Fact Sheet #1

Reducing the Risk of Groundwater Contamination by

Improving Drinking Water Well Condition

NEW MEXICO
FARM•A•SYST
Farmstead Assessment System

NM STATE

NEW MEXICO
FARM•A•SYST
Farmstead Assessment System

Fact Sheet #1

Reducing the Risk of Groundwater Contamination by

Improving Drinking Water Well Condition

1. Well location

Whether a well taps water just below the ground or hundreds of feet deep, its location on top of the ground is a crucial safety factor. Locating a well in a safe place takes careful planning and consideration of such factors as where the well is in relation to surface drainage and groundwater flow. A well downhill from a livestock yard, a leaking 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 ground. In shallow aquifers, groundwater flow is often in the same direction as surface water flow. If the aquifer supplying water to your farmstead well is deep below the surface, though, its slope may be different than that of the land surface. Finding out about groundwater movement on your farm (see Contacts and References) may require special monitoring equipment.

Separation distances

Many states encourage good well location by requiring minimum separation distances from sources of potential pollution, thus using the natural protection provided by soil. However, state well codes may not mention some farmstead activities and structures. For example, in New Mexico, private well regulations do not specify separation distances from specific farmstead pollution sources such as pesticide mixing, farm waste disposal areas, solid fertilizer storage, etc. For private wells, New Mexico state regulations require a minimum separation distance of 100 feet from any **potential** source of pollution. When no distances are specified, provide as much separation as possible between your well and any potential contamination source—especially if your farmstead is on highly permeable soils or thin soil overlying limestone bedrock, or if the contamination source or activity presents a high risk of contamination.

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

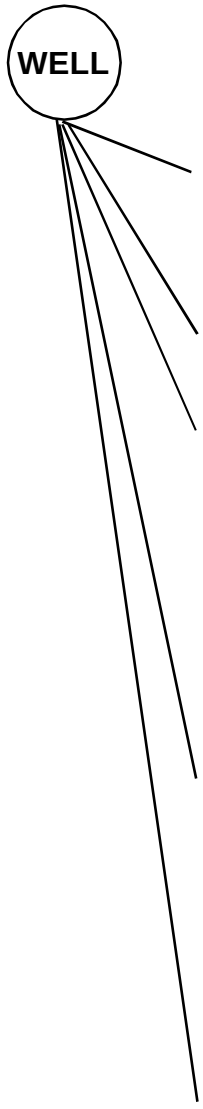
Both soil and slope can make siting a well a tricky business. Keep in mind that separation distances required by the state are minimums. You may want to choose greater separation distances in some cases, depending on factors at your site. This will help provide reasonable assurance that your well will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

For glossary, see Worksheet #1.

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

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

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



8 feet
- silage storage and transfer tube (plastic)
- nonpotable well
- cistern

25 feet
- animal barn pen with concrete floor

50 feet
- animal shelter or yard
- feed storage facility, glass-lined
- manure hopper or reception tank, liquid-tight
- silo with pit
- silo without pit, but with concrete floor and drain
- soil absorption unit (less than 8000 gallons/day)
- filter strip
- sewage holding tank (required distance)
- septic tank (required distance)

100 feet
- gasoline and other liquid petroleum products
  - underground
  - surface
- fuel oil tanks
  - underground
  - surface
- manure storage structure, fabricated, liquid-tight
- pesticide or fertilizer storage tank

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

For sources not addressed: Provide as much separation as possible from well.

These are distances recommended by NMED. Local waste storage ordinances may require different separation distances.

2. Well construction

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

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

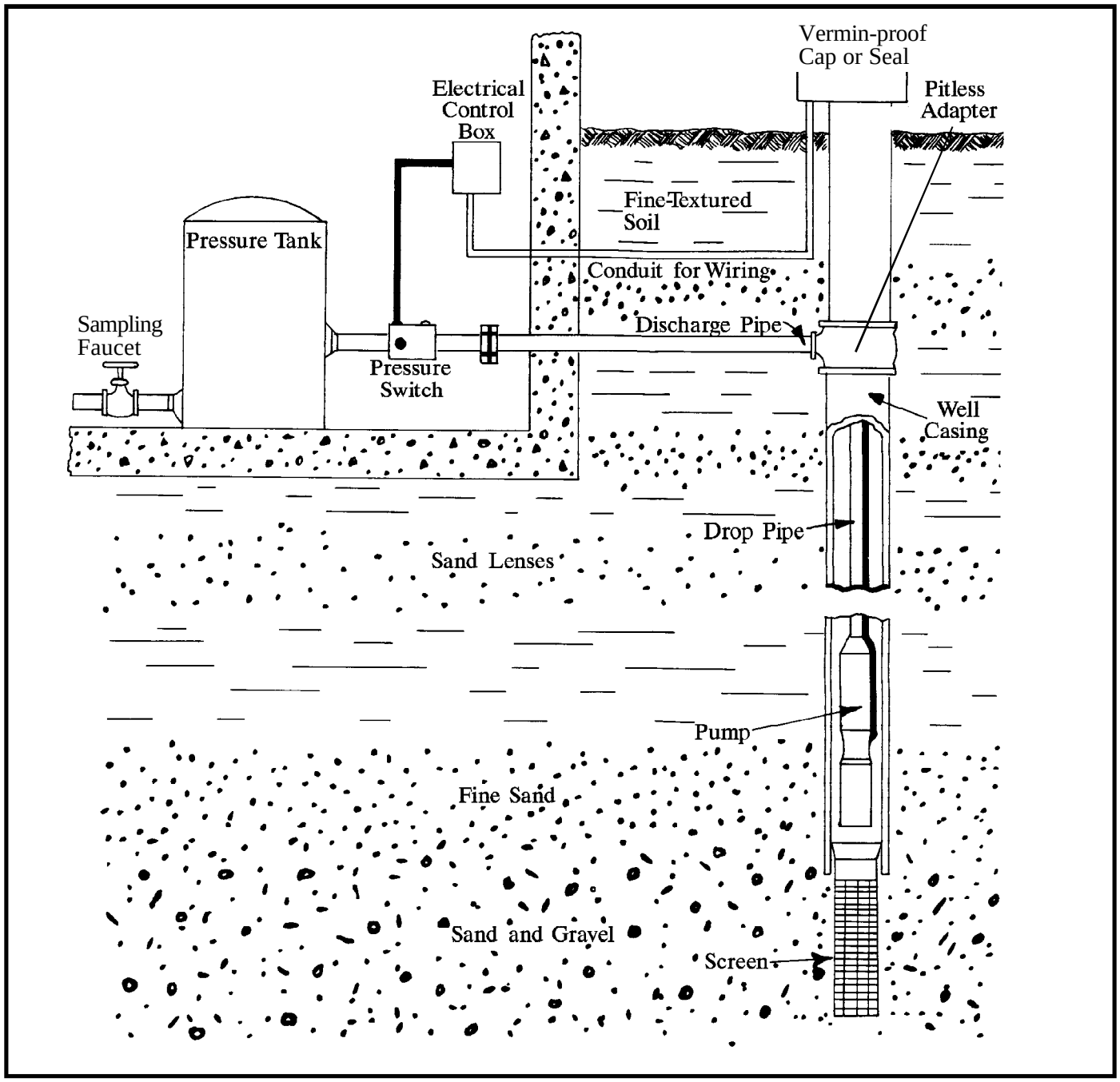


Figure 2: Typical domestic well installation with discharge pipe extending into the home. *Source: Adapted from Planning Your Well: Guidelines for Safe, Dependable Drinking Water, University of Illinois-Champaign Cooperative Extension Service, December 1988.*

This overview of well construction and inspection can help you understand your drinking water contamination risk ranking. For more information, contact a registered well driller or pump installer. The New Mexico Environment Department or State Engineer district office can help interpret construction requirements of the private well regulations.

Casing and well cap

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

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

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

Casing depth and height

The depth of casing required by the state private well code for your well depends on the nature of the subsurface geologic materials and water table depth. The casing should be below the depth of the water table to a point where future declining water levels will not affect the pumping yield (gallons per minute - gpm) of the well. The casing should not be allowed to touch or be supported by the bottom of the bore hole. Your State Engineer district office 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.

Wells cased below the water level in the well can afford greater protection from contamination. Well casing extending at least 30 feet below the water level in your well can ensure that surface water is filtered through soil and geologic materials before entering the well. Deeper cased wells can provide greater sanitary protection but can also result in aesthetic water problems caused by dissolved solids, such as hardness and iron. Typically, the casing extends one to two feet above surrounding land, preventing surface water from running down the casing or on top of the cap and into the well. State regulations 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 high nitrate concentrations. A well constructed more than 70 years ago is likely to be at the center of the farmstead; it may be a shallower well and is probably surrounded by many potential contamination sources. Older well pumps are more likely to leak lubricating oils, which can get into the well. Older wells are also more likely to have thinner casing that is corroded through. Even wells with modern casing that are 30 to 40 years old are subject to corrosion and perforation. If you have an older well, you may want to have it inspected by a qualified well driller.

Well type

Dug wells pose the highest risk of allowing drinking water supply contamination because they are shallow and often poorly protected from surface water. A dug well is a large-diameter hole (usually more than 2 feet wide), which is often constructed by hand.

Driven-point (sand point) wells, which pose a moderate to high risk, are constructed by driving assembled lengths of pipe into the ground. These wells are normally smaller in diameter (2 inches or less) and less than 50 feet deep. They can only be installed in areas of relatively loose soils, such as sand.

All other types of wells, including those constructed by a combination of jetting and driving, are **drilled wells.** Drilled wells for farm use are commonly 4 to 8 inches in diameter. All bedrock wells must be at least 6 inches in diameter.

Well depth

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

> Local geologic conditions determine how long it takes for this to happen. In some places, this process happens quickly, in weeks, days or even hours. Areas with thin soil over fractured bedrock or sand and gravel aquifers are particularly vulnerable. Even thick sands over fractured bedrock represent a site vulnerable to contamination.
>
> On the other hand, thick clay soils don't allow contaminants to reach the water table. They may prevent contamination or delay the day when a well "turns bad." If you have a deep well (more than several hundred feet below the water table), the groundwater supplying your well may have traveled a considerable distance underground over a long time, offering greater protection to the well.

3. Managing and maintaining existing wells

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

Better management of your existing well

Existing wells were most likely located according to traditional practice or regulations in place at the time of construction. While these wells are still legal, you may want to consider how well yours conforms to current standards, which incorporate new knowledge about groundwater contamination and well water. These standards can be found in the state private well regulations.

You might want to move such activities as pesticide mixing, tank rinsing or gasoline storage further from your well. You might want to upgrade wells, get rid of well pits, install caps or extend casings. When transferring property, a seller's disclosure statement may require that the landowner point out potential sources of groundwater contamination. It is possible that certain conditions or practices could affect the value or sale of real estate.

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

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

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

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

Backflow prevention

Backflow or backsiphoning from pesticide mixing tanks allows chemicals to flow back into the well through the hose. Use an anti-backflow device when filling pesticide sprayer tanks to prevent the chemical mixture from flowing back into the well and contaminating groundwater. Inexpensive anti-backflow devices for hoses used to fill farm sprayers may be available from irrigation or spray equipment suppliers.
If you don't have such a device, keep the hose out of the tank when filling the pesticide sprayer.

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

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

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

All backsiphon and spill events must be reported to the NMED Hazardous and Radioactive Materials Bureau. To report, and to receive advice and assistance in remedying backsiphonage, call the 24-hour Emergency Hotline of NMED-HRMB, at (505) 827-9329. Collect calls are accepted.

Water testing

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

At a minimum, test your water annually for bacteria and nitrate. Where the well draws from sandy materials or granite bedrock, testing once for corrosivity is also important. A good initial set of tests for a private well also includes hardness, alkalinity, pH, conductivity and chloride.

In addition, you may choose to obtain a broad scan of your water quality for a number of contaminants. Some mail-in labs offer a screening for metals, inorganic

chemicals, volatile organic chemicals, herbicides/pesticides and coliform bacteria for $80-$120.

The results may not include contaminants that could be near your farm—the most commonly used pesticides in your area, for example. Test for contaminants that are most likely at your farmstead. Test for lead if you have lead pipes or soldered copper joints. Test for volatile organic chemicals (VOCs) if there has been a nearby use or spill of oil, petroleum or solvent. While testing for pesticides can be very expensive (often $80-$100 per compound analyzed), the expense may be justified if:

- your well has nitrate levels over 10 mg/l (reported as nitrate-nitrogen, NO_3-N) or 45 mg/l (reported as nitrate, NO_3)
- a pesticide spill has occurred near the well, or backsiphonage has occurred
- your well is shallow, has less than 15 feet of casing below the water table, or is located in sandy soil and downslope from irrigated croplands where pesticides are used

You can seek further advice on appropriate tests to run from your county Extension office or health department, or your district NMED office.

You should test your water more frequently if:

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

You can have your water tested by both public and private laboratories. A list of certified labs is available from your county Extension Agent or district NMED office.

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

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

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

The chloride level also may indicate other problems. In New Mexico, chloride can come from sewage systems or animal wastes, however, some chloride is naturally occurring. Any significant change in chloride concentration in drinking water suggests that land use is somehow affecting your well.

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

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

Well maintenance

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

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

4. New wells

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

- Follow the state recommended minimum separation distances. New Mexico Water Supply Regulations contain these separation distances and other requirements for drinking water wells. A full listing is also available from NMED or the State Engineer Office.
- Locate your well on ground higher than such surrounding pollution sources as fuel tanks, livestock yards, septic systems or pesticide mixing areas. Where practical, locate the well as far as possible from pollution sources, but no closer than the minimum separation distances.
- If necessary, build soil up around the well so that all surface water drains away from it.
- Avoid areas that are prone to flooding.
- Groundwater flow generally follows surface drainage patterns. Unless you know the exact direction of groundwater flow on your property, locate the well so that pollution sources are between the well and the nearest creek, river or lake. Groundwater generally flows from upland areas and discharges in a surface water body. In all cases, locate your well on ground higher than surrounding pollution sources such as fuel tanks, livestock yards or pesticide mixing areas.
- Make the well accessible for pump repair, cleaning, testing and inspection.
- Hire a competent, licensed well driller and pump installer. Make sure the driller disinfects the well with chlorine after construction and tests the water for bacteria after drilling, and provides you with detailed information about the well's depth and construction.

5. Unused wells

Many farms have unused wells. Old home sites or shallow wells once pumped by windmills are common. No one knows how many of these wells there are in New Mexico, although estimates range in the hundreds of thousands.

If not properly filled and sealed, these wells can provide a direct conduit for surface water carrying pollutants to groundwater without filtering through soil, or allow contaminant movement from one aquifer to another. In addition to these wells being a threat to groundwater, large open wells pose safety hazards for small children and animals.

A licensed, registered well driller or pump installer should be hired to close these wells, since effective well plugging calls for experience with well construction materials and methods, as well as a working knowledge of the geology of the well site. You may, however, do your own well abandonment work. A license is not required, but you must meet the minimum well code requirements when you abandon and fill a well.

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

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

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

The New Mexico State Engineer Office regulates abandonment and well plugging. They can also explain well-closing requirements. General guidelines to follow when closing an old well are:

> Remove pump, piping and any other obstructions from the well.
>
> Close the entire length of unused wells with slurries of cement or clay.
>
> The well must be chlorinated before it is sealed. The entire length of the well should then be sealed to prevent surface water from entering the groundwater, and to prevent contamination movement from one aquifer to another.
>
> The goal of proper sealing is to restore as closely as possible the geologic conditions that existed before the well was constructed. For specific requirements, consult the State Engineer Office nearest you (see Contacts and References).

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

Written by Susan Jones. Revised by Craig Runyan, Plant Sciences Department, New Mexico State University Cooperative Extension Service.