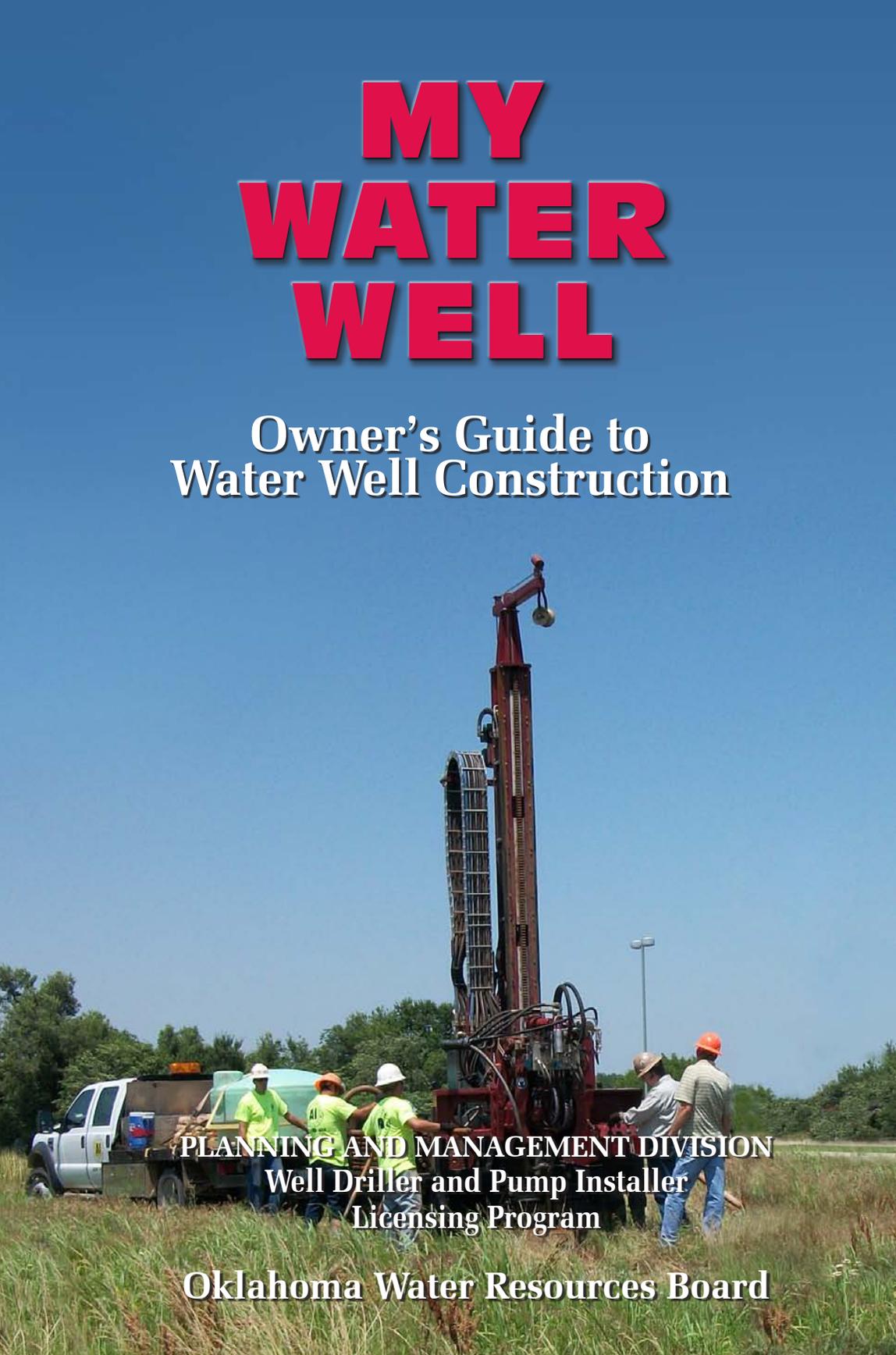


MY WATER WELL

Owner's Guide to Water Well Construction



**PLANNING AND MANAGEMENT DIVISION
Well Driller and Pump Installer
Licensing Program**

Oklahoma Water Resources Board

MY WATER WELL

Owner's Guide to Water Well Construction

June 2013

Oklahoma Water Resources Board

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The Importance of the Water Well Driller and Pump Installer Licensing Program

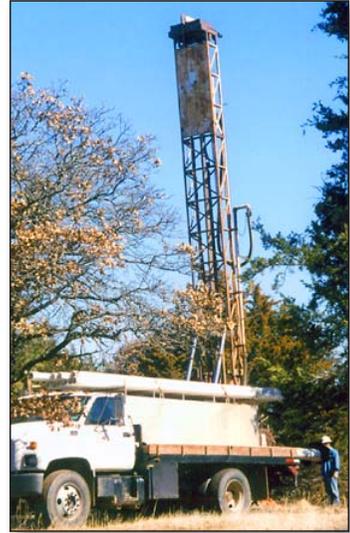
Overview of the Program

In 2000 the U.S. Geological Survey estimated about 45 million people in the United States had self supplied water sources. The program was initiated to ensure the integrity of water well¹ construction, prevent potential pollution of the state's groundwaters, and ensure public safety.

The Oklahoma Water Resources Board's (Board) Well Driller/Pump Installer Licensing Program (Program) has certified approximately 1,100 drillers and pump installers and/or operators since its inception.

The Board issues licenses to the following qualified firms or individuals:

- **Pump Installers**
- **Well Drillers:** Drillers of groundwater monitoring and fresh water wells, site assessment observation wells, wells used for heat exchange purposes (heat pump), and geotechnical borings (soil or geologic sampling).



The process for licensing and certification includes the applicant providing evidence of experience, education, passing score on an examination, and residency and citizenship. All licenses and operator certifications issued by the Board expire on June 30 of the second year following issuance. New licenses or operator certifications are issued for a two year period and may be renewed for a two-year period according to provisions in the rules².

Formal continuing education is required before any license or certification will be renewed. Completion of eight hours of continuing education credits is required every two years. One of the credited hours



1. Well(s) hereinafter refers to: Groundwater wells, groundwater test holes, monitoring wells, geotechnical borings, and heat exchange wells, unless otherwise specified.
2. Oklahoma Water Resources Board, Chapter 35. Well Driller and Pump Installer Licensing. Remember, OWRB Rules are Laws of the State of Oklahoma.

must be comprised of an approved Oklahoma Rules and Regulations unit. The Board conducts workshops to provide updates on new program rules, technological advancements, and related issues of interest to the state's well drillers and pump installers. Agency staff also routinely visit licensed drilling firms to answer questions related to the program and explain new or existing rules and regulations.

Addressing Oklahoma's Unique Geology and Groundwater Aquifers

The geology and groundwaters of Oklahoma are so varied that a single set of federal, state or local regulations is inadequate to protect state waters and ensure safety. To address this, the Board spearheaded creation of the Well Drillers and Pump Installers Advisory Council consisting of licensed water well drillers and pump installers to formulate fair and comprehensive well construction guidelines. Through direct public input, the council has developed a set of minimum standards that encompass all types of competent well construction and water well pump installation, including a variance procedure to address specialized problems. Standards for domestic drilling were ratified as state law in 1982, and for pump installation in 1990.

Protecting Oklahoma's Groundwater and Ensuring Safety for its Citizens

Oklahoma is underlain by 23 major groundwater basins containing an estimated 320 million acre-feet of water in storage, perhaps half of which is recoverable for beneficial use. Many of the minor basins may also yield significant amounts of fresh water. Water wells and springs supply more than 60 percent of the total water use, including almost 90 percent of the state's irrigation needs and provide municipal water to more than 300 Oklahoma cities and towns.

Unfortunately, groundwater supplies are often at risk due to poorly constructed and/or abandoned wells, which often provide a conduit for poor-quality water or contaminants to reach subsurface formations and groundwater supplies. The Program is a coordinated strategy by the state to protect our vital groundwater resources. Board hydrologists and geologists routinely conduct site inspections to investigate and, if necessary, coordinate restoration of poorly constructed wells or plug abandoned wells.



Old water wells that have not been properly plugged, regardless of their size or location, pose a tremendous risk for injury. Often overgrown by weeds and brush, these open holes can pose extremely dangerous hazards to both animals and humans, especially children.

The well driller is responsible for plugging an abandoned well or test hole as long as the well drilling equipment remains on the drilling site. If a well is abandoned after the well drilling equipment has been removed from the drilling site, the owner of the land where the well or test hole is located is responsible for plugging.

Utilizing the OWRB Website

The OWRB website provides access to data and information that may answer many of your questions about the Program including rules on *Well Driller and Pump Installer Licensing, Minimum Standards for Construction of Wells, Minimum Standards for Pump Installation, and Plugging and Capping Requirements.*

Licensed drillers are required to submit a multi-purpose completion report for each well within sixty days following the completion of a new well, plugging of an abandoned well, or reconditioning of an existing well. This database of well records (well logs) shares information on each recorded well in the state.

Navigating the OWRB Website

In your Web Browser, open the OWRB website, www.owrb.ok.gov, and start at the left navigation panel under **water supply and availability** then select **well drilling**. Here you will find buttons to access **Well Record Search** and **Well Driller/Pump Installer Search**. You may access most other information about the Program by using the **Quick Links** panel.

The **Well Record Search** button opens a fillable form which provides access to a database of more than 130,000 well logs, or completion reports, submitted by licensed commercial well drillers and well pluggers. These can be accessed for any area of interest; by county or by section, township, and range and by well type and water use.

Below is a sample results page of completion report data from a random query.

Search Results for 15, 15N, 02WI										Displaying Results 1 through 7 of 7.			
Well ID	County	Owner Name	Qtrs	SEC-TWP-RGE	Date Const	Well Type	Use	TD (ft)	Static WL	First Zone	Meas. WL	Est. Yld	WL Graph
8740	Logan	Kevin Mysinger	NWSESE	15-15N-02WI	08/01/85	Groundwater Well	Domestic	140	n/a	70	n/a	30	<input type="checkbox"/>
8741	Logan	Milis Humphry	NWSESW	15-15N-02WI	12/21/83	Groundwater Well	Domestic	200	n/a	60	n/a	40	<input type="checkbox"/>
25187	Logan	N/A	SWSWNW	15-15N-02WI	12/03/90	Groundwater Well	Domestic	200	n/a	32	n/a	30	<input type="checkbox"/>
29825	Logan	Floyd Mc Cuiiston	NWSESE	15-15N-02WI	07/24/93	Groundwater Well	Domestic	180	n/a	59	n/a	28	<input type="checkbox"/>
28228	Logan	Don Clark	NWNWSW	15-15N-02WI	05/13/92	Groundwater Well	Domestic	150	n/a	70	n/a	25	<input type="checkbox"/>
44751	Logan	R. Rognas	SWNESE	15-15N-02WI	02/15/98	Groundwater Well	Domestic	150	n/a	65	n/a	25	<input type="checkbox"/>
130922	Logan	Steve Chrisane	NWSESE	15-15N-02WI	04/04/08	Groundwater Well	Domestic	140	n/a	70	n/a	20	<input type="checkbox"/>

Completion reports are often used as a resource by landowners who want to know more about subsurface geologic conditions on their property or particular details about their water well construction. This information is also of interest to geologists and various researchers.

The **Well Driller/Pump Installer Search** button provides access to a database of over 400 licensed drillers and pump installers and is an important first step in seeking the most qualified contractor for your particular needs.

Things to Consider in Preparing for Construction of Your Water Well

Preliminary Planning and Investigation

If your well is to be used for any purpose other than domestic use as defined by OWRB rules, you (the landowner) must file a water use permit application to be considered and approved by the Board before the contractor can complete any work (other than test drilling).

A helpful resource in estimating the approximate depth and yield of your proposed well is to research the Board's online database for existing wells in your area (see *Utilizing the OWRB Website*, page 3).

Ask adjacent property owners or others about the specifics of their well including total depth, approximate yield, and water quality. Also, inquire about existing or potential well contamination threats in the area. You might also inquire about their general experience during the well construction process and their satisfaction with the contractor.

Establishing the Well Site

- Select a prospective well site that is located a minimum distance from possible pollution sources as prescribed in *OWRB Rules and Regulations, Minimum Standards for Construction of Wells*.
- ▶ **Possible pollution sources include but are not limited to the following:**
 - Building foundations (especially insecticide treated foundations)
 - Confined surface water areas
 - Existing or proposed septic systems (yours or your neighbors')
 - Confined animal boarding areas
 - Composting areas
 - Concentrated pollutant storage areas

- Oil or gas wells
- Landfills
- Avoid flood-prone areas.
- Keep underground and overhead utilities in mind. Allow ample room for drilling rig movement and operation.
- Stake the best appropriate location.

Selecting your Contractor

Select several OWRB-licensed well drillers and pump installers. Discuss your well specifications and construction details with each potential contractor. Compare construction prices and time frames. You may search for local well drillers and pump contractors and acquire the most current complete list of licensed firms and operators on OWRB's website (see *Utilizing the OWRB Website*, page 3).

Contact the Board and the Better Business Bureau for appraisals of past performances of your selection of firms before making your final choice of a licensed firm to contract with.

Information to Provide your Contractor

- Supply your contractor with all information collected from the Board and/or neighbors regarding the proposed well and its exact location (i.e., legal description).
- Give your contractor a list of any optional specifications you select (see page 7).
- Supply your contractor with all details concerning access to the drilling site.
- ▶ ***Factors to consider include but are not limited to the following:***
 - Can your contractor's drilling rig physically get to the selected site (obstacles may include buildings, fuel tanks, utility lines, septic systems, etc.)?
 - Is the property on a steep grade?
 - Are there deep creeks or ravines on your property that may limit access



of the rig to the proposed well site?

- Is there heavy timber on the property that will require cutting before the rig can attain access?
- Must fences be cut or gates be removed to allow the rig access to the selected location?
- Have there been any recent, major weather conditions that would limit access to the site, such as heavy rain events on clay or soft soils?
- If you would like for your contractor to select the well location, give him the locations of all pollution sources, drainage patterns and utilities (overhead as well as underground). Some contractors will not make the final well site selection for you, but may give you several site options.
- Give your contractor a list of damages that you would expect his firm to be responsible for and information on preliminary work required to get the rig on location.



Information to Request of Your Contractor

- Does your contracting firm and its operators possess a valid license or certification and is the firm in good standing with the Board?
- Has your contractor drilled wells in the area before? How many? Has your contractor encountered any special problems in the area? What is the nature and expense of any special problems related to drilling the well?
- What are the specifications of the standard well construction your contractor uses in the area?
- What is the price per foot of your contractor's standard well construction, including all materials and labor?
- What guarantees does your contractor's firm make for standard well construction in the designated area?
- If you have selected optional well construction methods and/or materials (see page 9) that exceed your contractor's standard well construction, ask if it is possible to construct a well to those specifications. Has your contractor constructed a well to those specifications before? Are there any special guarantees the firm will make using that type of construction?
- Also inquire about additional charges for optional well construction methods and/or materials and request the adjusted price per foot including all materials and labor in writing before construction begins.

- Agree on a starting date for the well construction project and the approximate completion date?
- Ask your contractor for special instructions regarding care of the well after drilling is completed and disinfected.
- Request a copy of the multi-purpose completion report which documents all details of the construction of your well.
- Always request a detailed receipt for work performed and discuss any line-item cost that you do not fully understand or that was not previously agreed upon.
- If groundwater is not encountered in the selected location, does your contractor have a dry hole charge? What is the cost?
- If the hole is dry who will be responsible for plugging and the cost? The Board requires all water well test holes to be plugged according to minimum standards within 3 days.



Selecting the Construction Type

Oklahoma's unique and varied geologic conditions are best suited for two general types of water well construction. The OWRB-licensed water well driller that you choose will provide assistance in selecting the appropriate construction method and ensure that your well is constructed in a manner that ensures maximum efficiency and a long life-span. Necessary steps will also be taken to prevent potential contamination of the well and its source groundwater basin.

Gravel or Filter Pack, with Well Screen or Well Perforations

The most common method of construction utilizes gravel or filter packs that provide a medium through which water moves from the formation into the well casing. This method is usually used in unconsolidated formations, but it can be used in any type of aquifer.

- Well casing keeps the hole open in unconsolidated formations, helps seal off zones of less favorable water and prevents surface water intrusion. In consolidated formations, the casing also prevents formation material from sloughing off and locking the submersible pump in the well bore.
- Cement surface seal is a cement barrier poured between the outside of the casing and the inside face of the borehole preventing potential contamination from washing down the annular space (the area between the inside of the bore hole and the outside of the well casing or surface pipe).

- Gravel or filter pack consisting of small gravel or coarse sand is placed between the well screen or perforated casing and the inside of the borehole. This filters out the geologic formation materials and prevents them from entering the screen or perforated casing.
- Well screen or perforated casing is a piece of factory-slotted or hand-perforated casing that prevents the filter pack or formation from collapsing into the borehole while allowing water to enter the well.

Open Hole Construction with Surface Casing

Open hole construction with surface casing is generally used in consolidated aquifers where the hole can stay open without the need for well casing.

- Surface casing is cement grouted in through loose, unconsolidated surface soils and anchored into the top of the consolidated aquifer. Surface casing prevents the collapse of loose soils at the top of the well and assists the cement surface seal in preventing intrusion from zones of less favorable water or surface water contamination. A smaller bore hole is drilled inside the casing to complete the well down to the total depth.
- Cement surface seal is a cement barrier poured between the outside of the surface casing and the inside face of the borehole which completely seals the well from potential contamination washing down the annular space.

Making Your Water Well the Best It Can Be

To help ensure that your water well supplies you with water of sufficient quantity and quality, according to your particular needs, all water wells or fresh water observation wells constructed in Oklahoma, either by OWRB-licensed drillers or other individuals, must comply with minimum construction standards. These standards were developed by the Board in tandem with the Well Drillers and Pump Installers Advisory Council which consists of eight of the state's licensed and experienced water well drillers. If you have specific questions concerning your water well, ask your contractor and/or contact the Board.

Regardless of construction method, a properly constructed well will possess a well casing consisting of new or sanitary used steel or new PVC. The casing and joints will be water-tight and the surface seal will be of appropriate thickness around the casing and extend from the land surface to a sufficient depth. Depending upon the type of construction required, the gravel or filter pack and well screen or casing perforations will be installed in a manner that achieves your desired water quality and quantity.

During the final phase of construction, the contractor will remove all drill cuttings and mud from the well. If chlorinated water was not used during the drilling phase, the contractor will properly disinfect the well prior to leaving the

site. The well will then be capped or sealed, depending upon plans for future pump installation.

Considering Optional Well Construction Methods

Certain optional construction methods and materials, though not mandated by minimum construction standards, may augment well yields, improve water quality and provide added protection from potential contamination sources. However, these measures may also increase final construction costs.

- **Increasing the diameter of the well casing** may prevent the pump from being locked in the hole should a piece of gravel or another item infiltrate the casing and wedge the pump in its place. This option may also increase the total volume of reserve water in the well.
- **Extend the casing and grouting** to the top of the production aquifer in open hole construction with surface casing. The well will receive greater protection from potential collapse of the formation below the surface casing or contamination from zones of lower quality water.
- **Increasing the length and thickness of the cement surface seal** will help ensure a complete annular seal which, in turn, reduces the chances that lesser quality water or surface contamination will penetrate the seal.
- **Using a uniform-sized gravel or filter pack** will maximize the quantity and quality of water yielded by the well.
- **Using a factory-manufactured well screen** can significantly increase the production, quality, and longevity of the well. A continuously slotted screen provides the best yields.

Implementing Sound Well-Water Quality Practices

Open water wells, or any open, sub-surface borings in close proximity to your supply well location (including abandoned wells) can be a potential source of contamination. As a result, it is imperative that well owners implement wise wellhead protection practices, plug all abandoned wells on their property, and be knowledgeable of general well maintenance and water quality assurance procedures.



Plugging Abandoned Wells

If you abandon your well, you are required by state law to properly plug the well and ensure that it is completely sealed to prevent potential contaminants from entering the hole and infiltrating the underlying or surrounding groundwater formation. Normally, this requirement involves filling the hole to a predetermined depth with cement and/or bentonite grout or a combination of other approved materials. Ask your contractor what requirements apply to your well.



In addition, if you have a previously abandoned well on your property, you must ensure that it has been properly plugged to prevent potential contamination of your existing well or the wells of your neighbors.

Disinfecting Your Well

To ensure that the water yielded from your well is safe and free from pollution, you should have your well water tested for coliform bacteria and nitrates at least once a year by the Oklahoma Department of Environmental Quality (DEQ) or another qualified testing firm. Also, keep a record of all water quality tests.

Significant rain events may raise groundwater levels to a height where they may come in contact with surface contamination sources, including nearby septic systems. If your well water gets cloudy or tastes different after a rain event, or if there is a sudden change of quality, test your well as soon as possible. If your water well is found to be contaminated, it should be disinfected immediately. In addition, all new wells should be disinfected after completion or following repairs to the well or pumping equipment.

Follow these general well disinfecting guidelines.¹

- Add enough chlorine to make a solution of not less than 100 parts per million in your well (for equivalent units see table on page 11). Use ordinary liquid laundry bleach having 5.25 percent chlorine. Do not use scented or non-chlorine bleach.
- Avoid extremely strong chlorine solutions because they can reduce the life of rubber and neoprene components in water systems, such as air bladders in pressure tanks and o-rings.



- Circulate the solution by pumping the discharge back into the well. This can be done by inserting a garden hose through the well seal at the top of the well and pumping until the chlorine is thoroughly mixed (at least fifteen minutes).
- Open each water tap in the system until a strong chlorine odor is present, then close the tap. This will also disinfect the house service lines.
- Let the chlorine stand for at least 24 hours, if possible, but no less than two hours.
- Flush the system thoroughly.
- To determine the effectiveness of the disinfection procedure, resample after a one week period to allow for the possibility of bacterial regrowth.

Amount of Chlorine Bleach Needed to Achieve an Approximate 100 ppm Concentration				
Depth of Well (ft.)	Diameter of Well (in)			
	3	6	6	12
50	3 oz	8 oz	25 oz	50 oz
100	6 oz	20 oz	50 oz	100 oz
150	8 oz	30 oz	75 oz	150 oz
Equivalents: 8 oz = 1 cup, 25 oz = 3.12 cups, 50 oz = 6.25 cups, 100 oz = 12.5 cups, 150 oz = 19 cups or 1.2 gal				

¹ Contact ODEQ if you have questions concerning disinfection of your specific well.

Practicing Wellhead Protection

Wellhead protection involves various efforts or safeguards which ultimately prevent contaminants from entering the area of land around your water supply well. All water well owners should follow at least minimum wellhead protection guidelines (below) to ensure that the quality of their supply remains safe for consumption.

- Whether your well has a cement pad poured around it or not (one is not required), do not make a planter or flower bed out of the area around the casing and do not apply any organic compounds to the casing area. Tillage of soil around the casing increases soil permeability and the velocity of percolation. Also, if you notice any channeling occurring to the cement surface seal, any unsealed electrical connections or faulty connections they need to be addressed as soon as possible as they can create a pathway for insecticides, herbicides or other harmful organic compounds to reach the groundwater. Regardless of the type of well installation, if there is no cement pad, hand-pull or use mechanical



means to control grass or weeds, this is most important in the case of a pitless adapter installation.

- If your system requires constructing housing for your well and pressure tank, do not store contaminants in or near your well house and make it secure against freezing conditions and intrusion from pests.



- When possible, keep potential sources of contamination at least 50 feet down-gradient from your water supply well location. Potential sources of contamination include (but are not limited to) building foundations (especially insecticide-treated foundations), confined surface water areas, septic systems, confined animal boarding areas, composting areas, and concentrated pollutant storage areas. Also, never store hazardous materials in your well house or near your well.
- If you've purchased a home that utilizes well water, find out the age of the well. Many older wells, especially those constructed before implementation of more rigid construction standards, are cased to a relatively shallow depth and are more susceptible to contamination and various other problems.

Maintaining Your Well

Some water wells require periodic maintenance to preserve their efficiencies (specific capacity). The specific capacity of a well is its yield per unit of drawdown over a given unit of time. It is typically expressed as gallons of water per minute per foot of drawdown (gpm/ft.). Well rehabilitation is the art of thoroughly cleaning the well screen, gravel pack, and the natural formation to raise the specific capacity to as high a value as possible. A new and properly developed well should have an efficiency approaching 100 percent. Discuss this and all questions concerning your well with your contractor.



► ***Some possible causes of reduction in a well's specific capacity:***

- Mineral deposits can accumulate and plug the well screen, gravel pack and native sand and gravel.

- If wells have significant amounts of iron, the bacteria have an available source of food. An iron bacterial slime can cause complete and almost sudden loss of specific capacity.
- The migration of very fine particles through the well can be restrained by the gravel pack. This accumulation can create a mechanical blockage.

▶ ***Some possible causes of system failure where you have no water available at any location:***

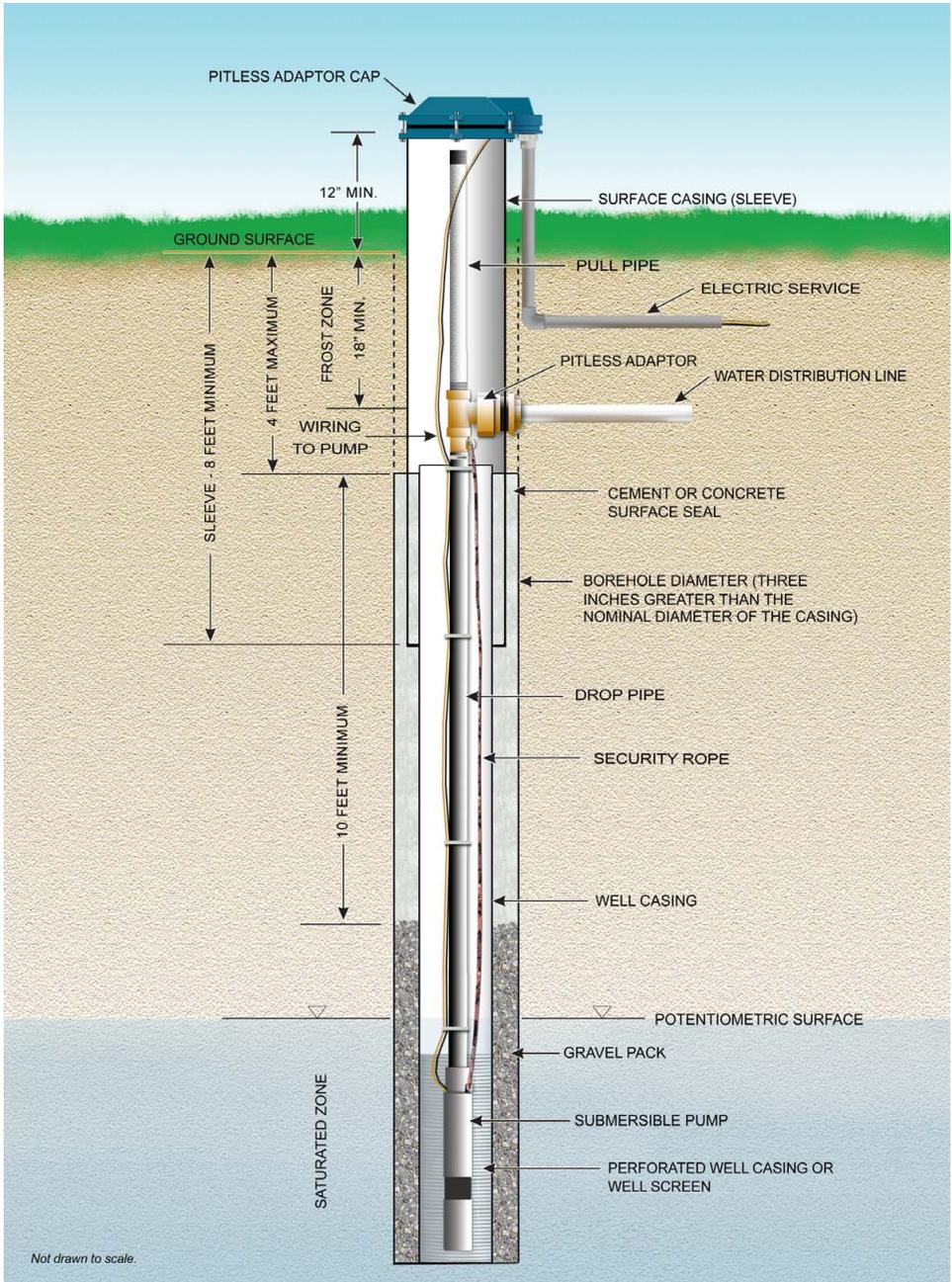
Caution: *Do not attempt any mechanical or electrical testing and/or maintenance that should be performed by a licensed professional.*

- General electrical power failure, a tripped circuit breaker, or a blown fuse.
- Water supply valve is in the closed/off position.
- In-line filters have restrictions or water treatment system is operating improperly.
- Water pipes are frozen.

Note: *If you have difficulty resolving the problem, call an OWRB-licensed pump installer.*

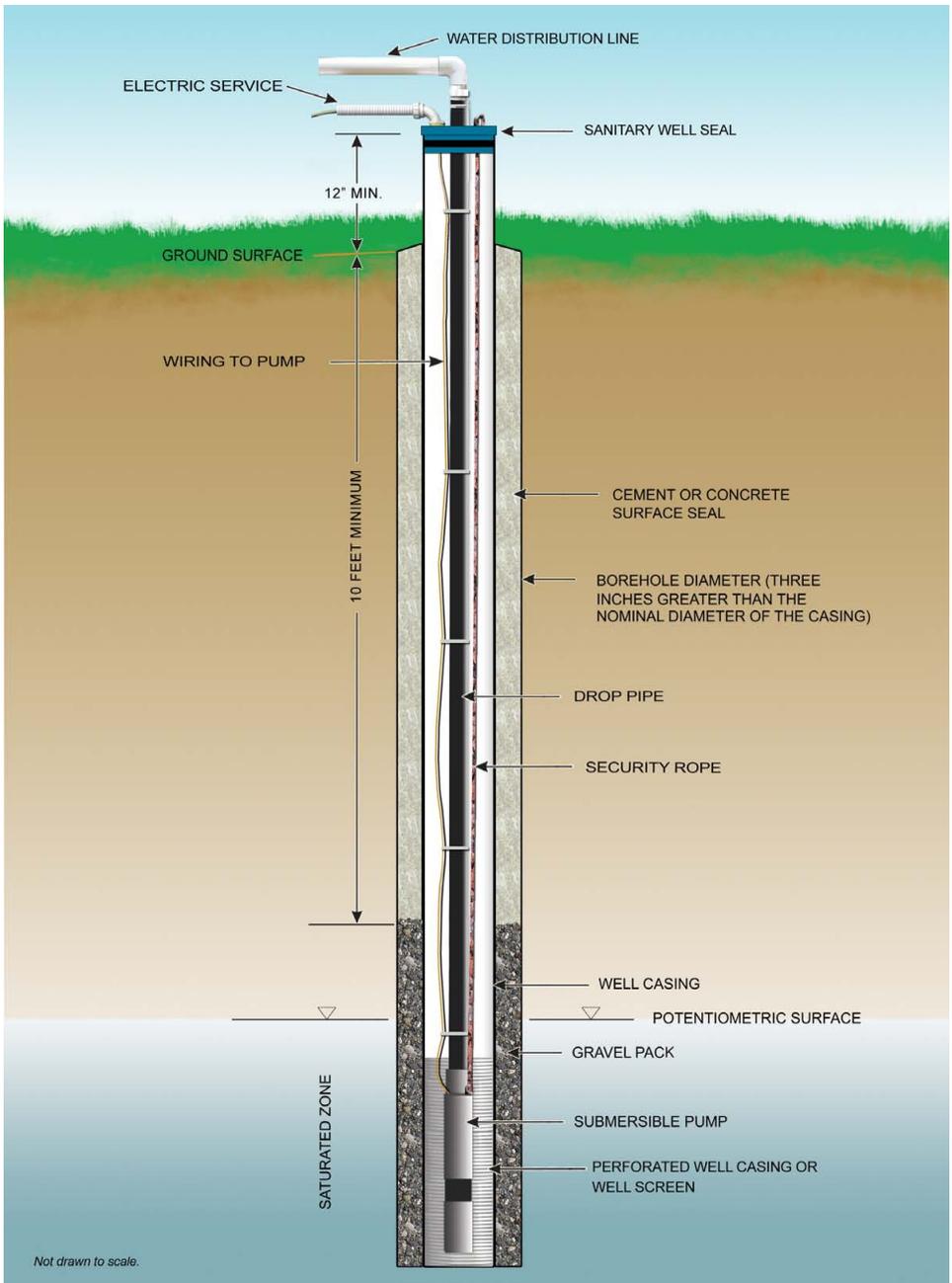
Illustrations

Drawing of Pitless Adapter Water Well



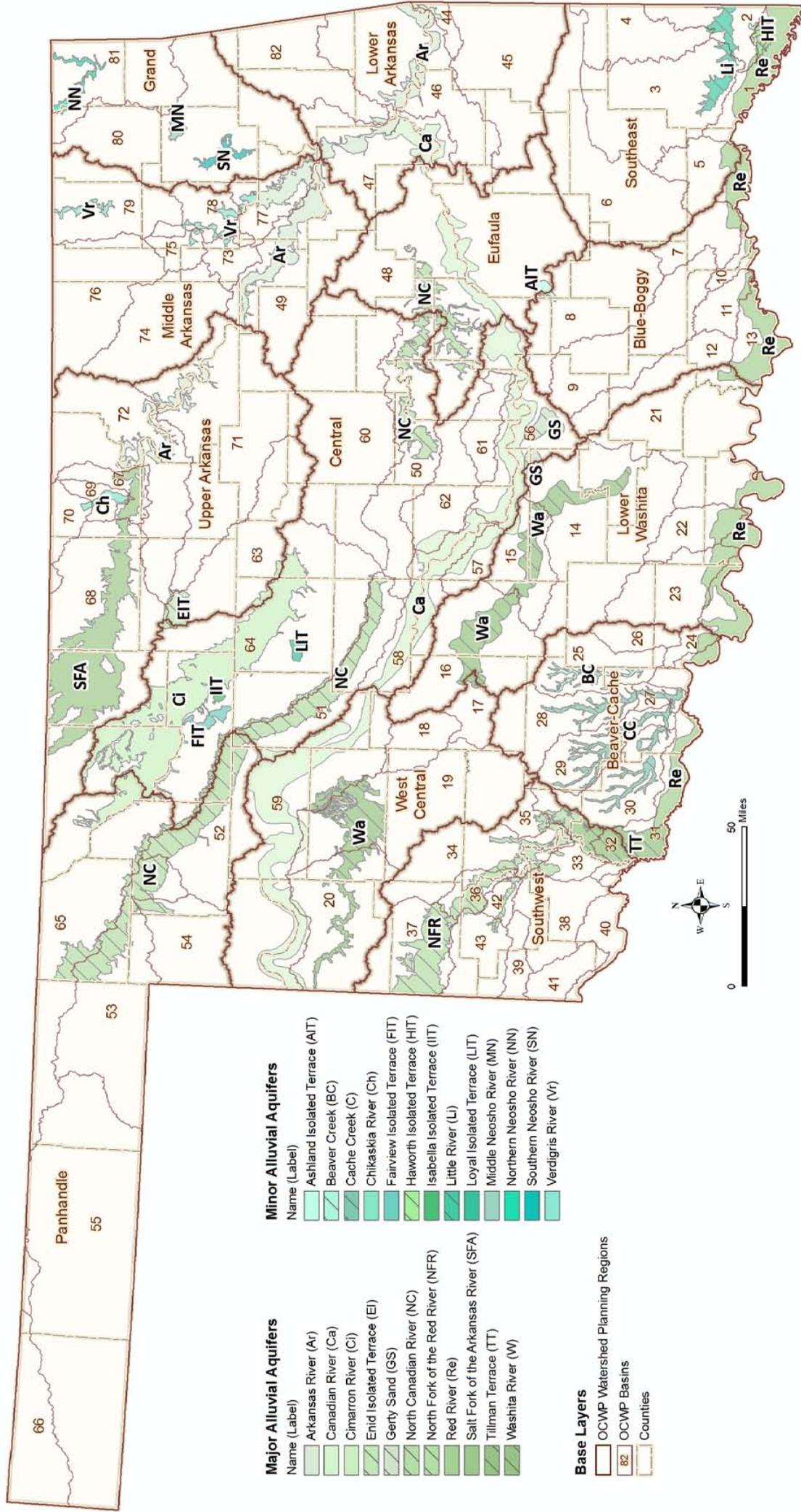
Note: This diagram is a general representation and not intended for construction purposes.

Drawing of Above Ground Water Well

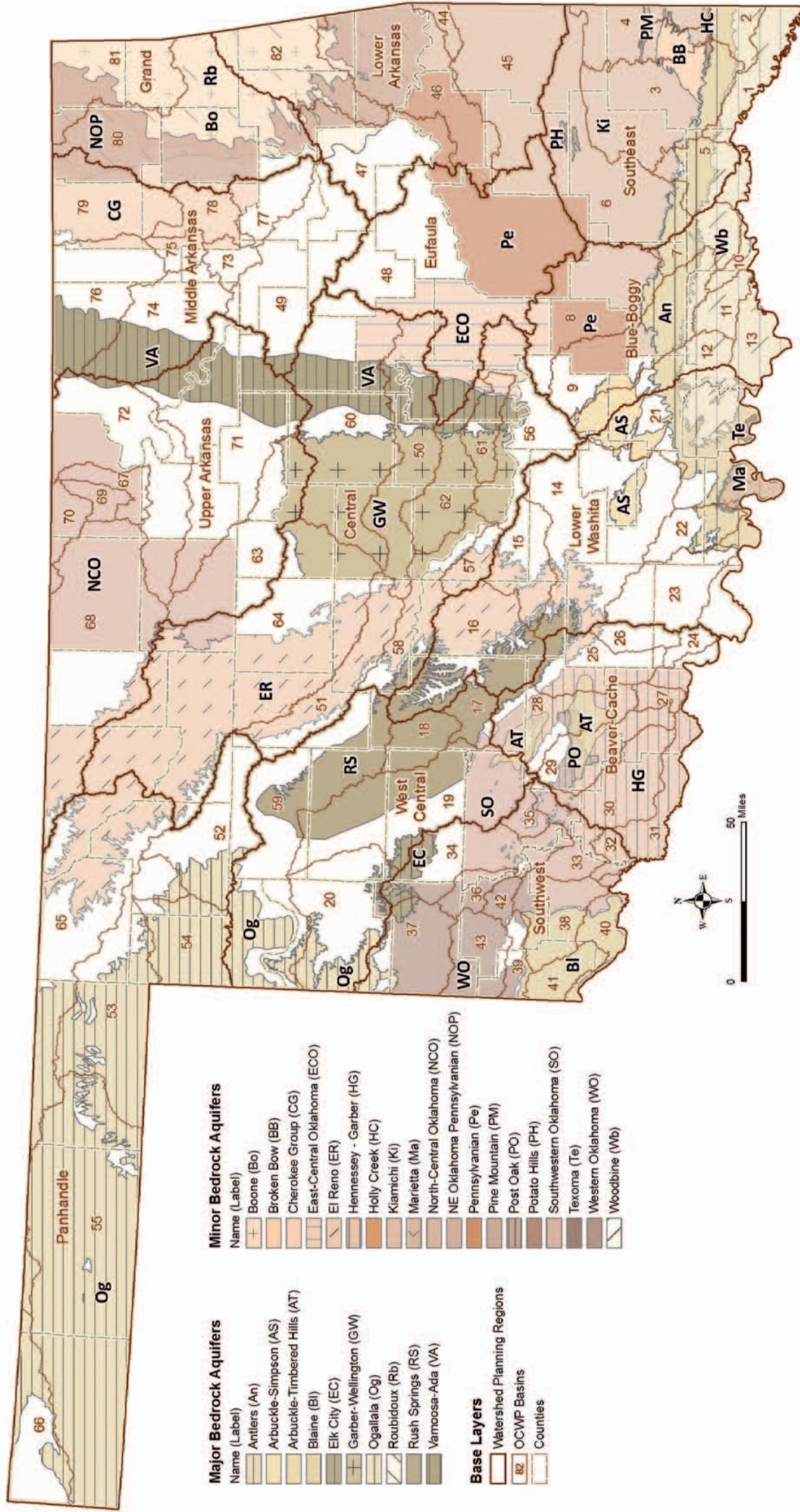


Note: This diagram is a general representation and not intended for construction purposes.

Map of Alluvial and Terrace Aquifers in Oklahoma



Map of Bedrock Aquifers in Oklahoma



***For more Information, Contact
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