Provide adequate road access for deliveries and emergency equipment.

9. For information on factors to consider in the design of a storage facility, such as ventilation, water access, temperature control and worker safety, contact your parish extension office, the Soil Conservation Service or the Department of Agriculture and Forestry.

10. All fertilizer handling areas should be roofed to avoid contact with rainfall.

Modifying an Existing Storage Facility

You may find the above principles to be expensive and difficult to apply to your current storage, but compared to the cost of a major accident or even a lawsuit, storage improvements are a bargain. Items 5-10 above are also important points to remember for existing storage.

The cheapest alternative you may have is to cut back on the amounts stored.

Sound containers are your first defense against a spill or leak. Should a bag be accidentally ripped, fertilizers should be confined to the immediate area and promptly recovered.

That means having a solid floor and, for liquid fertilizers, a curb. The secondary containment space should have enough volume to hold 125% of the contents of the largest container, plus the displaced volume of any other storage tanks in the area.

Ideally, your fertilizer storage area should be separate from other activities. If the building must also serve as a machine shed or as housing for livestock, you may find it difficult to meet all the requirements for safe storage.

Stored fertilizers can pose a danger to fire fighters and to the environment. Reducing the fire risk in the storage are be the first step, but other things can be done.

You can reduce the damages by anticipating such emergencies. If a fire should occur, consider where the water will go and where it might collect. In making the storage area secure, also make it accessible, allowing you to get fertilizers out in a hurry.

- If fertilizer containers are damaged, the stored nutrients may be carried away by water and spread over a large area.

- Label windows and doors to alert fire fighters to the presence of fertilizer stored in the structure.

- A curb around the floor can help confine contaminated water.

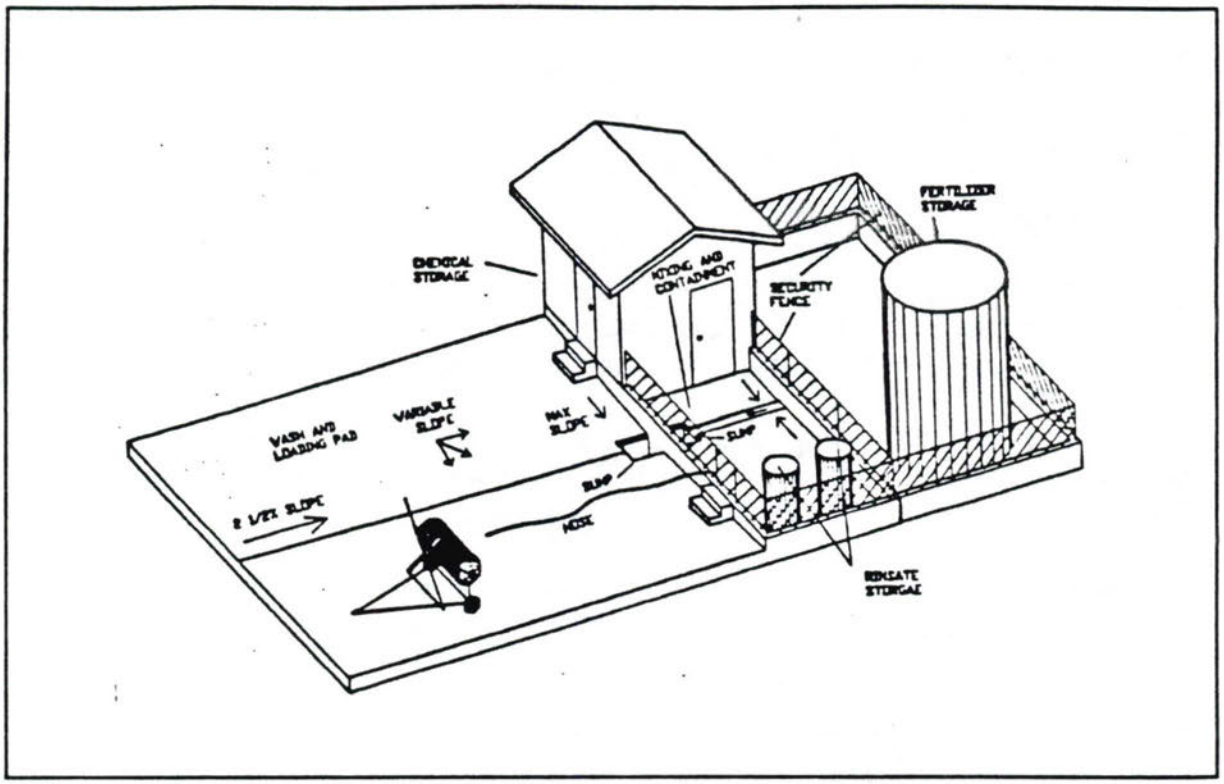


Figure 1: Farm-Sized Fertilizer Facility. *Source: Modular Concrete Wash/Containment Pad for Agricultural Chemicals, by R. T. Noyes and D. W. Kammel. American Society of Agricultural Engineers Paper Number 891613.*

2. MIXING AND LOADING PRACTICES

Ground water contamination can result from small quantities spilled regularly in the same place. Spills of dry fertilizer should be promptly and completely cleaned up and placed into the application equipment. Cleaning up spills of liquid fertilizers can be much more difficult.

Fertilizer Mixing and Loading Pad

Containing fertilizer spills and leaks requires an impermeable surface (such as concrete) for mixing and loading. A concrete pad should be large enough to accommodate your equipment and to contain leaks from bulk tanks, wash water and spills from transferring fertilizers to the sprayer.

Locate the pad adjacent to the storage area. Make sure that water from the pad moves away from the well. At sites where runoff could reach the well, construct a diversion to direct runoff to another area.

The size of the pad depends on the equipment you use. It should provide space around the parked equipment for washing and rinsing. The fertilizers and rinse water should have a confined area, such as a sump, for settling before transfer to rinsate storage tanks. Having several separate rinsate storage tanks allows you to keep rinse water from different fertilizer chemical mixes separate. That way, it can be used for mixing water on subsequent loads.

If you are considering constructing a mixing/loading pad, more detailed information is available from parish extension offices, the Soil Conservation Service or the Department of Agriculture and Forestry.

Better Management of Your Existing Mixing and Loading Site

Fertilizer spills and leaks are bound to occur from time to time. Even if you do not have an impermeable mixing and loading pad, you can minimize contamination by following some basic guidelines:

- Avoid mixing and loading fertilizer near your well. One way to do this is to use a nurse tank to transport water to the mixing and loading site. Ideally, the mixing site should be moved from year to year within the field of application.

- Avoid mixing and loading on gravel driveways or other surfaces that allow spills to soak into the soil. A clay soil is better than sand, for example.

- Install an anti-backsiphon device on the well or hydrants. Never put the hose in the spray tank. Provide an air gap of 6 inches between the hose and the top of the spray tank.

- Always supervise sprayer filling.

- Consider using a closed handling system, in which the fertilizer is directly transferred from the storage container to the applicator equipment, such as by a hose. Humans and the environment are never inadvertently exposed to the chemical.

- Use rinsate for mixing subsequent loads.

3. SPILL CLEANUP

For dry spills, promptly sweep up and reuse the fertilizer as it was intended. Dry spills are usually very easy to clean up. Dry impregnated fertilizer is considered a pesticide and, if spilled, should be recovered and applied to the target crop as it was intended.

For liquid spills, recover as much of the spill as possible and reuse as it was intended. Some contaminated soil may have to be removed and field applied.

The Department of Agriculture and Forestry requires spills of any amount to streams or lakes to be reported. Report spills of more than 50 gallons on the soil or a mixing/loading pad. Smaller quantities of liquid or dry products should be reported if they could cause damage because of the nature of the fertilizer or spill location.

To report, call the 24-hour Emergency Hotline of the Louisiana Department of Agriculture and Forestry, at (504) 925-3763. Collect calls are accepted.

Remove the spilled material and contaminated soil no matter what the quantity, and dispose according to recommendations of the Department of Agriculture and Forestry.

Have an emergency response plan for the site. Know where the runoff water will go, how to handle your particular fertilizers, and whom to call for help.

4. CONTAINER DISPOSAL PRACTICES

Bulk deliveries of anhydrous ammonia, liquid fertilizers and dry bulk fertilizers have reduced the need to dispose of containers. Many farmers do, however, use bagged fertilizers and burn the bags in the field. Burning bags is illegal. Bundle bags and dispose of them in an approved landfill.

Your drinking water is least likely to be contaminated by your disposal practices if you follow appropriate management procedures or dispose of wastes in any location that is **off the farm site**. However, proper offsite disposal practices are essential to avoid risking contamination that could affect the water supplies and health of others.

5. OTHER MANAGEMENT FACTORS

Reducing fertilizer waste makes financial as well as environmental sense, but it means more than just reducing spills. it also means not buying more than you need to apply and keeping records of what you do have on hand. Buying only what you need makes long-term storage unnecessary.

Keeping records may seem like a task unrelated to ground water contamination, but knowing what you have used in the past and what you have on hand allows you to make better purchasing decisions. Keep records of past field application rates and their effectiveness.

GLOSSARY

Fertilizer Storage and Handling

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

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 the unwanted reverse flow of liquids back down a water supply pipe into a well.

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

Backflow prevention device: (see **anti-backflow device**).

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

Closed handling system: A system for transferring pesticides or fertilizers directly from storage container to applicator equipment (through a hose, for example), so that humans and the environment are not inadvertently exposed to the chemicals.

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.

Rinsate: Rinse water from pesticide or fertilizer tank cleaning.

Secondary containment: Impermeable floor and walls around a chemical storage area that minimize the amount of chemical seeping into the ground from a spill or leak.

CONTACTS AND REFERENCES

Who to call about . . .

Plans and Recommendations for Fertilizer Mixing and Loading Pads

The Soil Conservation Service, the Department of Agriculture and Forestry or your parish extension office.

Fertilizer Spills

The 24-hour Emergency Hotline of the Louisiana Department of Agriculture and Forestry at (504) 925-3763.

Proper Disposal of Soil Contaminated by a Fertilizer Spill

Your parish extension agent or the Department of Agriculture and Forestry.

Interpretation of Soil Test Results

your parish extension agent or any commercial soil testing laboratory.

CONTACTS AND REFERENCES

What to read about . . .

Groundwater and Nitrates in Groundwater

Protecting Louisiana's Groundwater from Pesticide and Agricultural Chemical Contamination. 1991. Louisiana Cooperative Extension Service. Pub. 2453.

Protecting Groundwater from Pesticide Contamination. 1989. Louisiana Cooperative Extension Service. Pub. 2352.

Health Effects

The product label. Read your product labels carefully for specific information on fertilizer health effects.

Fertilization Recommendation for Agronomic Crops/Pastures

Fertilization Recommendations for Agronomic Crops in Louisiana. 1987. Louisiana Cooperative Extension Service (LCES). Pub. 2162.

Fertilizer Recommendations for Pasture and Forage Crops. LCES Pub. 2163.

Lime Use in Louisiana Soils. 1991. LCES Pub. 2442.

Converting Fertilizer Rates from Tones to Teaspoons. LCES Pub. 1545.

Fertilization of Louisiana Rice. 1991. LCES Pub. 2418.

Sugarcane Fertilization. 1992. LCES Pub. 2473.

Homeowners Guide for Fertilizing Pecan Trees in Louisiana. LCES Pub. 2075.

FARM*A*SYST
Farmstead Assessment System

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Project coordinated at the Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center.

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Editorial assistance: Jane Honeycutt, and special thanks to Helen Rhodes and Jan Townsley, Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center.

Louisiana State University
Agricultural Center
Louisiana Cooperative Extension Service

WATER WELL PROTECTION

FACTSHEET 4

Assessing the Risk of Groundwater Contamination from Petroleum Product Storage

NOTICE:

1. For underground storage tanks of 1100 U. S. gallons or more capacity consult LAC 33.XI for regulations under Louisiana Department of Environmental Quality, Underground Storage Tank Division.

2. For above-ground storage tanks of 660 U. S. gallons or more capacity consult LAC 33.IX for regulations under Louisiana Department of Environmental Quality.

3. Before any installation, check for local regulations that might be required.

1. STORAGE TANK LOCATION

One of the most important aspect of your liquid petroleum storage location is how close it is to your drinking water well. Storage tanks should be located at least 50 feet from an active or abandoned drinking water well.

Even though diesel fuel and fuel oil are denser than gasoline and move more slowly through the soil, they, too, may eventually reach groundwater.

Every site has unique geologic and hydrologic conditions that can affect groundwater movement. How quickly the petroleum product reaches groundwater will also depend upon local soils. The more porous the soil (sand and gravel, for example), the faster the rate of downward or lateral movement to groundwater. You may choose to locate a new tank more than 50 feet from your well in order to provide added protection in the event of a leak. The tank should also be located down slope from the well. Figure 1 illustrates petroleum product seepage into soils.

If you have an above-ground tank, follow existing recommendations for underground storage tanks as a guide. To protect against explosion and fire, do not locate tanks (especially above-ground tanks) closer than 25 feet to existing buildings.

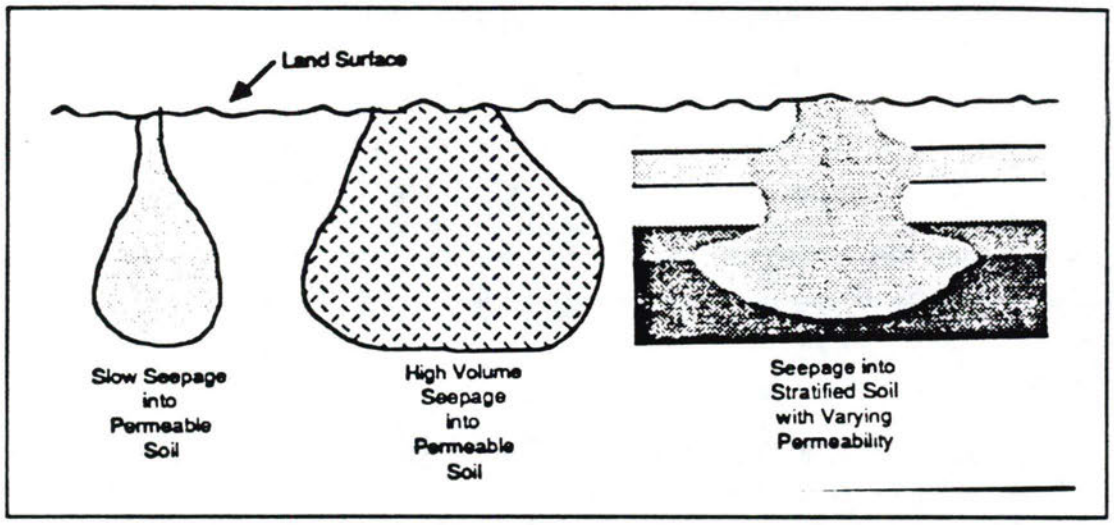


Figure 1: Petroleum product seepage into soils. *Source: Underground Tank Corrective Action Technologies, EPA/625/6-87-015, January 1987.*

New storage tank location

Along with maintaining adequate distance from your drinking water well, choose a location for a new tank based on the following considerations:

- **Soil characteristics.** Highly corrosive clays, wet soils, cinders and acid (low pH) soils can significantly speed up the rate of corrosion of underground metal tanks and piping. Using clean backfill during installation can decrease the negative effects of surrounding soils.

- **Soil stability.** Assess the ability of the underlying soil to support both underground and above-ground tanks. Be sure that pipes cannot twist or break if the tank is bumped or disturbed.

  Regardless of soil conditions, locate above-ground tanks over an impermeable liner of concrete or synthetic fabrics. Build a collection system for spills.

- **Current and previous land use.** Sites that contain abandoned pipes and tanks, agricultural drainage tiles or waste materials pose special installation problems. Any metal already in the ground at your chosen site may increase

corrosion rates for the new tank.

- **Traffic.** Assess traffic patterns around the tank. Determine whether the location of the tank or dispenser will block movement of farm vehicles during refueling or cause special problems if any work needs to be done on the tank. Protect piping from collisions with farm and fuel vehicles.

- **Depth to groundwater.** Floodways, wetlands or areas where the water table is close to the surface are poor locations for storage tanks. Tanks placed in such areas require special installation. To reduce pollution potential, an above-ground tank may be preferable to an underground tank.

2. TANK DESIGN AND INSTALLATION

Whenever you install a fuel storage tank, carefully follow the manufacturer's recommended practices for installation. Proper installation is one way to minimize the leaking potential of the tank or the piping connected to it. Even scratches in a metal tank caused by careless installation can increase corrosion and tank deterioration. It is illegal to reuse an underground tank above ground.

Underground tanks

All new underground petroleum storage tanks and related piping should be constructed of non-metallic materials such as fiberglass, or have corrosion protection. Methods of corrosion protection include coating the tank with dielectric material and cathodic protection systems. Interior liners made of noncorrosive synthetic materials can also be effective in protecting metal tanks.

All new underground tanks should have spill and overfill protection. Spill protection typically consists of a catch basin for collecting spills when the tank is filled. Overfill protection is a warning or prevention of an overfill such as an automatic shutoff or buzzer. Spill and overfill protection are important; they can prevent a number of small releases over a long period of time from polluting the soil and groundwater.

Above-ground tanks

The most important items to consider are the grounding of the tank to prevent fire and explosion, and the pollution potential.

To decrease pollution potential, place tanks within a secondary containment structure consisting of a dike and a concrete pad. All piping should be above ground within the dike or may go over the dike wall, but it should be placed below ground within 10 feet of the dike wall. Above-ground piping should be made of steel and coated to prohibit corrosion. Any below-ground piping may be either steel or fiberglass, but

steel should be coated and cathodically protected.

3. MONITORING

It is recommended that all tanks have a method of detecting leaks. Select the tank location carefully to ensure ease of installation and reliability of chosen leak-detection methods. Test the tank periodically for leaks, and measure the tank inventory on a monthly (or more frequent) basis to help detect leaks before major problems develop.

Since cleanup of gasoline leaks is always costly and often not totally effective, it is important to constantly monitor underground tanks containing petroleum products. If you already have a petroleum storage tank, be especially aware of the age of your tank as well as the need to establish a leak-detection program. Figure 2 shows how groundwater can be contaminated by underground tanks.

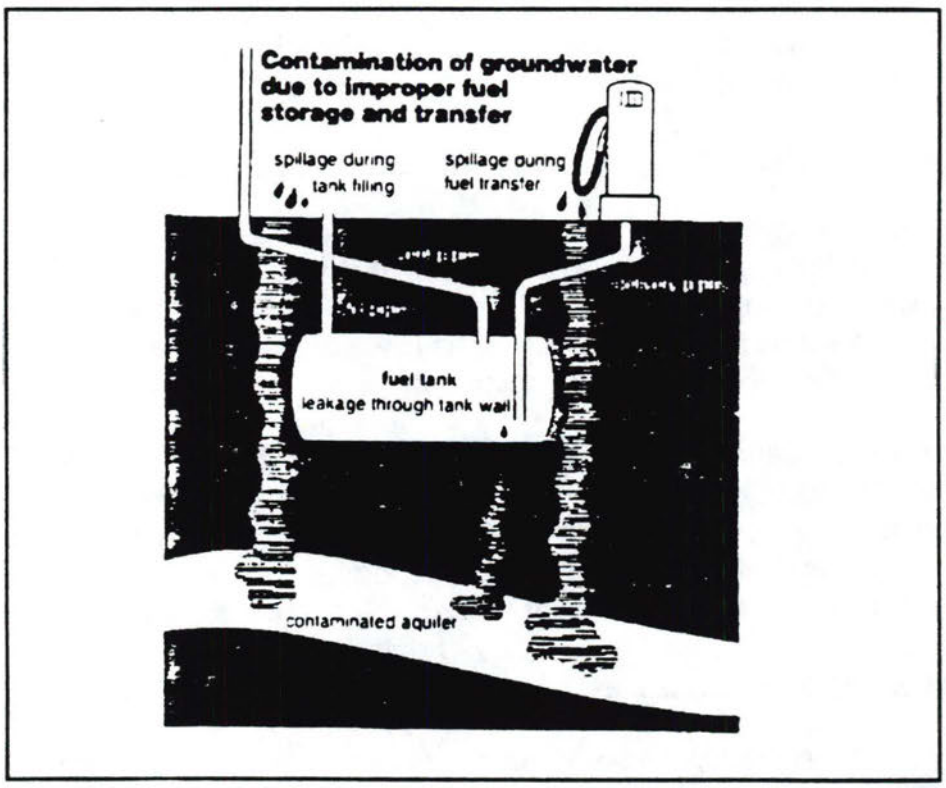


Figure 2: Contamination of groundwater due to improper fuel storage and transfer. *Source: Handling and Underground Storage of Fuels, Cooperative Extension Service, Michigan State University, Extension Publication WQ01. Reprinted February 1986.*

Since most tanks used are bare steel, tank corrosion or piping problems will cause

leaks sooner or later. If your tank is more than 20 years old, or if you don't know its age, make a special effort immediately to determine whether leaks exist. You can test tank integrity by such methods as precision testing/tightness testing and volumetric analysis.

Even when a tank has been tested and proven tight, good management practices require that you have a method for detecting leaks.

You can install such internal or external monitoring methods as groundwater monitoring wells, vapor monitoring, automatic tank gauging or other approved methods (required on tanks of 1100 gallons capacity or larger).

Measuring tank inventories is an inexpensive and easy way to help detect leaks. Leakage is apparent when there is any decrease in level over time without any withdrawal of fuel or an increase in water in the tank. While inventory measurement will not detect very small leaks, it will at least provide a warning that further investigation may be necessary.

If you use a measuring stick to measure tank liquid level, be sure that the stick does not puncture or damage the bottom of the tank. Use of a water detection compound on the measuring stick helps to monitor water levels.

The closer the tank is to the drinking water well, the more important it is to ensure that an adequate leak-detection system is in place.

Leaks and spills

If you find a leak or spill from any tank - whether it be above or below ground, or even a vehicle-mounted tank, take actions necessary to remedy the problem, according to recommendations you receive when you report the spill or leak to the local fire department, the Louisiana State Police at (504) 925-6595, the Louisiana Department of Environmental Quality at (504) 342-1234.

4. TANK CLOSURE

Tanks no longer in use can cause problems for owners and operators many years later. They will continue to corrode and, if they still contain gas or oil, may contaminate groundwater. Liability is of major concern to the property owner.
Try to determine the location of any unused tanks on your property. Also, try to find out whether the tanks still hold product or have leaks. These tanks must be pulled from the ground or filled with an inert solid material.

When pulling a tank, use a LDEQ certified contractor. Notify your local fire

department at least one (1) month before you have the tank pulled, to ensure that precautions are taken to prevent an explosion or other problem. Deaths have occurred due to improper closure.

If you are concerned that your unused tank has been leaking, consult an environmental engineer or LDEQ regional office investigator for assistance.

You should document steps you take to close your tank due to the possibility of some future legal action or to answer questions raised in an environmental audit prior to a fatal property transaction.

5. OTHER PETROLEUM PRODUCTS

Storage of other petroleum products can contaminate your drinking water.

Products such as antifreeze, used oil, hydraulic oil, paint and paint thinners, and solvents can readily move through the soil and affect your groundwater. Contact your local recycling agency to properly dispose of used motor oils and other petroleum products.

These products should not be stored in an existing well pump shed. Any spills can find their way down the well shaft and directly contaminate your drinking water.

Other petroleum products should be stored at least 50 feet from the water well. A catch basin, such as a concrete floor, should be constructed to prevent groundwater contamination and to control any spills. If the products are stored in an enclosure, make sure adequate ventilation is provided and all electrical connections are installed properly to prevent sparks and fire or explosion.

GLOSSARY

Petroleum Product Storage

These terms may help you make more accurate assessments when completing Worksheet 4. They may also help clarify some of the terms used in the Fact Sheet.

Cathodic protection: One of several techniques to prevent corrosion of a metal surface by reversing the electric current that causes corrosion. A tank system can be protected by sacrificial anodes or impressed current (see **sacrificial anodes** and **impressed current**).

Certified installer: A person certified by the Department of Environmental Quality, Underground Storage Tank Division to install and repair or remove petroleum storage tanks.

Corrosion: Deterioration of a metallic material ("rust") due to a reaction with its environment. Damage to tanks by corrosion is caused when a metal underground tank and its underground surroundings act like a battery. Part of the tank can become negatively charged, and another part positively charged. Moisture in the soil provides the connecting link that finally turns these tank "batteries" on. Then, the negatively charged part of the underground tank system --- where the current exits from the tank or its piping --- begins to deteriorate. As electric current passes through this part, the hard metal begins to corrode, holes form, and leaks begin.

Corrosion protection: One method of corrosion protection is cathodic protection. Steel tanks can be protected by coating them with a corrosion-resistant coating combined with "cathodic" protection. Steel underground tanks can also be protected from corrosion if they are bonded to a thick layer of noncorrosive material, such as fiberglass-reinforced plastic. Also, the corrosion problem can be entirely avoided by using tanks and piping made completely of noncorrosive material, such as fiberglass.

Galvanized: The result of coating an iron or steel surface with zinc. Galvanized materials do not meet corrosion protection requirements.

Impressed current: This protection system introduces an electric current into the ground through a series of anodes that are not attached to the underground tank. Because the electric current flowing from these anodes to the tank system is greater than the corrosive current attempting to flow from it, the underground tank is protected from corrosion.

Interior liner: A liner for petroleum storage tanks made of noncorrosive synthetic

materials that can be effective in protecting metal tanks.

Inventory control: Measuring and comparing the volume of tank contents regularly with product delivery and withdrawal records to help detect leaks before major problems develop.

Sacrificial anodes: Pieces of metal attached directly to an underground tank that are more electrically active than the steel tank. Because the anodes are move active, electric current runs from the anodes rather than from the tank. The tank becomes the cathode (positive electrode) and is protected from corrosion. The attached anode (negative electrode) is "sacrificed" or consumed in the corrosion process and must eventually be replaced.

Secondary containment: A system such as a sealed basin and dike that will catch and hold the contents of a tank if it leaks or ruptures.

Soil permeability: The quality that enables soil to transmit water or air. Low permeable soils have fine-textured materials like clays that permit only slow water movement. Moderately or highly permeable soils have coarse-textured materials like sands that permit rapid water movement.

Spill and overfill protection: Spill protection usually consists of a catch basin for collecting spills when the tank is filled. Overfill protection is a warning or prevention of an overfill, such as an automatic shutoff or buzzer. These precautions can prevent a number of small releases over a very long period of time from polluting the groundwater.

Tank tightness testing: A procedure for testing a tank's ability to prevent accidental release of any stored substance into the environment, or intrusion of groundwater into an underground tank.

CONTACTS AND REFERENCES

Who to call about . . .

DEQ Regulations; Tank registration; Petroleum product storage, tank testing methods and suppliers; Reporting closure and changes in tank ownership:

Louisiana Department of Environmental Quality, Office of Solid and Hazardous Waste, Underground Storage Tanks Division, (504) 765-0243.

Petroleum product spills:

Notify the local fire department, the Louisiana State Police at (504) 925-6595 or the Louisiana Department of Environmental Quality at (504) 342-1234.

Health effects of gasoline-contaminated groundwater:

Louisiana Department of Health and Hospitals, Environmental Consultant, (504) 342-9500.

For more information, Contact:

Your parish extension office or the
Louisiana Cooperative Extension Service
Water Quality Specialist
Knapp Hall
Baton Rouge, Louisiana 70803
(504) 388-4141

CONTACTS AND REFERENCES

What to read about . . .

Petroleum product storage and handling. Tank design, regulations, installation, financial responsibilities, site selection, testing, and tank closure.

Underground Storage Tank Rules and Regulations.
Louisiana Department of Environmental Quality, Office of Solid and Hazardous Waste, Underground Storage Tank Division, Post Office Box 82178, Baton Rouge, Louisiana, 70884-2178.

FARM*A*SYST
Farmstead Assessment System

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Farm*A*Syst team members: Jan Boydstun, Keith Casanova, and Linda Levy, Louisiana Department of Environmental Quality; David Horcasitas, Louisiana Department of Health and Hospitals; Butch Stegall, Louisiana Department of Agriculture and Forestry; Billy Moore and Emmett Wilson, Soil Conservation Service; J. B. LeRay, Agricultural Stabilization and Conservation Service; Gary Eldridge, Farmer's Home Administration; Wendell Miley, Louisiana Farm Bureau Federation; Clyde Carlson, Louisiana Department of Transportation and Development.

Technical reviews: Bo Bolourchi, Louisiana Department of Transportation and Development; Keith Casanova, George Gullett and Linda Levy, Louisiana Department of Environmental Quality; Bob Hayes, Louisiana Department of Public Safety.

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WATER WELL PROTECTION

FACTSHEET 5

Assessing the Risk of Groundwater Contamination from FARMSTEAD HAZARDOUS WASTE MANAGEMENT

1. FARMSTEAD HAZARDOUS WASTE CAN POLLUTE GROUNDWATER

When we think of hazardous waste, we usually think of manufacturing or mining operations. But farmsteads also produce waste which can be hazardous to human health and can contaminate surface and groundwater.

Many of these products are in the kitchen, bathroom, garage or storage shed. Used motor oil, pesticides, antifreeze, wood preservatives, paints, batteries and some household cleaners would be considered hazardous waste if they existed in large quantaties. They may contain solvents, caustics, petroleum products, heavy metals or hazardous chemicals. Because of their chemical nature they can poison, corrode, explode or burst into flame when handled improperly. Some may interfere with septic systems and wastewater treatment plants which have trouble breaking them down and rendering them less harmful to the environment. If discarded outside, they can wash into streams or lakes and kill fish and small animals. Ingestion, breathing,or contact by children could be dangerous or even fatal.

The best way to avoid farmstead hazardous waste disposal is to avoid generating hazardous waste. Before you buy a product, read the label and make sure it will do what you want. Products labeled "poison" are the most dangerous; "danger" means the product is highly toxic, and "warning" or "caution" means the product is moderately to slightly toxic.

Buy only those house, yard and automobile products you need. Use the product safely. Purchase in smallest quantity for the job you want to do. Unused products should be kept in original, labeled containers and passed on to others who can use them. A neighbor, school, youth group, church or service organization may be glad to share your remaining products. Organize a material exchange for leftover products like cleaning solutions, paint, fertilizer or insect spray.

USE only as directed.
USE only the amount of a product that is absolutely necessary.

USE hazardous household products as infrequently as possible.
USE safer substitutes when they are available.

2. PREVENT DRINKING WATER CONTAMINATION

NEVER bury household waste.
NEVER dump waste along the side of the road.
NEVER pour wastes into any drain or storm sewer.
NEVER dump waste into a stream, pond or lake.

What is the best way to dispose of potentially hazardous farmstead waste?

- If you cannot avoid generating a hazardous waste, take it to a hazardous waste collection day or to a permitted collection facility.

- If after all of the above precautions have been attempted and a small household quantity remains, follow label directions, wrap it carefully to avoid spillage or leakage, and place it in the trash for pick up and disposal in a permitted landfill.

3. SOME SPECIAL CONSIDERATIONS

Motor Oil

Many auto repair shops, oil change stations or gasoline stations accept used motor oil for recycling. If they do not accept oil, they may post a notice telling customers where to recycle oil. Drain the oil in the oil filter into the rest of the used oil. Then wrap the drained oil filter in newspaper and discard with household trash. To dispose of used motor oil, first drain the oil through a funnel into a container that has a tightly secured lid. Then deliver the used oil to a local oil recycling center. Large farms may find it most practical to acquire a storage tank and contract to have a used oil recycler collect it routinely. Check with your parish extension agent or Louisiana Farm Bureau office about local used oil collection day programs. Some retailers have equipment for removing used oil from soil filters.

Tires

Landfilling used tires is not allowed in Louisiana. Tires placed in landfills take a lot of storage space, cause uneven settling and tend to rise and can break landfill covers.

Piling of used tires also presents problems and can be done only by licensed recyclers. Large tire piles are a potential source of fires which are difficult to extinguish and emit noxious fumes. The tire piles also provide an ideal habitat for mosquitos and vermin that can spread disease.

Some used tires can be retreaded and put back on the road. Some are used for boiler fuel or mixed with coal to generate electricity. Some are used to manufacture other products. New uses will be found, but for the near future there are more used tires than are needed. Tire dealers must accept used tires when you purchase new tires. A fee will be charged on each new tire to pay for recycling. Special collection day programs have been worked out for old tractor and truck tires stored on farms. Contact your parish extension agent or the Farm Bureau for details.

Pesticides

The group of chemicals known as "pesticides" includes insecticides, herbicides, fungicides, algacides, termiticides, defoliants, fungicides, rat and mouse poisons, and pet flea collars and sprays. For information on which pesticides are legal to use in Louisiana or how to dispose of banned, outdated or excess pesticides, contact your parish Extension agent or the Department of Agriculture and Forestry (DAF).

Take special precautions when disposing of empty pesticide containers. Follow the directions on the label, rinse containers with water three times and puncture plastic and metal containers to prevent reuse. Homeowners can wrap household pesticide containers securely in plastic wrap or newspaper, and dispose of them with other household refuse or as local regulations direct. Empty bags and fiberboard cans that contained pesticides should be emptied, then slit on three sides and sent to an approved landfill.

Aerosols

Discard empty aerosol cans with household refuse. Never put pressurized cans in a trash compactor or incinerator.

Burning

Researchers estimate that ground-level concentrations of dioxin caused by burning household trash in a barrel are 7000 times the amount formed during trash burning in a municipal incinerator. Ash and sludge resulting from burning household trash may also contain amounts of toxic substances such as lead, cadmium, chromium, dioxin and furan. Permitted incinerators can handle these residues safely. Individuals cannot.

Louisiana regulations prohibit open burning of household garbage, feed and seed bags, pesticide containers, wet combustible rubbish, oily substances, asphalt, plastic or rubber products. Household trash can be burned only in permitted incinerators that meet state air quality regulations and ash disposal requirements.

For more information on regulations on burning household and farm wastes, contact the your extension agent, the Department of Environmental Quality (DEQ) or DAF.

4. RECYCLING/COLLECTION DAY PROGRAMS

Recycle as many products as possible. Call the recycling center to be sure which products it will accept.

The DEQ and DAF, in conjunction with industry and environmental groups has organized "Household Hazardous Materials Collection Days" and pesticide collections in some communities. If a waste collection site is not available in your area, work with elected officials and DEQ to set up a proper disposal system.

5. STORAGE OF CHEMICALS AND HAZARDOUS WASTE

Some farmstead activities result in leftover or unused chemicals, such as waste oil and solvents, that need to be stored until properly disposed of. Locate the storage area for these chemicals and wastes at least 150 feet and down hill from your well. Dike storage areas to minimize contamination from potential spills. Such storage areas should be lined with materials impervious to the material being stored.

Store chemicals in clearly labeled containers designed to contain that hazard category (flammables, poisons, corrosives). Provide a well-ventilated, flame-free area with sturdy shelving for storing of labeled containers in the building where they are commonly used. When choosing the storage location, keep indoor air quality, safety and flammability considerations in mind. Be sure the area is adequately vented to prevent buildup of fumes from leftover products. If you can smell products, ventilation may be inadequate to protect health. Be sure the storage area provides a means to segregate flammables, poisons and corrosive wastes, to minimize accidental release caused by chemical interactions.

Hazardous wastes generated in the course of maintaining household equipment and vehicles, such as solvents and parts washer solution, must be collected and placed in closed containers. They should be stored safely until they can be taken to a hazardous waste collection site or properly disposed of. If you are not sure whether a particular waste is hazardous, contact the hazardous waste section at the DEQ, DAF, or your extension agent.

Store flammable chemicals and batteries in an area shaded from direct sunlight. Rags used to clean up solvent spills may also be a fire hazard. Store them with the same care as hazardous materials.

Inspect all storage areas regularly for spills or leaks, proper labeling and to see that containers are in good condition, closed and not bulging. For more information on proper storage methods, contact the hazardous waste section of the DEQ, the DAF or your extension agent.

GLOSSARY

Farmstead Hazardous Waste Management

These terms may help you make more accurate assessments when completing Worksheet 5. They may also help clarify some of the terms used in Factsheet 5.

Dump: An illegal garbage disposal site not designed to prevent leaching and offering little groundwater protection.

Hazardous Waste Contractor: A hazardous waste collection service offered by businesses with vehicles licensed to transport hazardous waste to permitted hazardous waste facilities.

Household Hazardous Waste Collection Program: A special program in which a community and a hazardous waste contractor collect waste for disposal in a specially constructed hazardous waste landfill or incinerator.

Household Quantities: Less than five gallons.

Household Incinerator: A facility specifically engineered to burn hazardous waste.

Landfill: A facility specifically designed for waste storage to protect groundwater through the use of a high quality impervious clay or clay/synthetic liner, accompanied by a system of buried pipes to collect any leachate. Meets current state and federal standards and is permitted by DEQ.

On-farm Disposal: Any method of burning, dumping or land spreading of wastes on the farm. Also includes the use of a sewage system for waste disposal.

Recycling: Reusing waste materials.

Solvent Recycler Collection Service: A pick-up service provided by businesses licensed to reprocess used solvents.

CONTACTS AND REFERENCES

Who to call about . . .

Health Concerns

Louisiana Department of Health and Hospitals, Environmental Epidemiology Section, (504) 568-2514.

A Specific Product

Contact the company that makes the product. The company's telephone number is frequently on the label. Or, call the Chemical Referral Center at (800) CMA-8200. Sponsored by the Chemical Manufacturers' Association, this number will refer you to a specific manufacturer for answers about product questions.

Identification and Disposal of Hazardous Wastes

Louisiana Department of Environmental Quality, Hazardous Waste Division, (504) 765-0355

Hazardous Waste Contractors

To obtain a listing of hazardous waste contractors, contact the Louisiana Department of Environmental Quality or check the yellow pages under **Hazardous Waste and Waste Contractors.**

Chemicals and Their Disposal in your Parish

Your parish extension agent or the Louisiana Department of Environmental Quality.

Pesticides and Other Agricultural Chemicals

Louisiana Department of Agriculture and Forestry, Pesticides Section, (504) 925-3770.

Human Poisoning

Your physician or the Poison Control Center in the nearest city, 1-800-858-7378.

CONTACTS AND REFERENCES

What to read about . . .

Health Effects of Hazardous Wastes

Understanding Pesticide Hazards. 1988. Louisiana Cooperative Extension Service (LCES), Pub. 2279.

How to Read and Understand a Pesticide Label. 1991. LCES, Pub. 2416-B.

Care of Pesticide Contaminated Clothing. 1987. LCES, Pub. 2335.

Pesticides - Proper Perspective: Some Facts to Help Us Keep "Toxic Things" in Proper Prospective. 1990. LCES, Pub. 2416-A.

Pesticide Waste Minimization and Disposal

Applying Pesticides Correctly: A Guide for Private and Commercial Applicators. LCES, Pub. 2374.

Pesticide Container Disposal. 1992. LCES, Pub. 2416-F.

Video

Pesticide Container Disposal. To view this video, contact your parish extension office.

Publications Available from:

Your parish extension office.

The Louisiana Department of Environmental Quality. You may contact them at their notification hotline at (504) 765-0720 or write to them at Post Office Box 82263, Baton Rouge, Louisiana 70884-2263.

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Agricultural Center
Louisiana Cooperative Extension Service

WATER WELL PROTECTION

FACTSHEET 6

Assessing the Risk of Groundwater Contamination from Household Wastewater Treatment

TYPES OF HOUSEHOLD SEWAGE SYSTEMS

What Is a Sewage System?

Most household sewage treatment and disposal systems consist of three components: (1) the house, where the waste is generated; (2) one or more tanks, where solids and grease are captured and partial treatment takes place; and (3) the final treatment and disposal system.

Household sewage is wastewater from kitchen sinks, toilets, showers, washing machines, and dishwashers. The quantity and content of household sewage depends upon the number and age of residents, their water use habits and the number, type and condition of water-using appliances. Toilets collect body wastes and sinks, showers and washing machines collect wastewater that contains small amounts of soil, soap, grease, detergents, lint and animal/vegetable matter. It is estimated that the actual volume of household wastewater is about 60 gallons/person/day.

Garbage disposals add significant amounts of wastewater and solids, which increases the needed size of the sewage system. Installation of garbage disposals in older homes without corresponding alterations in the sewage system or its management is not recommended.

Types of Systems

There are several types of household sewage treatment systems approved for use in Louisiana by the Department of Health and Hospitals (DHH). Following are brief descriptions of each. The DHH parish sanitarian must approve a system before it is installed.

The Septic Tank

When wastewater leaves the house, it is usually collected and temporarily stored in a septic tank. The septic tank is a large container, often made from concrete, with sufficient capacity to hold several days of sewage. The function of the septic tank is to trap solids, oil and

grease and to partially treat the sewage prior to secondary treatment. Within the tank:

1. The heavy particles settle to the bottom creating a sludge layer.

2. Grease and other light materials float to the top and form a layer which is retained in the tank by vertical baffles.

3. Bacteria cause some treatment to take place in the tank producing gases and dissolved solids.

To ensure satisfactory performance of the system throughout its lifetime (20-30 years), the Louisiana Sanitary Code provides that a septic tank be sized as to hold 2-1/2 times the expected daily flow. The minimum size tank is 500 gallons which is allowed for a one bedroom house. A two bedroom house requires a minimum 750 gallon tank and a three bedroom house requires a minimum 1000 gallon tank. Sizes for other buildings can be obtained from the parish sanitarian.

The depth of the sludge layer on the bottom and the scum layer on the top, gradually increases and the tank must be pumped out periodically to ensure that solids will not plug up or overload into the secondary treatment system. This may result in a backup of the sewage into the house or discharge of partially treated sewage into the yard. Pumping may have to be done every five to ten years, depending on the residents' water usage pattern and the sludge build-up rate.

The Absorption Field

From the septic tank the partially treated sewage should flow into a absorption field composed of one or more field lines. Field lines are perforated pipe from which the sewage can flow into the surrounding gravel and soil for treatment. Size of the absorption field depends on how fast water can soak into the soil (permeability) and the volume of sewage.

Solids in the sewage build up in the pore spaces of the gravel and soil surrounding the field lines until aerobic bacteria can digest them. This decreases the infiltration rate, increases contact time of wastewater in the soil and improves water quality. Plant nutrients, organic solids and bacteria and viruses are filtered by the soil and digested by soil micro organisms.

If solids overflow from the septic tank to the absorption field, the soil can become clogged, oxygen becomes unavailable for the bacteria and the system will fail. When this happens, sewage may back up into the house, there may be odors, wastewater may surface in the yard, or in road and drainage ditches or it may get into water wells. Once such a failure occurs, the system can only be renovated by a prolonged rest period and must usually be replaced. A new absorption field may cost from $1000 to $1500. Proper maintenance and operation of the septic tank can save the homeowner considerable trouble and expense with the absorption field.

A variety of products which are currently on the market claim to improve septic system performance or even to renovate failing systems. Research indicates that most of these products are not necessary for properly maintained and operated septic systems.

Oxidation Ponds

If the soil percolation rate is too slow for an absorption field, an oxidation pond may be used to further treat the septic tank effluent.

Oxidation ponds or lagoons, are surface impoundments which receive the effluent from a septic tank and expose it to sunlight and oxygen so that aerobic bacteria can digest the organic matter and improve the water quality to make it suitable for discharge. Ponds should be fenced or access otherwise restricted to prevent accidental drowning or recreational uses.

In some mobile homes, subdivisions or municipalities, multiple ponds are used in series to "polish" the water. Ponds are usually located in heavy clay soils which are not suitable for absorption fields because of their slow percolation rate.

The Sand Filter Bed

In areas in Louisiana where soils exist with high water tables or shallow soils, or clay soils where water cannot percolate easily, a sand filter may be used. Sand and gravel are mounded on top of natural soil to filter wastewater received from the septic tank before the wastewater reaches natural soil.

The Mechanical Plant

Mechanical plants serve as a combination septic tank and secondary treatment system. They operate like many municipal waste water treatment plants. Sewage first flows into a holding compartment in the front of the tank, where solids settle out. Partially treated sewage then flows into a second, aeration compartment, using aerobic bacteria (must have oxygen) for further treatment. Air is pumped into this compartment and the sewage is stirred to help the bacteria digest the solids. A third compartment allows solids to settle out, and return to the aeration chamber. The result is a treated effluent which can be discharged.
Mechanical plants may cost more than septic tanks and other systems and have a small operating cost for electricity and pump replacement. They take up less space than other systems.

Who to Call

For the name of a sewage system contractor or installer who may be able to help you with a specific problem or question check the yellow pages for "Plumbing and Sewer Service."

- Parish: Your parish sanitarian with the Louisiana Department of Health and Hospitals or your local building inspector with the city or parish.

  County agent or home economist with the Louisiana Cooperative Extension Service.

- State: Department of Health and Hospitals, Sanitarian Services.
  P.O. Box 60630, New Orleans, LA 70161.

  Department of Environmental Quality, Nonpoint Source Water Quality Management Program. P. O. Box 88215, Baton Rouge, LA 70884-2215.

GLOSSARY

HOUSEHOLD WASTEWATER TREATMENT

These terms may help you make more accurate assessments when completing Worksheet 6. They may also help clarify some of the terms used in Factsheet 6

Approved Septage Disposal Site: A site for land application for disposal of septic tank pumpage that meets state standards and is approved by the Department of Health and Hospitals.

Cesspool: Covered excavation in the ground that receives sewage directly from a building's sanitary drainage system. It is designed to retain the organic matter and solids and permit liquid to seep into soil cavities. No longer allowed by DHH or the Louisiana Sanitary Code.

Clear Water Infiltration: Entry of water into a system that does not need treatment, such as rainfall or tile drainage, through unsealed joints, access ports and cracks.

Design Capacity: Maximum volume of liquid that can be treated in a particular wastewater treatment system. For systems that include subsurface wastewater disposal and distribution, capacity is also based on the soil's ability to accept and treat sewage effluent.

Effluent: Liquid discharged from a mechanical plant or oxidation pond.

Hydraulic Loading Rate: The volume of wastewater discharged per unit area per unit time.

Off-Site Disposal: Disposal of wastewater or sludge off the farm, as at a municipal treatment plant or approved septage disposal site.

Scum: Floatable solids, such as oil, grease and fat.

Sludge: Settleable, partially decomposed solids resulting from biological, chemical or physical wastewater treatment.

FARM*A*SYST
Farmstead Assessment System

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WATER WELL PROTECTION

FACTSHEET 7

Assessing the Risk of Groundwater Contamination from LIVESTOCK WASTE MANAGEMENT

1. LIVESTOCK WASTE AND GROUNDWATER QUALITY

Livestock waste is a potential source of groundwater contamination. Managing these livestock wastes in an economical manner must be accomplished while assuring satisfactory environmental protection.

Potential Sources of Contamination

Groundwater contamination by livestock waste may occur through abandoned and improperly plugged wells and surface drains. Groundwater contamination can also occur from percolation or leaching through the soil. Contamination from livestock waste can occur when the waste is improperly applied to the land as organic matter or when the waste is temporarily stored before application.

Surface Application of Livestock Waste

Major factors that affect groundwater quality during land application of livestock waste are soil type, tillage practices, soil fertility levels, crop uptake, waste application rate and timing, and rainfall amounts. Contaminant leaching is highly dependent upon rainfall and varies from year to year. Research have shown that nitrate leaching from fertilizer application is higher for no-till than for conventional tillage. Nitrates from livestock waste may behave in a similar fashion. Providing temporary livestock waste storage may reduce the amount of nitrate leaching because of better timing of livestock manure applications.

2. TEMPORARY WASTE STORAGE

Livestock producers may store waste temporarily before it is disposed of or used. Temporary storage may last a few days or it may be stored for a year or more in waste storage structures. Temporary storage should prevent contact with rainfall or allow collection and storage of rainfall runoff from the waste.

3. LONG-TERM WASTE STORAGE

Lagoons are a type of earthen storage constructed to decompose and break down livestock waste biologically. The bacteria involved in the waste decomposition may be aerobic (need oxygen to live) or anaerobic (do not need oxygen to live). There are two types of lagoons: aerobic and anaerobic. Anaerobic lagoons are most commonly used for livestock waste. In the anaerobic lagoon, some of the solid material settles to the bottom where it undergoes anaerobic decomposition. The by-products may then be further broken down in the upper layers of the lagoon. These lagoons are usually eight feet deep or deeper. A second lagoon may also be used for polishing effluent from an anaerobic lagoon before recycling this water for flushing. This lagoon is usually shallow, three to five feet deep, and allows aerobic bacteria to develop and further decompose solids and organic matter dissoved in the wastewater.

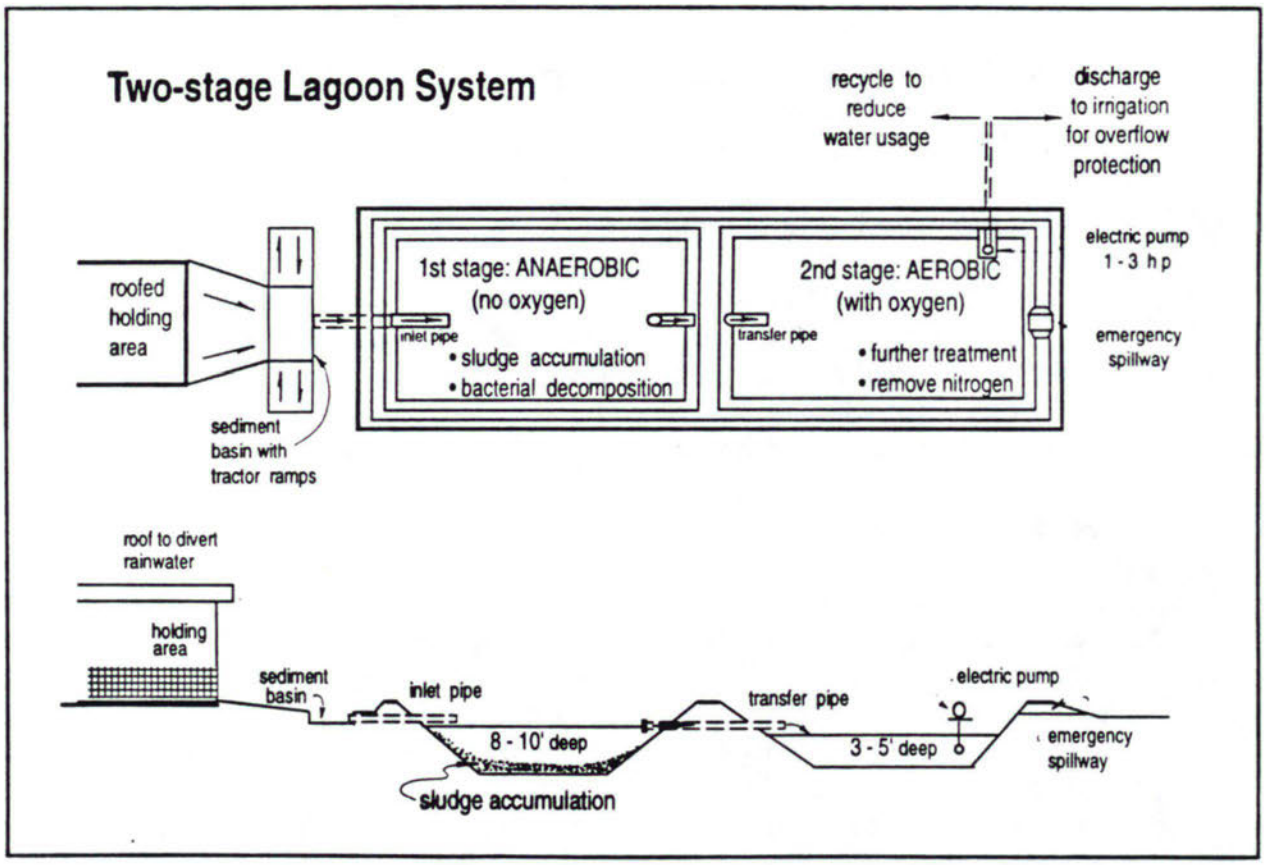


Figure 1. *A schematic overview of a two-stage lagoon system commonly constructed in Louisiana.*

Lagoons must be managed to protect groundwater, surfacewater and water wells. The liquid level must be maintained low enough so that a discharge from the lagoon system will not occur except in the event of a major rainstorm. This is usually done by using the water for irrigation. Lagoon solids must be removed when they take up about half of the volume in the anaerobic lagoon. Because about 20% of the solids in livestock waste are non-biodegradable, these solids accumulate as sludge on the bottom of the lagoon and must be cleaned out to restore holding capacity and treatment capability of the lagoon.

4. CONSIDERATIONS FOR LAGOON CONSTRUCTION

Soil Type

The primary groundwater quality concern of livestock waste storage in surface impoundments or lagoons is the potential for seepage through the bottom and sides. Bacteria and solids on the lagoon bottom clog soil pores and help reduce seepage. Self-sealing actions alone, however, should not be relied upon to protect groundwater. Contamination of groundwater may be minimized by avoiding very sandy or gravelly soils. Earthen lagoons built in these areas should be sealed with compacted clay or a synthetic liner as recommended by an appropriate soil survey and engineering design. Avoid sites where an extremely high water table will be within the storage area. Louisiana livestock producers should request assistance of the USDA Soil Conservation Service or a qualified engineering or geotechnical consultant to locate and construct a new lagoon or to enlarge or improve an existing lagoon.

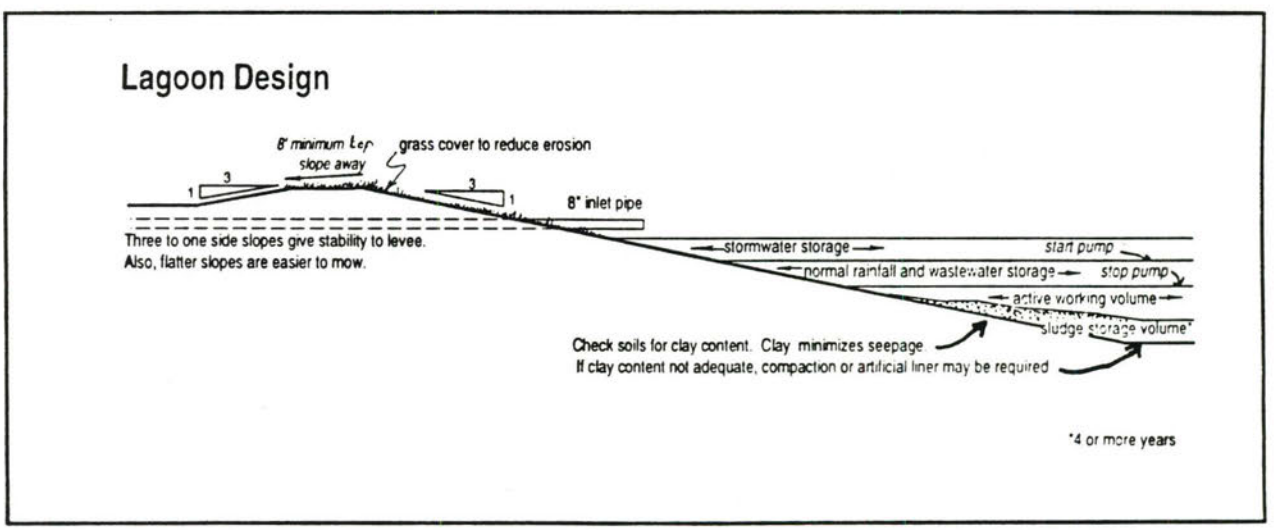


Figure 2. *A typical cross-section of a working lagoon.*

Other Considerations

Some facilities for storage of solid or semi-solid manure, bedding or litter allow seepage from the waste stack. In these instances, structured design must include treatment for the wastes that seep out.

The best way to handle seepage may be to channel it into a watertight holding pond or storage tank. In those areas where sufficient soil is unavailable for the construction of filter strips, or where the construction of a holding pond is not feasible, another important consideration is to build a roof over the structure to eliminate additional water being added to the manure stack and runoff from rainfall.

5. SOLID WASTE STORAGE

Stored manure, bedding or litter generates heat from bacterial decomposition and sponteneous combustion can occur. Care should be taken not to allow rainfall to blow in on a litter stack and cause excess heating to occur.

6. LOCATING WASTE STORAGE FACILITIES

Since storage and handling areas for livestock waste are a potential source of groundwater contamination, careful consideration must be given to the location. This is especially important to the farm family and the people living nearby since their quality of life may be adversely affected. The Louisiana Department of Health and Hospitals (DHH) requires storage facilities for livestock waste to be located at least 100 feet and preferably downhill from a water well. To minimize the effect of livestock waste on groundwater contamination and your neighbors, it is recommended that waste storage facilities: (1) be located near the holding area and downhill for gravity flow, (2) be located at least 300 feet from the neighboring property line, (3) be located as far as possible from the homes of neigbors, and (4) be located away from the owner's/operator's house.

7. POTENTIAL CONTAMINANTS FROM LIVESTOCK WASTE

Bacteria present in livestock waste can contaminate groundwater through nearby wells. If during a water test any coliform bacteria are detected, the water should not be used for drinking until disinfected. A new sample should be tested for confirmation and a fecal coliform test should be conducted.

Drinking water contaminated by bacteria may cause infectious diseases such as dysentery, typhoid and hepatitis. Nitrates are also present in livestock waste. Water that contains 10 milligrams of nitrate (as nitrogen) per liter should not be consumed

by babies under six months of age or pregnant women because high concentrations of nitrates in the drinking water can cause the potentially fatal "blue baby" syndrome in infants. Young farm animals can also be adversely affected by high nitrate concentrations. Nitrate is apparently not a problem for older children or adults.

Nitrate levels in Louisiana water wells have been very low. Nitrate poisening of calves and heifers usually results from high nitrate levels in grass under wet weather conditions. Coliform tests can be easily contaminated during sample collection as the bacteria occurs in soil. A positive test may only indicate a contaminated sample. Resample to confirm taking care not to contaminate the sample, or chlorinate the well and water system and resample after flushing the system. Your parish sanitarian or extension agent can help you in sampling and chlorinating a well water system.

If bacteria or nitrate is detected, inspect the well to see if rainwater can seep from the surface into the well. If so, modify the well and surrounding area to prevent surface contamination. A licensed well driller may be needed.

GLOSSARY

Livestock Waste Storage

These terms may help you make more accurate assessments when completing Worksheet 7. They may also help clarify some of the terms used in this publication.

Lagoon: Clay-lined manure storage facility constructed according to specific engineering standards. Not simply an excavation.

Engineering standards: Design and construction standards available from the Soil Conservation Service (SCS). These standards are part of the SCS Field Office Technical Guide.

Glass-lined steel storage: A type of liquid-tight, above-ground animal waste storage structure. Located on a concrete pad, it consists of steel panels bolted together and coated inside and outside with fiberglass to provide corrosion protection.

Poured concrete storage: A type of liquid-tight animal waste storage structure. Located on a concrete pad, it consists of poured concrete reinforced with steel. It may be partially or entirely below ground level.

Water table depth: Depth to the upper surface of groundwater. This depth is sometimes indicated in the parish soil survey, but it varies from parish to parish and seasonally. This information may be available from your well construction report or from hydrogeological reports and groundwater flow maps of your area. Your parish extension agent, or SCS district conservationist may also be able to help you gather this information.

There are two types of water tables: (1) the water table typically noted in a well log as an indication of usable water supply, and (2) the seasonal high water table. The seasonal high water table is most important in regard to construction of livestock manure facilities, because it may present construction problems and prevent or reduce sealing.

CONTACTS AND REFERENCES
Who to call about . . .

Waste Storage Needs, Designing Appropriate Structures

Soil Conservation Service district conservationist or your parish extension agent.

Cost-sharing Funds

Financial assistance for animal waste management practices, including waste storage, may be available through the Agricultural Stabilization and Conservation Service, the Soil Conservation Service, and the Department of Environmental Quality or through private environmental organizations.

Animal Waste Management

The Soil Conservation Service has design standards and accepted animal waste management practices for feeding operations. You may contact a district office, one of which is located in most parishes. The Louisiana Department of Agriculture and Forestry, office of Soil and Water Conservation, is responsible for Best Management Practices (BMPs) used to reduce water contamination from animal waste.

Contact your parish Extension office for more information on

- Land application of livestock waste
- Planning and design of livestock facilities
- Handling, management and storage of livestock waste
- Health effects of livestock waste in groundwater
- Animal waste management

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WATER WELL PROTECTION

WORKSHEET 1

Assessing the Risk of Groundwater Contamination from Drinking Water Well Condition

WHY SHOULD I BE CONCERNED?

Almost all of Louisiana'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 near the well could result in the contamination of your family's drinking water supply. Feedlots, poultry barns, septic systems, fertilizer and waste storage areas could release nitrate, thus contaminating your well water.

Preventing well water contamination is very important. Once the groundwater supplying your well is contaminated, it is very difficult and expensive 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 both your family and your neighbors and a potential financial liability to you.

The goal of this worksheet 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 own analysis of your drinking water well condition and management practices.

- It will allow you to rank your activities according to how they might affect the groundwater that provides your drinking water supplies.

- It will result in 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 you might want to modify 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 determine 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. If you need more information about wells and water supply, refer to Fact Sheet 1, Drinking Water Well Condition.

DRINKING WATER WELL: 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 do not apply to your farmstead).
3. Then look above the description you circled to find your "risk 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 water well management practices and conditions.

	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.	At same elevation 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, 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, clay loams, silty clay).	Medium-textured soils (silt loam, loam).	Medium- or coarse-textured soils.	Coarse-textured soils (sands, sandy loam).	
CONDITION***					
Condition of casing and seal***	No holes or cracks. Seal secure. Screened vent.	No defects visible. Well is vented but not screened.	No holes or cracks visible. Seal loose.	Holes or cracks visible. Seal loose or missing.	
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.	

WHAT DO I DO WITH THESE RANKINGS?

Step 1: Begin by determining your overall well management risk ranking. Add 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		Average 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 condition and 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 2 of Worksheet 12. If you are also ranking other categories, you will later 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 subsurface characteristics), 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 and family health 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 and causing family health problems.

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 ranking before you take action.

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

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
CONDITION* (continued)**					
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.	
Well age* **	Less than 20 years old.	21-50 years old.	51-70 years old.	More than 70 years old.	
Well type* **	Drilled	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. Air gap maintained. No cross-connections.	No anti-backflow devices. Air gap maintained. No cross-connections.	No anti-backflow devices. Air gap not maintained. Cross-connections between water supplies.	
Unused or abandoned well	No unused, unsealed wells or abandonded, improperly closed wells.	Unused wells capped and protected, abandoned wells properly closed.	Unused, unsealed well in field. Not capped or protected or properly closed.	Unused, unsealed well in farmstead. Not capped or protected or properly closed.	
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 flooding. Noticeable changes in color, clarity, odor or taste.	

*See page 3 of Fact Sheet 1, Drinking Water Well.

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

***Refer to Water Well Rules, Regulations and Standards. State of Louisiana. 1985. Copies available from the Department of Transportation and Development, Water Resources Section DOTD.

TOTAL

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

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

FARM*A*SYST
Farmstead Assessment System

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WATER WELL PROTECTION

WORKSHEET 2

Assessing the Risk of Groundwater Contamination from PESTICIDE STORAGE AND HANDLING

WHY SHOULD I BE CONCERNED?

Pesticides are showing up where they are not wanted - in our surface water. If pesticides are not handled carefully around the farmstead, they can also seep into the ground after a leak or spill, or they can enter a well directly during mixing and loading by back-siphoning or by being washed from the surface into an improperly sealed well.

Pesticides play an important role in agriculture. They have increased farm production and enabled farmers to manage more acres with less labor. Taking voluntary action to prevent pesticide contamination of groundwater will help assure their continued availability for responsible use.

Pesticides work by interfering with the life processes of plants and insects. Pesticides are also toxic to people. If pesticides enter a water supply in large quantities - as can happen with spills or backsiphonage accidents - **acute health effects** (toxic effects apparent after only a short period of exposure) can range from moderate to severe, depending on the toxicity of the pesticide and the amount of exposure. Contaminated groundwater used for drinking water supplies may result in **chronic exposure** (prolonged or repeated exposure to low doses of toxic substances), which may be hazardous to people and livestock.

When found in water supplies, pesticides normally are not present in high enough concentrations to cause acute health effects, which can include chemical burns, nausea and convulsions. Instead, they typically occur in trace levels, and the concern is primarily for their potential for causing chronic health problems from prolonged exposure.

Your drinking water is least likely to be contaminated if you follow best management practices and dispose of wastes properly.

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 pesticide handling, storage and disposal practices.
- It will help you to rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will result in rankings that will help you analyze the "risk level" of your pesticide handling, storage and disposal practices.
- It will help you determine which of your practices are reasonably safe and effective and which practices might require modification to protect your drinking water better.

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.

WORKSHEET 2

PESTICIDE STORAGE AND HANDLING: 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 do not apply to your farmstead).
3. Then look above the description you circled to find your "risk 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 pesticide storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
PESTICIDE STORAGE					
Amount Stored	No pesticides stored at any time.	Less than 1 gallon or less than 10 pounds of each pesticide.	More than 1 gallon or more than 10 pounds of each pesticide.	More than 55 gallons or more than 550 pounds of each pesticide.	
Types Stored:					
Leachability*	No chemicals stored.	Chemicals classified as having low leaching potential.	Chemicals classified as having medium leaching potential.	Chemicals classified as having high leaching potential.	
Liquid or Dry Formulation	No liquids. All dry.	Some liquids. Mostly dry.	Mostly liquids. Some dry.	All liquids.	
Spill or Leak Control in Storage Area	Impermeable surface (such as concrete) does not allow spills to soak into soil. Curb installed on floor to contain leaks and spills.	Impermeable surface with curb installed has some cracks, allowing spills to get to soil. OR impermeable surface without cracks has no curb installed.	Permeable surface (wooden floor) has some cracks and no curb. Spills could contaminate wood or soil.	Permeable surface (gravel or dirt floor). Spills could contaminate floor.	
Containers	Original containers clearly labeled. No holes, tears or weak seams.	Original containers old. Labels partially missing or hard to read.	Containers old but patched. Metal containers show signs of rusting.	Containers have holes or tears that allow chemicals to leak. **No Labels.**	
Security	Fenced or locked area separate from all other activities.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill chemicals.	Open access to theft, vandalism and children.	

MIXING AND LOADING PRACTICES

Location of storage mixing/loading area with no curbed and impermeable containment area in relation to well	100 feet or more downslope from well.	50 feet downslope from well.**	10 - 50 feet downslope from well,** or 100-500 feet upslope.	Within 10 feet downslope or within 100 feet upslope from well.**	
Surface runoff to well from nearby fields which have been sprayed* **	No surface runoff.	Very little surface runoff.	Moderate surface runoff.	High surface runoff.	
Mixing and loading pad (spill containment)	Concrete pad with curb keeps spills contained. Sump allows collection and transfer to storage.	Concrete pad with curb keeps spills contained. No sump.	Concrete pad with some cracks keeps some spills contained. No curb or sump.	No mixing/loading pad. Permeable soil (sand). Spills soak into ground.	
Backflow prevention on water supply	Anti-backflow device installed or 6-inch air gap maintained above sprayer tank.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. **Hose in tank below water line.**	
Water Source	Separate water tank.	Hydrant away from well.	Hydrant near well.	Obtained directly from well.	
Filling Supervision	Constant.	Most of the time.	Frequent.	Seldom or never.	
Handling System	Closed system for all liquid and dry product transfers.	Closed system for most liquids. Some liquid and dry product hand poured. Sprayer fill port easy to reach.	All liquids and dry product hand poured. Sprayer fill port easy to reach.	All liquids and dry product hand poured. Sprayer fill port hard to reach.	
Sprayer Cleaning and Rinsate (rinse water) Disposal	Sprayer washed out in field. Rinsate used in next load and applied to labeled crop.	Sprayer washed out on pad at farmstead. Rinsate used in next load and applied to labeled crop.	Sprayer washed out at farmstead. Rinsate sprayed less than 100 feet from well.	Sprayer washed out at farmstead. **Rinsate dumped at farmstead or in field.**	

CONTAINER DISPOSAL

Disposal Location	Triple-rinsed containers or properly slit bags returned to dealers or taken to permitted landfill, or incinerator.	**Unrinsed containers and empty bags taken to permitted landfill, incinerator.**	**Disposal of unrinsed containers or empty bags on farm.**	**Disposal of partially filled plastic or paper containers on farm.**	

BOLDFACE TYPE: Besides representing a higher-risk choice, this practice also violates Louisiana law.

FOOTNOTES: *See Pesticide Runoff and Leachability Chart. Note the "Leachability Factor" for each pesticide you store on your farmstead. The values are high (if the RLPI number is less than 20), medium (if the RLPI value is between 20 to 100), and low (if the RLPI value is 100 or greater). Identify the pesticides stored on your farmstead from the pesticide leachability and runoff chart. Note the leachability for each pesticide you store, then give yourself an overall "leaching ranking" (low, medium, high) which represents the pesticides you store. Use this ranking to complete the "leachability" section on this worksheet.

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

***See attached pesticide runoff and leaching chart. Note the "runoff factor" for each pesticide you store on your farmstead. These values are high (if the RRPI value is less than 20), medium (if the RRPI value is 20 to 100) and low (if the RLPI value is 100 or greater). Then give yourself an overall "runoff ranking" (low, medium, high) which represents the pesticides you store. Use this ranking to complete the "runoff" section on this worksheet.

NOTE: Runoff refers to the portion of rainfall on land that is lost without entering the soil.

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 pesticide management risk ranking. Add 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	Average Risk Ranking

*Carry your answer out to one decimal.

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 pesticide 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 pesticide management risk ranking on page 2 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, depth and moisture characteristics), 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; take action

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 page 7 of Worksheet 12.

Step 3: Study Factsheet 2, *Pesticide Storage and Handling*, and consider how you might modify your farmstead practices to better protect your drinking water.

FARM*A*SYST
Farmstead Assessment System

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Louisiana Cooperative Extension Service

Louisiana Department of Environmental Quality

WATER WELL PROTECTION

WORKSHEET 3

Assessing the Risk of Groundwater Contamination from
FERTILIZER STORAGE AND HANDLING

WHY SHOULD I BE CONCERNED?

Fertilizers play a vital role in agriculture. Over the years, they have increased farm production dramatically. Commercial fertilizer is, however, a major source of nitrate. Nitrate-nitrogen levels exceeding the public health standard of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) have been found in drinking water wells. The other major components of commercial fertilizer, phosphorus and potassium, are not generally a groundwater contamination concern.

Nitrate levels in drinking water above federal and state drinking water standards of 10 mg/l nitrate-nitrogen can pose a risk to some infants. Infants under 6 months of age are particularly susceptible to health problems from high nitrate-nitrogen levels, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate can also affect adults, but the evidence is much less certain.

Young livestock are also particularly susceptible to health problems from high nitrate-nitrogen levels. While livestock may be able to tolerate several times the 10 mg/l nitrate-nitrogen level, levels of 20-40 mg/l may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Farmstead handling of fertilizers can affect ground water by allowing materials containing nitrogen to seep into the ground after a leak or spill. Other potential farmstead sources of nitrate are septic systems, livestock waste storage facilities and silage storage.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures or dispose of wastes **off the farm site.** However, proper off site disposal practices are essential to avoid risking contamination that could affect the water supplies and health of others.

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 fertilizer handling, storage and disposal practices.
- It will allow you to rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will result in rankings that will help you analyze the "risk level" of your fertilizer handling storage and disposal practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

HOW DO I COMPLETE THE WORKSHEET?

Follow the direction 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.

WORKSHEET 3

FERTILIZER STORAGE AND HANDLING: 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 do not apply to your farmstead).
3. Then look above the description you circled to find your "risk 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 yours risk ranking for fertilizer storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
FERTILIZER STORAGE					
Dry Formulation					
Amount Stored	None stored at any time.	Less than 1 ton.	Between 1 and 20 tons.	More than 20 tons.	
Type of Storage	Covered on impermeable surface (such as concrete or asphalt). Spills are collected.	Covered on clay soil. Spills are collected.	Partial cover on loamy soils. Spills not collected.	No cover on sandy soils. Spills not collected.	
Liquid Formulation					
Amount Stored	None stored at any time.	Less than 55 gallons.	Between 55 and 1500 gallons.	More than 1500 gallons.	
Type of Storage	Concrete or other impermeable secondary containment does not allow spill to contaminate soil.	Clay-lined secondary containment. Most of spill can be recovered.	Somewhat permeable soils (loam). No secondary containment. Most of spill cannot be recovered.	Permeable soil (sand). No secondary containment. Spills contaminate soil.	
Containers	Original containers clearly labeled. No holes, tears or weak seams. Lids tight.	Original containers old. Labels partially missing or hard to read.	Containers old but patched. Metal containers showing signs or rusting.	Containers have holes or tears that allow fertilizers to leak. No labels.	

FERTILIZER STORAGE (continued)					
Security	Fenced or locked area separate from all other activities, or locks on valves.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill fertilizer.	Open access to theft, vandalism and children.	
MIXING AND LOADING PRACTICES					
Location of mixing/loading area with no curbed and impermeable containment area in relation to well	**100 or more feet downslope from well.**	50 feet downslope from well.*	**10 to 50 feet downslope from well*,** or 100 to 500 feet upslope.	**Within 10 feet downslope*,** or within 100 feet upslope from well.	
ADDITIONAL MIXING AND LOADING PRACTICES FOR LIQUID FERTILIZER					
Mixing and Loading Pad (spill containment)	Concrete mixing/loading pad with curb keeps spills contained. Sump allows collection and transfer to storage.	Concrete pad with curb keeps spills contained. No sump.	Concrete pad with some cracks keeps some spills contained. No curb or sump.	No mixing/loading pad. Permeable soil (sand). Spills soak into ground.	
Water Source	Separate water tank.	Hydrant away from well.	Hydrant near well.	Directly obtained from well.	
Backflow prevention on water supply	Anti-backflow device installed or 6-inch air gap maintained above sprayer tank.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. **Hose in tank below water line.**	
Filling Supervision	Constant	Most of the time	Frequent	Seldom or never	
Handling System	Closed system for all liquid product transfers.	Closed system for most liquids. Some liquids hand poured. Spreader fill port easy to reach.	All liquids hand poured. Spreader fill port easy to reach.	All liquids hand poured. Spreader fill port hard to reach.	

CLEANUP AND DISPOSAL PRACTICES

Spreader Cleaning and Rinsate (rinse water) Disposal	Spreader washed out in field. Rinsate used in next load and applied to labeled crop.	Spreader washed out on pad at farmstead. Rinsate used in next load and applied to labeled crop.	Spreader washed out at farmstead. Rinsate sprayed less than 100 feet from well.	Spreader washed out at farmstead. **Rinsate dumped at farmstead or in nearby field.**	

BOLDFACE TYPE: Although these practices are legal for fertilizers in Louisiana, they are illegal for pesticides. Therefore, if the same area is used for both pesticide and fertilizer handling, these conditions are illegal.

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

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. Add the ranking for the categories you completed and divide by the number of categories you ranked:

_____	divided by _____	equals _____ *
Total of Rankings	# of Categories Ranked	Average 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 condition and 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 2 of Worksheet 12. If you are also ranking other categories, you will later 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 subsurface characteristics), 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 and family health 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 and causing family health problems.

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 page 7 of Worksheet 12.

Step 3: Study Factsheet 1, Drinking Water Well Condition, and consider how you might modify your farmstead practices to better protect your drinking water.

Step 4: Study Factsheet 3, Fertilizer Storage and Handling, and consider how you might modify your farmstead practices to better protect your drinking water.

FARM*A*SYST
Farmstead Assessment System

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Technical reviews: Don Robinson, Department of Agronomy, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center.

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WATER WELL PROTECTION

WORKSHEET 4

Assessing the Risk of Groundwater Contamination from Petroleum Product Storage

WHY SHOULD I BE CONCERNED?

Improper storage of liquid petroleum products such as motor fuel, antifreeze, used oil, hydraulic oil, paint and paint thinners, and solvents can present a threat to public health and the environment. Nearly one out of every four underground storage tanks in the United States may now be leaking, according to the U. S. Environmental Protection Agency. If an underground petroleum tank is more than 20 years old, especially if it's not protected against corrosion, the potential for leaking increases dramatically. Newer tanks and piping can leak, too, especially if they weren't installed properly.

Even a small gasoline leak of one drop per second can result in the release of about 400 gallons of gasoline into the groundwater in one year. Less than a gallon of gasoline in the groundwater may be enough to pollute drinking water severely. At low levels of contamination, fuel contaminants in water cannot be detected by smell or taste, yet the seemingly pure water may be contaminated to the point of affecting human health.

Preventing tank spills and leaks is especially important because of how rapidly gasoline, diesel and other petroleum products can move through surface layers and into groundwater. Also, vapors from a leak or spill that collect in sheds, sumps or other structures have the potential to explode. Selling property with an old, leaking underground tank may also be difficult because of potential liability for groundwater contamination and cleanup.

Petroleum fuels contain a number of potentially toxic compounds, including common solvents such as benzene, toluene and xylene, and additives such as ethylene dibromide (EDB) and organic lead compounds. EDB is a carcinogen (cancer-causer) in laboratory animals, and benzene is considered a human carcinogen.

The worksheet focuses on storage of gasoline, kerosene and liquid fuels. It does not apply to LP (liquid propane) gas, since leaks vaporize quickly and do not threaten groundwater.

The goal of this worksheet is to help you protect the groundwater that supplies your drinking water.

HOW WILL THIS WORKSHEET HELP ME PROTECT MY GROUNDWATER?

- It will take you step by step through your petroleum product storage 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 petroleum product storage 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.

PETROLEUM PRODUCT STORAGE: 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 you, read across to the right and circle the statement that **best** describes your situation (skip & leave blank any categories that do not apply).
3. Look above the description circled to find your 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 petroleum product storage practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION (all tanks)					
Position of tank in relation to drinking water well	Tank downslope more than 50 feet from well in medium- or fine-textured soils (silt loam, loam, clay loams, silty clay) with low soil permeability.	Tank at grade or up-slope more than 50 feet from well in medium- or fine-textured soils (silt loam, loam, clay loams, silty clay) with low soil permeability.	Tank downslope more than 50 feet from well in coarse-textured soil (sands, sandy loam) with high soil permeability.	Tank at grade or up-slope **less than 50 feet from well** in coarse-textured soil (sand, sandy loams) with high soil permeability.	
Tank location and local land use (leakage potential)	Well-drained soils. Water table always beneath tank. Above-ground tank more than 50 feet from buildings.	Moderately well-drained soils. Only occasionally high water table. Located more than 50 feet from buildings.	Located more than 50 feet from buildings. Medium- or fine-textured soils (silt loams, loam, clay loams, silty clay) saturated seasonally.	Located near buildings and in area with fine-textured soils (clay loams, silty clay) often saturated.	
DESIGN AND INSTALLATION (all tanks)					
Type and age of tank/corrosion protection	Synthetic tank or tank protected from rust by cathodic protection.	Steel tank less than 15 years old, coated with paint or asphalt.	Coated steel tank 15 or more years old. OR bare steel tank less than 15 years old.	Bare steel tank 15 or more years old.	
Spill and tank overfill protection	Impermeable catch basin plus automatic	Impermeable catch basin plus overfill	Impermeable catch basin or concrete catch	No protection.	

Piping	Piping protected from rust by cathodic protection and isolated from tank, sloped back to tank. Check valve at pump (not at tank).	Piping galvanized but not isolated from tank. Pipe drains back to tank. Check valve at pump.	Pipe galvanized, not isolated or bare. Piping sloped back to tank, but check valve is located at tank (foot valve).	Piping and tank isolated and of dissimilar materials. Unisolated pipe bare, cannot drain freely to the tank. All pressure pipe systems.	
Tank installation	Installed by state-certified installer.	**Installed according to recommendations provided with new tank by seller.**	**No information on installation.**	**Installed without backfill, setback, secondary containment, anchors and other protections, or by untrained individual.**	
DESIGN AND INSTALLATION (above-ground tanks only)					
Tank enclosure	Tank surrounded by 6 foot tall non-combustible building or fence with lock. Building well-ventilated. Fire wall in place.	Tank surrounded by low fence with lock. Fire wall in place.	Tank surrounded by low fence. No lock. No fire wall.	No enclosure.	
Secondary containment	Tank placed within concrete or synthetic dike and pad able to hold 125% of tank capacity.	Tank placed within dike and pad made of low permeability soils, able to hold 125% of tank capacity.	**Tank placed on pad.**	**No secondary containment.**	
MONITORING (all tanks)					
Tank integrity testing and leak detection monitoring	Regular (monthly) leak monitoring.	Daily inventory control and annual tank tightness testing.	Occasional inventory control and annual tank tightness testing.	No inventory control, testing or monitoring.	

TANK CLOSURE (underground tanks)

Unused tank	Tank taken from ground, excavation checked for evidence of contamination by licensed contractor	Tank filled with inert material and excavation checked for evidence of leaking by licensed contractor.	**Tank removed or filled with inert material. Excavation not checked for contamination.**	Tank left in ground.	

BOLDFACE TYPE: Besides representing higher risk choice, this practice may also violate Louisiana law.

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 petroleum product storage 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		Average 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 petroleum product storage **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.

Enter your boxed well management risk ranking on pages 2 and 3 of worksheet 12. If you are also ranking other categories, you will later 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 subsurface conditions), 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 page 7 of worksheet 12.

Step 3: Read Fact Sheet, *Petroleum Product Storage*, and consider how you might modify your practices to better protect your drinking water.

FARM*A*SYST
Farmstead Assessment System

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WATER WELL PROTECTION

WORKSHEET 5

Assessing the Risk of Groundwater Contamination from Farmstead Hazardous Waste Management

WHY SHOULD I BE CONCERNED?

Consider the variety of hazardous products commonly used in households and on farms: paints, solvents, oils, cleaners, wood preservatives, batteries, adhesives and pesticides. Small, unusable amounts often wind up spilled, buried, dumped or flushed onto farm property. Minimizing the amounts of hazardous substances in the households and on the farm, along with practicing proper disposal methods, can reduce health risks, financial liability and potential groundwater contamination. Farmers and their families are generally familiar with the hazards of pesticides commonly used in the farm operations, but they may be less aware of the hazards of other chemicals that make many tasks around the home and farm easier or more efficient.

Improper use of hazardous products may cause toxic health effects. Improper storage may allow chemicals to leak, causing potentially dangerous chemical reactions, toxic health effects or groundwater contamination. Improper disposal may allow dangerous chemicals to contaminate drinking water.

Drinking water is least likely to be contaminated by your hazardous wastes if the following management and disposal practices are used.

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

HOW WILL THIS WORKSHEET HELP PROTECT DRINKING WATER?

- It will take you step by step through your hazardous waste management practices.
- It will help to rank activities according to how they might affect the groundwater that provides drinking water supplies.

- It will result in rankings that will help analyze the "risk level" of hazardous waste management practices.

- It will help determine which practices are reasonably safe and effective, and which practices might require modification to better protect drinking water.

HOW DO I COMPLETE THE WORKSHEET?

Follow the directions at the top of the chart on the next page. It should take about 15 to 30 minutes to complete this worksheet and figure out your ranking.

WORKSHEET 5

FARMSTEAD HAZARDOUS WASTE MANAGEMENT: 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 do not apply to your farmstead).
3. Look above the description you circled to find your "risk 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 hazardous waste disposal practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
HOME WORKSHOP/HOBBY PRODUCTS					
Paint, Oil based	Used up or shared with someone, or hazardous waste collection service used.	**Liquid evaporated in open air**. Sludge or leftover product taken to permitted landfill or incinerator.**	**DISPOSAL AT DUMP.**	**DISPOSAL ON FARM.**	
Paint strippers*, brush or spray gun cleaners*, glues and adhesives, turpentine*, varnish, lacquers, auto-body repair compounds	Products used up in contained, ventilated area or shared with someone, or hazardous waste collection service used.	**Filtered cleaning solvents reused or evaporated in open air**. Sludge taken to permitted landfill or incinerator.**	**DISPOSAL AT DUMP.**	**DISPOSAL ON FARM.**	
CONTAINER DISPOSAL					
Paper/cardboard pesticide containers	Hazardous waste collection service used.	Empty container taken to permitted landfill or incinerator.	**DISPOSAL AT UNPERMITTED DUMP NOT ALLOWED BY LDAF*** REGULATIONS.**	**DISPOSAL ON FARM NOT ALLOWED BY LDAF** REGULATIONS.**	
Metal or plastic pesticide containers	Triple-rinsed container taken to permitted landfill or incinerator. Rinsate added to spray mix.	**REUSE OF CONTAINER FOR OTHER PURPOSES, NOT ALLOWED by LDAF*** REGULATIONS.**	**DISPOSAL OF EMPTY BUT UNRINSED CONTAINER AT UNPERMITTED DUMP NOT ALLOWED BY LDAF*** REGULATIONS.**	**DISPOSAL ON FARM NOT ALLOWED BY LDAF*** REGULATIONS.**	

Motor vehicle and hazardous household product containers	Product used up. Container reused for a similar product or container taken to a recycling facility.	Empty container taken to permitted landfill or incinerator.	**DISPOSAL OF EMPTY CONTAINER ON FARM.**	**DISPOSAL OF PARTIALLY FILLED CONTAINER ON FARM.**	
PESTICIDES					
Unwanted or banned pesticides	Participation in EPA/Industry banned pesticide buy-back program or return of unused pesticides to place of purchase if allowed. Licensed hazardous waste collection service used.	Pesticide sold for restricted or general purposes used up or **TAKEN TO A PERMITTED HAZARDOUS WASTE INCINERATOR.**	**DISPOSAL OF UNUSED PESTICIDES AT UNPERMITTED DUMP NOT ALLOWED BY LDAF***** REGULATIONS.	**DISPOSAL OF UNUSED PESTICIDES ON FARM NOT ALLOWED BY LDAF***** REGULATIONS.	
VEHICLE/METAL EQUIPMENT MAINTENANCE PRODUCTS					
Waste oil and grease	Taken to used oil collection center for recycling.	Reused for lubrication. **COLLECTED AND DISPOSED OF AT PERMITTED LANDFILL OR INCINERATOR.**	**DISPOSAL AT DUMP.**	**DISPOSAL ON FARM.**	
Spent organic solvent/parts cleaner	Solvent recycler collection service used for leftover cleaners.	Filtered in ventilated area and reused or evaporated in open air.** Sludge taken to permitted landfill or incinerator.	**DISPOSAL OF SOLVENTS OR SLUDGE AT DUMP.**	**DISPOSAL OF SOLVENTS OR SLUDGE ON FARM.**	
Rust-removal products	Used up or shared with someone else. Licensed hazardous waste collection services used.	Taken to permitted landfill or incinerator.	**DISPOSAL OF LEFTOVER PRODUCT AT DUMP.**	**DISPOSAL OF USED PRODUCT ON FARM.**	
Lead acid battery	Taken to battery recycler or battery store.	**USED BATTERIES TAKEN TO PERMITTED LANDFILL OR INCINERATOR;** or stored away from well.	**USED BATTERIES TAKEN TO DUMP** or stored near well.	**DISPOSAL ON FARM.**	

Vehicle maintenance drips and spills	Contained on paved area with an absorbent. Contaminated absorbent disposed of at permitted landfill or incinerator.	Contained on paved area with an absorbent. Contaminated absorbent disposed of at dump.	Occasional flushing onto farm property away from well.	Frequent flushing onto farm property near well.	
Used antifreeze	Saved and taken to antifreeze recycling facility, or filtered and reused in other radiators.	Taken to permitted landfill or incinerator.	Disposal on farm away from well or septic system.	Dumped near well.	
WOOD PRESERVING					
Application drips and spills	Drips and spills contained. Applicator and drop cloths disposed of at permitted landfill or incinerator.	Drips and spills contained. **APPLICATOR AND DROP CLOTHS DISPOSED OF AT DUMP.**	Application without containment more than 100 feet from well. Applicator and drop cloths disposed of on farm.	Application without containment within 100 feet of well.	
Disposal of unused preservatives	Used up or shared with someone else. Hazardous waste contractor collection service used for leftover preservatives.	**DISPOSAL AT PERMITTED LANDFILL OR INCINERATOR.**	**DISPOSAL AT DUMP.**	**DISPOSAL ON FARM.**	

BOLDFACE TYPE: If you are unsure how to dispose of specific wastes, contact the Louisiana Cooperative Extension Service or the Department of Environmental Quality.

*These items are recyclable and may be saved for a solvent recycler collection day.

**The practice of evaporating liquid volatiles such as oil-based paint, paint strippers, turpentine, varnish, spent organic solvents, etc. does not cause groundwater contamination, but does contribute to air pollution.

***Refers to the Louisiana Department of Agriculture and Forestry.

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

WHAT DO I DO WITH THESE RANKINGS?

Step 1: Begin by determining your overall hazardous waste risk ranking. Add 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	Average Risk Ranking

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

This ranking gives you an idea of how your hazardous waste practices **as a whole** might be affecting your drinking water. This ranking should serve as only 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 hazardous waste risk ranking on page 3 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 subsurface characteristics), 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 prioritization before you take action.

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

Step 3: Read Fact Sheet 5, *Hazardous Waste Management*, and consider how you might modify your farmstead practices to better protect your drinking water.

FARM*A*SYST
Farmstead Assessment System

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WATER WELL PROTECTION

WORKSHEET 6

Assessing the Risk of Groundwater Contamination from HOUSEHOLD WASTEWATER TREATMENT

WHY SHOULD I BE CONCERNED?

Virtually all farms use a septic system for household wastewater treatment. While these systems are generally economical and safe, household wastewater can contain contaminants that degrade water quality for such uses as drinking, livestock watering, food preparation and irrigation.

Potential contaminants in household wastewater include bacteria which can cause gastroenteritis, viruses which can cause hepatitis, household chemicals and nutrients such as nitrate and phosphorus. If coliform bacteria (a group of indicator organisms) are found in your well water, they show that the water is potentially contaminated and may be dangerous for drinking and food preparation. Your septic system is one potential source, along with livestock and dog pens, of water well contamination.

The **quantity** of wastewater can also present an environmental concern. Too much water, such as from a sink-mounted food disposal unit entering the home treatment system, reduces the efficiency of the system and can shorten its life.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures.

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 household wastewater treatment practices.
- It will allow you to rank your activities according to how they might affect the groundwater that provides your drinking water supplies.

- It will result in rankings that will help you analyze the "risk level" of your household wastewater treatment 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.

WORKSHEET 6

HOUSEHOLD WASTEWATER TREATMENT: 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 do not apply to your farmstead). For categories separated by "OR" choose only one category.
3. Then look above the description you circled to find your "risk 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 household wastewater treatment practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Quantity of Wastewater	Conservative water use (less than 20 gallons per person per day). Good maintenance of water conserving fixtures. Whole house use is less than waste-water system design capacity.*	Moderate water use (20-60 gallons per person per day). Fair maintenance of fixtures. Some water conservation fixtures. Water softener recharges twice a week or less. Whole house use is near wastewater system design capacity.*	High water use (60-120 gallons per person per day). Poor maintenance of fixtures. Water softener recharges more than twice a week. Whole house use occasionally exceeds wastewater system design capacity.*	Excessive water use (greater than 120 gallons per person per day). Leaking fixtures. No water conserving fixtures. Whole house use frequently exceeds wastewater design capacity.*	
Quality of Wastewater					
Settleable Solids	No use of garbage disposal unit in kitchen sink.	Minimal use of garbage disposal unit (1-2 times per week).	Moderate use of garbage disposal unit (3-5 times per week).	Daily use of garbage disposal unit.	
Dissolved Solids	Minimal use of household chemicals. No disposal of solvents and toxic cleaning agents. No water softener or not recharged on site.	Careful use of household chemicals. Minimal disposal of solvents and toxic cleaning agents. Water softener used, recharged on site.	Moderate use of household chemicals. Moderate disposal of solvents and toxic cleaning agents.	Extensive use of household chemicals. Extensive disposal of solvents and toxic cleaning agents.	
Floatable Solids	No disposal of grease or oils into septic system. Domestic wastes only.	Minimal disposal of grease or oils. Oil and grease wiped from cooking utensils before washing.	Moderate disposal of grease or oils. No attempt to reduce disposal of grease and oil from household, but little generated.	Extensive disposal of grease or oils.	

Collection of Wastewater	All wastewater collected for treatment. No rain water collected. No leakage of wastewater that should be treated. No settling or wetting of surface soil near tank or collection system. Collection and treatment system more than 50 feet from well.	All wastewater collected for treatment. Some rain water collected. No leakage of wastewater that should be treated. Collection system near the 50 feet from well.	Some wastewater leakage that should be treated and rain water infiltration. Collection system less than 50 feet from well.	Rain water infiltration. Leakage of wastewater that should be treated. **Collection system (pipe) less than 25 feet from well.****	
Pretreatment System: **Cesspool**	------	------	------	**Any cesspool or direct discharge of waste water.**	
OR **Septic Tank**	Serial tanks or added solids retention system. No leakage. Pumped at least every 3 years and maintained. Baffles checked. Tanks checked; no leakage.	Single tank pumped at 4-5 years intervals.	Single tank. Pumped at 6-9 year intervals.	Leaking tank. Seldom pumped out (greater than 10 year interval). **Less than 25 feet from well.**** Less than 4 feet above saturated soil.	**OR**
OR **Packaged Aerobic System**	Maintenance program followed. Loaded at less than design capacity.*	No mechanical failures. Loaded near design capacity.*	Occasional failures.	Frequent system failure. Load exceeds design capacity.*	**OR**
OR **Holding Tank*****	Excess capacity for usual pumping interval. More than 50 feet downslope from well. Tanks checked; no leakage.	Excess capacity for pumping interval. More than 50 feet upslope from well. Tanks checked; no leakage.	Occasional overflow or leakage. More than 25 feet from well.	**Less than 25 feet from well.**** Leaking tank. Upslope from well.	**OR**
Additional Treatment (all systems)	Aeration, denitrification, filtration and disinfection.	Aeration and/or denitrification.	Filtration and/or disinfection.	No additional treatment.	

Disposal of Wastewater Subsurface Application	Offsite disposal.	Pressure or gravity-fed distribution to trench system.	Bed or seepage pit.	**Field tile drainage system. Pipe to surface.**	
Horizontal Separation of Wastewater Disposal Site from Water Supply	Offsite disposal.	Subsurface disposal downslope more than 50 feet from well. Surface disposal more than 200 feet from well.	**Subsurface disposal downslope less than 50 feet from well. Surface disposal less than 200 feet from well.**	Upslope from well.	
Vertical Separation of Wastewater Disposal Site from Water Supply	Offsite disposal.	More than 6 feet to saturated soil.	More than 4 feet to saturated soil.	**Less than 4 feet to saturated soil.**	
Subsurface Application Rate	Offsite disposal.	Below design capacity	At design capacity.	Above design capacity.	
Soils	Offsite disposal.	Medium- or fine-textured soils (silt loam, loam, clay loams, clays).	Medium- to coarse-textured soils (sandy loam, sands).	Very coarse sands or gravel.	

Boldface Type: Besides representing a higher-risk choice, this practice also violates Louisiana law.

* If design capacity of your treatment system is unknown, estimate at 500 gallons per bedroom per day (Louisiana Sanitary Code, Chapter XIII).

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

***If you have only a holding tank for wastewater disposal, skip to the bottom of the page and total your score.

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. Add 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	Average 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 condition and 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 3 of Worksheet 12. If you are also ranking other categories, you will later 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 subsurface characteristics), 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 and family health 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 and causing family health problems.

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 page 7 of Worksheet 12.

Step 3: Read Fact Sheet 6, Household Waste Water, and consider how you might modify your farmstead practices to better protect your drinking water.

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WATER WELL PROTECTION

WORKSHEET 7

Assessing the Risk of Groundwater Contamination from
LIVESTOCK WASTE MANAGEMENT

WHY SHOULD I BE CONCERNED?

Storing livestock waste allows farmers to spread manure litter or bedding when conditions are right for nutrient use by crops. Accumulating manure in a concentrated area, however, can be a threat to the environment and to human and animal health.

Facilities for manure stored in liquid form on the farmstead sometimes leak or burst, releasing pollutants. Manure in lagoons can form a semi-impervious seal of organic matter that limits leaching potential, but seasonal filling and emptying can cause the seal to break down. Short-term manure storage and abandoned storage areas can be sources of groundwater contamination by nitrates or bacteria. Manure can contribute nutrients and disease-causing organisms to both surface water and groundwater.

Nitrate levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) nitrate-nitrogen can pose health problems for infants under 6 months of age, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate may also affect adults, but the evidence is much less certain.

Young livestock are also susceptible to health problems from high nitrate-nitrogen levels. Levels of 20-40 mg/l in the water supply may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Bacteria in livestock waste can contaminate groundwater, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials that lend an undesirable taste and odor to drinking water are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing into groundwater.

The goal of this publication 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 livestock waste management practices.
- It will allow you to rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will result in rankings that will help you analyze the "risk level" of your livestock waste 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.

WORKSHEET

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 do not apply to your farmstead). For categories separated by "OR," chose only one category.
3. Then look above the description you circled to find your "risk 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 livestock waste storage practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LONG-TERM STORAGE (180 days or more)					
Steel, glass-lined (liquid-tight design, above ground) **OR**	Designed and installed according to accepted engineering standards. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Leaking tank on medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Leaking tank on coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.	____ **OR**
Poured concrete (liquid-tight design) **OR**	Designed and installed according to accepted standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Leaking from cracked concrete, medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Leaking from cracked concrete, coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.	____ **OR**
Lagoon Earthen storage	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Not designed to engineering standards. Constructed in medium-or fine-textured dense materials (silt loam, loam, clay loams, silty clay). Water table deeper than 20 feet.	Not designed to engineering standards. Constructed in coarse-textured materials (sands, sandy loam). Water table shallower than 20 feet. More than 10 years old.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LONG-TERM STORAGE (usually 30-90 days; in some cases, up to 180 days)					
Stacked in field (on soil base)	Stacked on high ground and covered. Medium- or fine textured soils (silt loam, loam, clay loams, silty clay). Water table is deeper than 20 feet.	Stacked on high ground and covered. Coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.	Stacked on low ground subject to flooding and covered.	Stacked uncovered on low ground subject to flooding and/or near surface water.	____
Stacked in yard*	Covered concrete yard with curbs, gutters and settling basin.	Concrete yard with curbs and gutters. Grass filter strips installed and maintained.	Earthen yard with medium- or fine-textured soils (silt loam, loam, clay loams, silty clay). Water table deeper than 20 feet.	Earthen yard with coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.	____
LOCATION					
Location of livestock waste storage in relation to drinking water well	Manure stack or lagoon more than 250 feet downslope from well. Manure storage structure (liquid tight) more than 100 feet downslope from well.	Manure stack or lagoon more than 250 feet upslope from well. Manure storage structure (liquid tight) more than 100 feet upslope from well.	**Manure stack or lagoon less than 250 feet downslope from well. Manure storage structure (liquid tight) less than 100 feet downslope from well.***	**Manure stack or lagoon less than 250 upslope from well. Manure storage structure (liquid tight) less than 100 feet upslope from well.***	____

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

*Access of dairy cows to stored manure is in violation of Louisiana dairy permit requirements of the Department of Health and hospitals.

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

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 livestock waste risk ranking. Add the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals _____*		
Total of Rankings	# of Categories	Average 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 livestock waste 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 livestock waste risk ranking on page 4 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 and soil depth characteristics), 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 ranking before you take action.

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

Step 3: Study Factsheet 7, *Livestock Waste Management"*, and consider how you might modify your farmstead practices to better protect your drinking water.

FARM*A*SYST
Farmstead Assessment System

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WATER WELL PROTECTION

WORKSHEET 11

SITE EVALUATION

WHY IS THE SITE EVALUATION IMPORTANT?

How each farmstead practice, such as pesticide handling or manure management, affects groundwater depends in part on the physical characteristics of your farmstead site: soil type and depth to groundwater. That is why evaluating the soils and geologic characteristics of your farmstead is such an important step in protecting the groundwater you drink.

WHAT IS INVOLVED IN COMPLETING THIS EVALUATION?

This evaluation has four parts:

Part 1: Evaluating your soil type and depth

Part 2: Evaluating subsurface and geologic materials, along with depth to groundwater

Part 3: Determining your overall site evaluation ranking (combining parts 1 and 2)

Part 4: Completing a farmstead diagram (optional)

Getting the information to complete parts 1 and 2 will require assistance from outside sources, such as your parish Soil Conservation Service (SCS) or Extension office. How long this takes will vary, depending on availability of information in your parish. Once you have the information, it should take about an hour to complete the first three parts of Worksheet 11 (the farmstead diagram will take additional time).

If some of the information you need is not readily available, the worksheet contains instructions on how to proceed. The more information you can get, the better; but some information is better than no information.

HOW DO SOILS AFFECT THE POTENTIAL FOR GROUNDWATER CONTAMINATION

Soil characteristics are very important in determining whether a contaminant breaks down to harmless compounds or leaches into groundwater. Because most breakdown occurs in the soil, there is a greater potential for groundwater contamination in areas where contaminants are able to move quickly through the soil.

- Sandy soils have large "pore" spaces between individual particles, and the particles provide relatively little surface area for "sorption," or physical attachment of most contaminants. Large amounts of rainfall can percolate through these soils, and dissolved contaminants can move rapidly down through the soil and into groundwater.

- Clay soils, on the other hand, are made up of extremely small particles that slow the movement of water and dissolved contaminants through the soil. Contaminants are also tightly adsorbed onto clay surfaces.

While held securely to soil particles, contaminants are broken down by bacteria, other soil organisms and by chemical reactions in the soil. Most of this chemical and biological breakdown takes place in the loose, cultivated surface layers, where the soil tends to be warm, moist, high in organic matter and well aerated.

Finally, soil organic matter is important in holding contaminants. Soils high in organic matter provide an excellent environment for chemical and biological breakdown of these contaminants --- before they reach the groundwater.

The natural cleaning capability of the soil is limited. Under certain conditions, heavy rainfall and chemical spills may exceed the soil's cleaning capacity, allowing leaching to occur. In such cases, the subsurface geologic material and the distance a contaminant must travel to groundwater are important in determining whether a contaminant actually reaches the groundwater.

HOW DO SUBSURFACE AND GEOLOGIC MATERIALS AFFECT THE POTENTIAL FOR GROUNDWATER CONTAMINATION?

Louisiana soils were formed as sediment ranging from a few feet to 50 feet deep.

Depth is important primarily because it determines not only the depth of material through which a contaminant must travel before reaching a groundwater aquifer but also the amount of time a contaminant is in contact with the soil. As a result, where soil is fairly deep, contaminants are less likely to reach groundwater.

Parent material for a soil causes differences in color, texture, permeability and degree of leaching.

The depth and characteristics of soil largely determine the potential for groundwater contamination.

A WORD OF CAUTION

As with the results of the previous seven assessment worksheets, use the rankings from this worksheet cautiously. Many factors affect whether or not a contaminant will leach to groundwater. There is no guarantee that a "low-risk" site will be uncontaminated --- or that groundwater will become contaminated at a "high-risk" site. The type of contaminant involved, how you handle and store potential contaminants (such as pesticides and manure), the location and maintenance of your well, and many other factors can affect the potential for groundwater contamination.

PART 1: EVALUATING THE SOIL ON YOUR FARMSTEAD

To complete your soil evaluation, you will need a copy of your parish's soil survey report. This report is available at most parish SCS offices or the Extension Service.

Step 1: Start by locating your farmstead on the aerial photos in the soil survey, note the soil mapping designation indicated on the photo. Obtain the name of the soil mapping unit and information related to that soil from the written sections in the soil survey report.

If you have more than one soil mapping unit on your farmstead, rank each soil individually using this worksheet. Space is provided for three different soils. Transfer soil mapping unit boundary lines from the soil survey to the farmstead diagram on page 16.

Do not skip any parts of the worksheet. If you are not familiar with using soil surveys, you may need help completing Part 1. Ask your parish Extension agent or your SCS specialist to help you find the following information:

- Location of your farmstead on the map and aerial photographs provided in the soil survey report.
- The soil mapping unit and soil series from the legend provided in the soil survey report.
- The soil series and/or soil mapping unit, including the profile description, as well as any other information in the report regarding depth to water or organic content.

- The classification of the soil series, including family, subgroup and order. Soil surveys published before 1965 will not include the soil classification. You will have to get this information from your parish SCS office.

Step 2: With this information, you are ready to rank your soil according to seven characteristics. For each of the seven characteristics in the left column, find information about your soils in the soil survey. Then, match your soil description to the description in the middle column to determine your score (for example, if the soil survey tells you that the texture of your soil is a clay loam, your score for that category would be eight). Enter your score(s) in the space(s) indicated.

SOIL CHARACTERISTICS
For characteristics 1-5 that follow, consult the soil profile description and text and the soil mapping unit text in the "Description of the Soils" section of your parish soil survey.

					SCORE
1.	Texture of Surface (A horizon)	Loam, silt loam, sandy clay loam, silt			10
		Clay, sandy clay, silty clay, clay loam, silty clay loam			8
		Loamy fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam			4
		Sand, loamy sand, sandy loam, organic materials (all "O" horizons), and all textural classes with coarse fragment class modifiers (such as "gravelly loam")			1
YOUR SCORE(S):					
		Soil 1	Soil 2	Soil 3	
					SCORE

2.	Texture of Subsoil (B horizon. If there is no B horizon, consider the character of materials within approximately 2 feet below the A horizon).	Clay, sandy clay, silty clay			10
		Sandy clay loam, loam, silt loam, silt, clay loam, silty clay loam			7
		Loamy fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam			4
		Sand, loamy sand, sandy loam organic materials and all textural classes with coarse fragment modifiers (such as "gravelly loam")			1
YOUR SCORE(S):					
		Soil 1	Soil 2	Soil 3	
					SCORE

3.	pH-Surface (A horizon)	A pH 6.6 or greater (the A horizon description will include one of the following terms: Neutral, mildly alkaline, moderately alkaline or strongly alkaline)			6
		Less than 6.6 (the A horizon description will include one of the following terms: Slightly acid, moderately acid or strongly acid)			4
YOUR SCORE(S):					
		Soil 1	Soil 2	Soil 3	
					SCORE

4.	Depth of Soil(depth of A and B horizons, minus inches of. erosion from surface layer noted in soil survey description)	Greater than 60 inches			10
		40-60 inches			8
		30-40 inches			5
		Less than 30 inches			1
YOUR SCORE(S):					
		Soil 1	Soil 2	Soil 3	

SCORE

5.	Soil Drainage Class	Well drained			10
		Moderately well drained			7
		Somewhat poorly drained			4
		Poorly and very poorly drained			1
YOUR SCORE(S):					
		Soil 1	Soil 2	Soil 3	

For item 6, consult the table "Classification of Soil Series" in your soil survey

					SCORE
6.	Organic Matter Content Ap Horizon or 0-6" depth from Surface	**a.** If the "classification of Soil Series" table classifies your soil series as Histosols, Aquic suborder or Lithic, Aquollic and Aquic subgroup, use the ranking "1" (these are organic soils, shallow or wet soils. See a parish specialist if your soil falls into one of these categories). **OR** **b.** If your soil does not fall into the above groups, obtain the organic matter percentage from a soil test report for your farm, the chart of "Soil Properties Significant to Engineering" found in some soil surveys or your parish SCS office. You can find the soil order for your soil series in the "Classification of Soil Series" table.			
		<u>Organic Matter (%)</u>	**OR**	<u>Soil Order</u>	
		High (4-10%)			10
				Mollisols	8
				Vertisols	7
		Medium (2-4%) Moderately low (1-2%)		Alfisols Ultisols	5
		Low (05.-1%)		Inceptisols, Entisols	3
		Very low (less than 0.5%)			1
		(Lower your score by one level if the soil mapping unit description in the soil survey indicates erosion, unless you take organic matter from soil test results)			
YOUR SCORE(S):					
		Soil 1	Soil 2	Soil 3	

Step 3: Add your 6 scores together for each soil you ranked.

TOTALS:			
	Soil 1	Soil 2	Soil 3

Step 4: In the box below, find your score in the listed ranges in the left column. Then identify your soil's "potential to protect groundwater" and find the rank number assigned to your score.

TOTAL SCORE	SOIL'S POTENTIAL TO PROTECT GROUNDWATER	RANK
51+	Best	1
41-50	Good	2
31-40	Marginal	3
00-30	Poor	4

Step 5: Enter rank number(s) here:

SOIL 1 RANK	
SOIL 2 RANK	
SOIL 3 RANK	

Step 6: Understand your soils ranking(s).

A soil with more than 50 points (ranking 1) probably is a deep, medium- or fine-textured, well-drained soil which contains 4% - 10% organic matter. Potential contaminants move slowly through the soil, allowing them to become attached to soil particles. Sunlight, air and microorganisms then have the potential to break down the contaminant into harmless compounds. The groundwater contamination risk level is low.

A soil with a score of 30 or less (ranking 4) is probably a coarse, sandy, extremely well-drained soil with less than 1% organic matter. Such a soil would enable most contaminants to move rapidly down toward the water table.

Overall, the lower your ranking number, the more likely that your soil conditions **will help to reduce** the risk of groundwater contamination from farmstead practices.

PART 2: EVALUATING SUBSURFACE AND GEOLOGIC MATERIALS ON YOUR FARMSTEAD

This part looks at the subsurface and geologic materials beneath your farmstead's soils. Completing the worksheet will give you a much clearer picture of your site's potential for keeping pollutants out of groundwater.

> For example, the soil evaluation might have indicated a moderate potential for protecting groundwater. However, if the soils are fairly shallow, the potential for groundwater contamination at the site is probably higher than indicated by the soil evaluation alone.

This part requires only two items of information -- your site's subsurface geologic material and depth to groundwater. Unfortunately, information on subsurface geologic material, as well as depth to water, is often difficult to obtain:

- It is sometimes available from the soil survey report, although this differs from parish to parish.

- You can also obtain it from your well construction report if the well installer filled out the report correctly and submitted it to the Department of Transportation and Development, Water Resources Section at Post Office Box 94245, Baton Rouge, Louisiana 70804-9245.

- You can find additional information from other well construction reports in your area, hydrogeological reports and groundwater flow maps for some parishes, which are also available from the Louisiana Geological Survey. These are generalized maps, though, and may not accurately reflect the depth to groundwater or direction of flow at your farmstead.

- Published geological reports for your parish may show the type of geologic material in your area.

Try not to skip any steps in this part. Ask your parish Extension agent or your SCS specialist to help you gather the information and provide assistance in completing Part 2.

If the information for this part is not available, you may skip to Part 3 on page 10. The instructions will tell you how to proceed without it.

Step 1: Find the information you need --- from the soil survey, well construction reports or Louisiana Geological Survey reports --- to identify (1) the geologic materials beneath your farmstead and (2) depth to groundwater.

Step 2: Match the information on your site's geology to one of the descriptions in the left column below (you will be choosing **only one description** from the entire table that follows).

If your well construction report describes more than two types of geologic material below 5 feet, ask for help in filling out this section from your parish Extension or SCS office.

Step 3: When you have chosen the description that best matches your site's geology, read across to the right until you get to the appropriate "depth to groundwater" for your site and circle that score for your farmstead.

For example, you may determine from your well construction report that geologic material beneath your farmstead consists primarily of fine textured materials and the depth to groundwater is 15 feet. Looking down the left column to find your category, and then going across to the right, you see that your rank is "2."

GEOLOGICAL MATERIAL (more than 5' below ground)	DEPTH TO GROUNDWATER (in feet)			
	0-10'	11-30'	31-50'	More than 50'
Fine-textured Materials				
Silt, clay or shale	3	2	1	1
Sand and Gravel				
Greater than 12% silt or clay	4	4	3	3
Less than 12% silt or clay (sorted)	4	4	4	4

There may be other situations that do not fall into the above categories (such as unconsolidated materials over limestone/shale/sandstone sequence). Determining a ranking for such situations requires a judgment call.

Step 4: Enter your circled number here:

SUBSURFACE RANK: ☐

Step 5: Understand your subsurface and geology ranking. The table below shows what your rank means.

RANK	LEVEL OF RISK OF GROUNDWATER CONTAMINATION
1	Low
2	Low/Moderate
3	High/Moderate
4	High

A ranking of "1" shows that the subsurface material has the best potential to protect groundwater. This material has small pore spaces, groundwater is at least 10 feet from the soil surface and the risk of groundwater contamination is low.

A ranking of "4" indicates a material with poor potential to protect groundwater. Its large pore spaces allow contaminants to move downward easily, increasing the risk of groundwater contamination. In highly fractured rock or in very coarse-textured, unconsolidated materials, the depth to groundwater does not seem to matter, because some contaminants will flow through the pore spaces with very little slowdown.

Overall, the lower your ranking number, the more likely that your farmstead's geologic conditions and depth to groundwater ***will help to reduce*** *the risk of groundwater contamination from farmstead practices.*

PART 3: COMBINING YOUR FARMSTEAD'S SOIL AND SUBSURFACE/GEOLOGIC RANKINGS

Combining the rankings from parts 1 and 2 will provide you with a good overall ranking of your farmstead site's potential to keep pollutants from moving down to groundwater.

Step 1: Transfer your boxed rankings from the soil evaluation (Part 1, page 8) and the subsurface/geologic evaluation (Part 2, Page 10) to the boxes below:

SOIL 1 Rank	
SOIL 2 Rank	
SOIL 3 Rank	
SUBSURFACE Rank	

Step 2: The table below shows the overall level of groundwater contamination risk associated with your farmstead site conditions. Find your two numbers **written in the correct sequence (soils rank-subsurface rank)** and circle the sequence.

LEVEL OF RISK			
Low Risk (rank 1)	**Low-Moderate Risk (rank 2)**	**High-Moderate Risk (rank 3)**	**High Risk (rank 4)**
4-1	4-2	3-3	4-4
3-2	2-3	1-4	4-3
3-1	1-3		3-4
2-2			2-4
2-1			
1-2			
1-1			

Step 3: Look above the sequence you circled to find your risk level and your ranking (for example, if your numbers are 2-3, your site is in the low-moderate risk column and your ranking is 2).

Step 4: Enter your combined ranking here (if you calculated more than one soils ranking, calculate a combined ranking for each soils ranking).

COMBINED RANKING 1	
COMBINED RANKING 2	
COMBINED RANKING 3	

Step 5: Understand your combined ranking.

In general, a site with a combined ranking of 4 (low groundwater pollution risk) will have a soil with a good capacity to hold and break down contaminates. Its subsurface conditions will also keep contaminants from reaching the water table. Under certain conditions, however, such as spills, poor management and heavy rainfall, contaminants may reach groundwater.

On the other hand, if you carefully manage a site with a combined ranking of 1 (high groundwater pollution risk), you may not affect your drinking water. **Both site characteristics and your management practices are of equal importance.**

Your three site ranking numbers (soils ranking, subsurface ranking and combined ranking) will be used again in Worksheet 12. They will be combined with your risk rankings for specific activities from the seven assessments (such as pesticide handling) to give you a more accurate assessment of potential groundwater contamination on your farmstead.

If you have more than one soil on your farmstead, you will need to transfer individual soil rankings and combined rankings to Worksheet 12. It will be especially important for you to complete Part 4 of this worksheet if you have more than one soil on your farmstead, so that you can link particular site vulnerability with each farmstead activity.

You may now proceed with Part 4 of this worksheet, or you may go directly to Worksheet 12.

PART 4: LEARNING MORE ABOUT YOUR SITE

Sketching a diagram of your farmstead can provide useful information to help you understand how the physical layout and site characteristics of your farmstead may contribute to --- or lessen --- the effects of possible contaminants reaching your drinking water.

The diagram can show the location of wells, septic drainfields, manure storage areas, direction of groundwater flow, surface water, buildings and other activities that may contribute potential contaminants. Along with the soil and subsurface evaluations, the diagram will help point out aspects of your farmstead that may present a hazard to your drinking water.

Step 1: Begin by looking at the sample diagram on page 16.

Step 2: Then diagram your farmstead on the blank grid provided on page 17. Include all of the following that apply to your farmstead:

- All buildings and other structures (home, barn, machine shed)
- Wells in use and abandoned wells.
- Septic system (tank, absorption field and/or oxidation pond)
- livestock yard
- Manure storage
- Underground petroleum storage tank
- Above-ground petroleum storage tank
- Pesticide and fertilizer storage, handling and mixing areas
- Silage storage
- Milking parlor waste disposal system
- Farm dumps
- Vehicle maintenance areas
- Liquid disposal areas
- Tile drains and open ditches

You can use the same diagram to indicate surface water (ponds and streams), direction of landslope, groundwater flow and the different soil types found around your farmstead. Generally, groundwater follows surface topography and moves downhill toward surface water.

Step 3: Use your diagram to note which activities or structures on your farmstead have a greater likelihood of allowing contaminants to reach groundwater. This information should help prepare you to make better decisions about your farmstead activities and structures and how they might be affecting your drinking water.

When you have completed the diagram of your farmstead, go on to Worksheet 12.

GLOSSARY

SITE EVALUATION

These definitions may help clarify some of the terms used in Worksheet 11.

Organic Matter: Matter containing compounds of plant or animal origin, measured by organic carbon content.

Permeability: The quality that enables soil to transmit water or air.

Soil Classification: A system that provides detailed soil management information. Includes such groupings as *order, suborder, subgroup* and *family.*

Soil Drainage Class: The conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soils, as opposed to human-altered drainage. Different classes are described by such terms as *somewhat drained, well-drained* and *poorly drained.*

Soil Horizon: A layer of soil, approximately parallel to the surface, that has distinct characteristics, such as color, structure and texture. Described in shorthand form by letters, such as A, B and C.

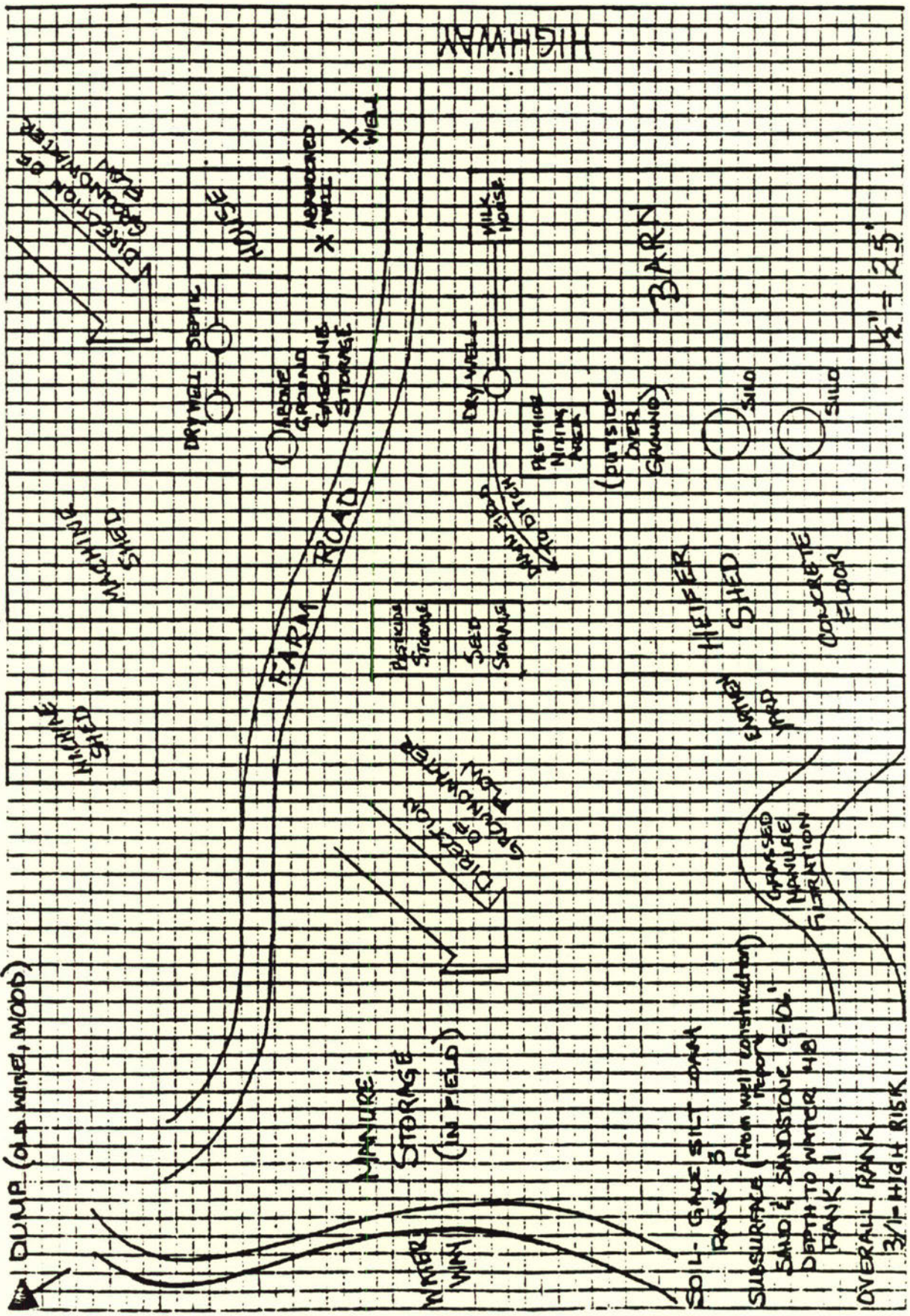
Soil Mapping Unit: A soil or combination of soils shown on a map and, where possible, named.

Soil Series: The basic unit of soil classification, consisting of soils that are similar in characteristics.

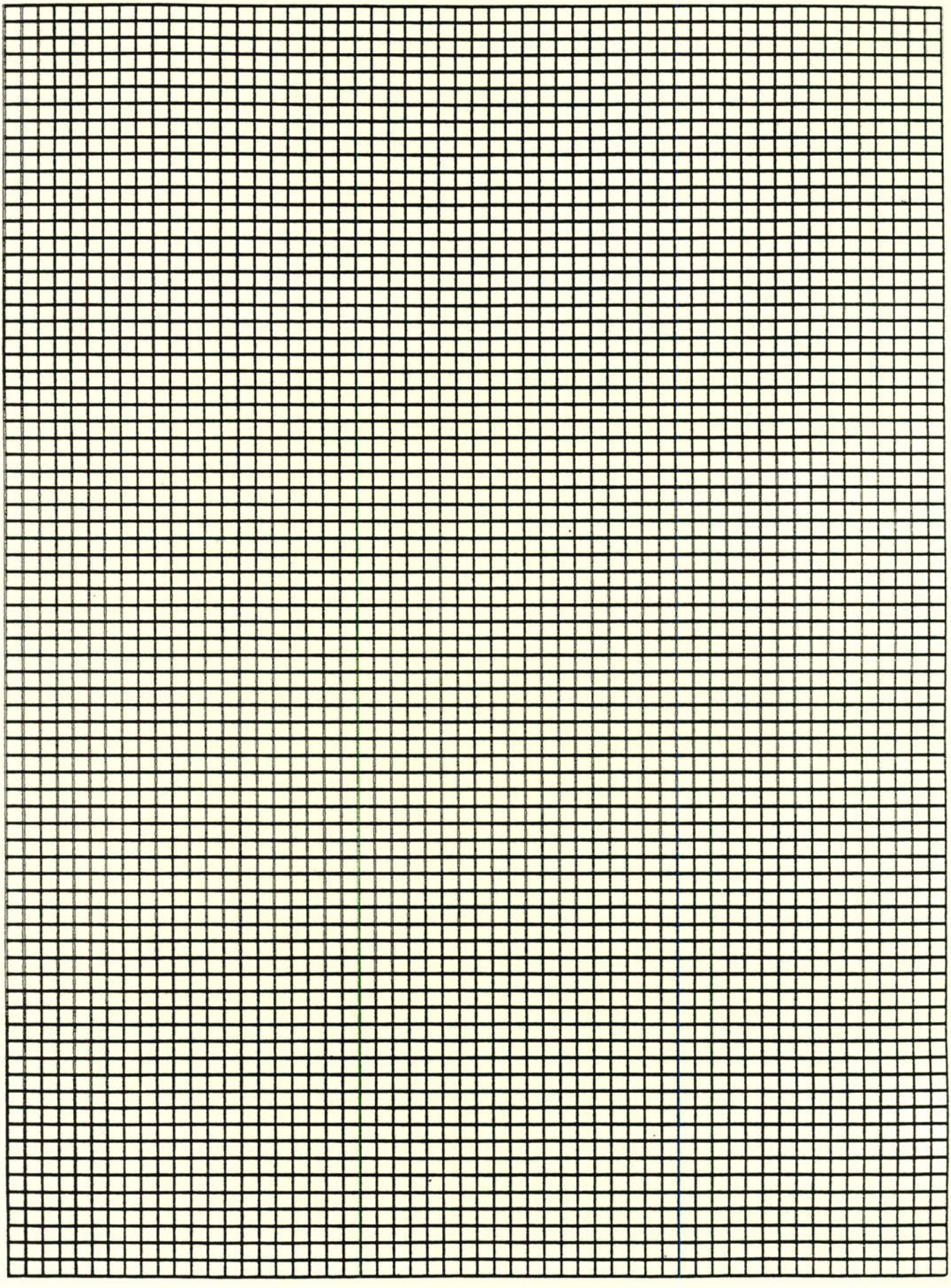
Soil Texture: The relative proportions of the various soil separates (sand, silt and clay) in a soil. Described by such terms as *sandy loam* or *silty clay.*

Subsoil: The B horizon, roughly the part below the depth of plowing.

SAMPLE FARMSTEAD DIAGRAM



YOUR FARMSTEAD DIAGRAM



FARM*A*SYST
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Louisiana State University
Agricultural Center
Louisiana Cooperative Extension Service

WATER WELL PROTECTION

WORKSHEET 12

OVERALL FARMSTEAD ASSESSMENT

As an overall summary of the work you have already done to assess your farmstead structures and activities, this worksheet has two parts:

Part 1: Your first step will be to combine the individual risk rankings for various farmstead structures and activities (from Worksheets 1-7) with your soils ranking and subsurface geologic ranking from Worksheet 11. Combining these rankings will give you a much more accurate picture of the groundwater contamination risk of your various farmstead practices as they are affected --- for better or worse --- by your particular site conditions.

Part 2: Your second step will be to list any individual farmstead activities from your seven worksheets that you ranked with 1's (high risk). You have probably been adding to this list as you have completed each worksheet. In this part, you will look at individual concerns, giving you very specific information about the groundwater contamination risk of particular farmstead practices.

PART 1: COMBINING RISK RANKINGS WITH SITE RANKINGS

Step 1: To calculate overall risk rankings for each of the seven worksheets you completed, take your farmstead risk rankings and site rankings and add them to the appropriate blanks below and calculate the average of the two numbers as indicated.

If you do not have a combined site or subsurface rank for your farmstead, use the soil rank. Although subsurface information, either by itself or in a combined site rank, gives a more accurate picture of your site's ability to hold and break down contaminants, **soil rank is an acceptable substitute for the combined site rank** if subsurface information for your site is unavailable.

If you have more than one soil on your farmstead --- therefore more than one soils ranking or combined ranking to transfer --- you may need to refer to your farmstead diagram in Worksheet 11 to see which soil is associated with each farmstead structure or practice. For each category below, use the appropriate soil ranking or combined ranking.

1: DRINKING WATER WELL CONDITION

Rank from Worksheet 1 _____ = _____ Overall Drinking Water Well Risk Ranking
(DO NOT USE A SITE RANK)

2: PESTICIDE STORAGE AND HANDLING

Rank from Worksheet 2 _____
Combined Site Rank _____
TOTAL _____ ÷ 2 = _____ Overall Pesticide Risk Ranking

3: FERTILIZER STORAGE AND HANDLING

Rank from Worksheet 3 _____
Combined Site Rank _____
TOTAL _____ ÷ 2 = _____ Overall Fertilizer Risk Ranking

4: PETROLEUM PRODUCT STORAGE

(select **one or both** categories below, as appropriate to your site)

ABOVE-GROUND STORAGE

Rank from Worksheet 4 _____
Combined Site Rank _____
TOTAL _____ ÷ 2 = _____ Overall Ground Storage Risk Ranking

BELOW-GROUND STORAGE

Rank from Worksheet 4 _____

Combined Site Rank _____

TOTAL _____ ÷ 2 = _____ Overall Below-Ground Storage Risk Ranking

5: HAZARDOUS WASTE MANAGEMENT

Rank from Worksheet 5 _____

Combined Site Rank _____

TOTAL _____ ÷ 2 = _____ Overall Hazardous Waste Risk Ranking

6: HOUSEHOLD WASTEWATER TREATMENT

(select **one or both** categories below, as appropriate to your site)

SURFACE APPLICATION (includes holding tanks)

Rank from Worksheet 6 _____

Combined Site Rank _____

TOTAL _____ ÷ 2 = _____ Overall Surface Household Wastewater Risk Ranking

SUBSURFACE APPLICATION

Rank from Worksheet 6 _____

Combined Site Rank _____

TOTAL _____ ÷ 2 = _____ Overall Subsurface Household Wastewater Risk Ranking

7: LIVESTOCK WASTE STORAGE

(select **one or both** categories below, as appropriate to your site)

ABOVE GROUND STORAGE

Rank from Worksheet 7 _____

Combined Site Rank _____

TOTAL _____ ÷ 2 = _____ Overall Above Ground Livestock Waste Storage Risk Ranking

BELOW GROUND STORAGE

Rank from Worksheet 7 _____

Combined Site Rank _____

TOTAL _____ ÷ 2 = _____ Overall Below Ground Livestock Waste Storage Risk Ranking

Step 2: Interpret and compare your overall risk rankings. For each ranking in the blanks above, use the box below to assess your overall groundwater contamination risk from that area of activity on your farmstead. This information should give you a general idea of areas of concern that need addressing.

INTERPRETING YOUR SCORES	
Ranking	**Groundwater Contamination Risk**
3.6 - 4.0	Low
2.6 - 3.5	Low-Moderate
1.6 - 2.5	Moderate-High
1.0 - 1.5	High

Keep in mind, however, that each of these rankings is based on an averaging of many individual activities and structures --- such as all of your specific pesticide storage and handling practices in Worksheet 2. Do not use these overall rankings to assess or predict the amount --- if any --- of actual groundwater contamination on your farmstead. An actual determination of groundwater contamination requires an intensive on-site investigation.

The rankings do provide an overall assessment of the risk level of various farmstead activities and how site conditions affect these levels of risk. Part 2 focuses on specific activities or structures that your ranked as 1's on your individual worksheets.

PART 2: IDENTIFYING SPECIFIC HIGH-RISK ACTIVITIES

Step 1: If you have not already done so, go back to each of the seven worksheets you completed and identify any individual activities or structures that you ranked as 1's (high risk). You may have already done this as you completed each worksheet.

Step 2: List each activity of concern on the attached charts. Begin by filling in the first three blanks (to the left of the double vertical line on the chart). Do this for each of the seven worksheets you completed.

Step 3: Then, for each activity that you listed, fill in the "response options" and "taking action" sections to the right of the double vertical line on the chart.

- **Response Options:** Check one of the two boxes: either "immediate action possible" or "further planning required". This should be a quick assessment of whether a change in practice requires major effort and money (like relocating a well or building a pesticide storage facility) or whether it "just" requires a change in practice (like cleaning a livestock yard more often or being sure that stored pesticides are clearly labeled).

- **Taking Action:** Decide right now on a possible first step to take to begin to address each concern listed. It might be patching old pesticide containers, or testing your water well right away, or making a first phone call to get information about relocating and redesigning your pesticide storage area.

The first step for a concern that you identified as "immediate action possible" should, of course, be easier than a first step for a major or costly project. But, whatever the area of concern, what is an initial step you can take to begin to address each of the high-risk concerns you have listed?

Step 4: Keep this handy and refer to it often. It provides important information for you as you plan how to begin to protect more effectively the groundwater that provides drinking water to you and your family.

HIGH-RISK ACTIVITIES

A listing of individual activities or structures that ranked "1" on your Farm* A* Syst worksheets

After completing **each** of the 10 assessments appropriate to your farmstead, list **any individual activities or structures** that you ranked as "1" (high risk). Fill in the worksheet number, the worksheet name and the individual activity of concern. Do not fill in the blanks to right of the double line. You will do that later, when you are completing Worksheet 12.

Worksheet Number	**Worksheet Name**	**Individual Activity Identified as Being High Risk (1)**	**RESPONSE OPTIONS** (check one)		**TAKING ACTION** (proposed first step to address concern)
			IMMEDIATE ACTION POSSIBLE (change in practice only; cost not a factor)	FURTHER PLANNING REQUIRED (requires major structural improvements or relocation; involves major effort or high cost)	

A FEW FINAL WORDS

After doing all you can to reduce the risk of groundwater contamination on your farmstead, you may still have well test results showing high levels of some contaminants.

- One factor could be activities away from the farmstead. Nitrates could be leaching from your fields, for example.

- Problems could originate in more distant areas, too. Depending on the geology of an area, activities miles away can result in groundwater contamination flowing slowly toward your property and the groundwater you drink. It may take years for a spill on someone else's land to show up in your well. Leaking petroleum tanks, farm dumps and waste pits away from your property all have the potential to affect your drinking water --- **just as activities on your farmstead have the potential to affect the drinking water of your neighbors and even others living miles away from you.**

You may want to keep track of potential sources of groundwater contamination beyond your farmstead. You may also want to encourage your neighbors to use this farmstead assessment.

On the other hand, despite the fact that results of your farm well water quality tests are quite good, your worksheet results may show the need for changes. Your well may be upslope from your farmstead, so the water drawn from that area is not affected by your activities. That does not mean, however, that contaminants are not entering the groundwater and affecting someone else's drinking water. You need to be as careful as you can about farmstead management, especially if your farmstead is on land vulnerable to groundwater contamination.

You may have quite a few "high-risk" pollution potential rankings. You may also be concerned about your well water quality test results and want to know more about how your farmstead activities might have influenced them. If so, after completing the Farmstead Assessment System, you may want to ask an expert to conduct a detailed site analysis and look more closely at potential sources to determine the causes of the contamination.

For further information about potential sources of groundwater contamination on your farmstead, contact your parish Extension or Soil Conservation Service.

FARM*A*SYST
Farmstead Assessment System

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