

# Abandoned Water Wells and the Challenges They Pose

White Paper Prepared by the Texas Groundwater Protection Committee (TGPC)  
Groundwater Issues (GWI) Subcommittee

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## Executive Summary

Texans rely on water wells to access groundwater for a variety of different uses including domestic, irrigation, and industrial purposes. Water wells are also used by public water systems to supply drinking water to municipalities. In some areas of Texas, water wells provide the only source of fresh water. Water well construction in Texas is regulated by the Texas Department of Licensing and Regulation and by local groundwater conservation districts. Hundreds of thousands of water wells have been drilled in Texas and approximately 30,000 new wells are drilled each year. Water wells are abandoned when they stop working or are no longer needed for their intended purpose. Once a well becomes abandoned, they can pose a serious risk to groundwater quality. In this white paper we discuss why abandoned water wells pose a threat to groundwater and give examples from around the State. We also discuss challenges in locating and plugging them, and the efforts the State of Texas has taken to address them.

## Acronym List

AWRS	Abandoned Well Reporting System
CAD	County Appraisal District
CAFO	Concentrated Animal Feeding Operation
EAA	Edwards Aquifer Authority
GCD	Groundwater Conservation District
GPS	Global Positioning System
GWJ	Groundwater Issues (Subcommittee)
MOU	Memorandum of Understanding
NRCS	Natural Resources Conservation Service
OSSF	On-site Sewage Facility
ppm	parts per million
PSW	Public Supply Well
SDR	Submitted Drillers Reports
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TDLR	Texas Department of Licensing and Regulation
TDS	Total Dissolved Solids
TGPC	Texas Groundwater Protection Committee
TNRCC	Texas Natural Resource Conservation Commission
TWRSRS	Texas Online Well Report Submittal and Retrieval System
USDA	United States Department of Agriculture
USGS	United States Geological Survey

## Introduction

A water well is an artificial excavation constructed to explore for or produce groundwater (Texas Occupations Code Title 12 Subtitle A Chapter 1901.001 (14), <https://statutes.capitol.texas.gov/Docs/OC/htm/OC.1901.htm>). Texans rely on water wells to access groundwater for drinking water, agricultural needs, and other industrial purposes. Texans get an estimated 60% of their freshwater from groundwater, including 80% of agriculture use, 28% of the public water supply, and >99% of drinking water for the rural population (Texas Groundwater Protection Committee (TGPC), Groundwater Facts and References, [https://tgpc.texas.gov/groundcommittes/TGPC\\_GW\\_Facts\\_References.pdf](https://tgpc.texas.gov/groundcommittes/TGPC_GW_Facts_References.pdf)).

A properly constructed water well (Figure 1) should allow access to groundwater while preventing contaminants at the surface from reaching the aquifer and preventing commingling (i.e., mixing of aquifers or zones with different water quality) in the subsurface. For a water well to be installed correctly it must, at a minimum, include:

- Watertight well casing to prevent the well from collapsing.
- An annular seal (i.e., bentonite or cement grout) to prevent surface contaminants from reaching the groundwater through the annulus (the space between the borehole and well casing), prevent commingling, and stabilize the well casing.
- A surface completion (e.g., sleeve or slab) to protect the well casing above land surface.
- A sealed well cap to prevent contaminants from entering the well head.

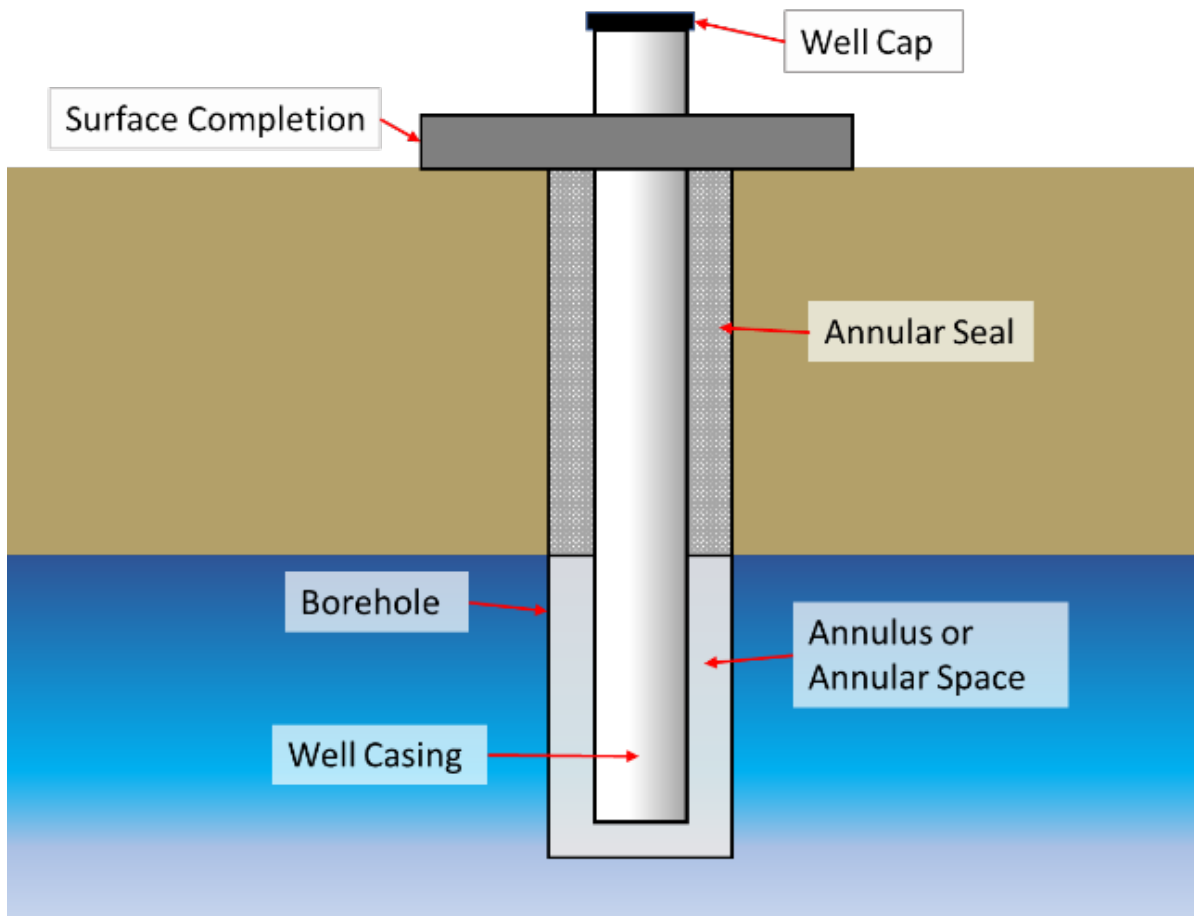


Figure 1. Conceptual drawing of a properly completed water well.

The Texas Department of Licensing and Regulation (TDLR) is responsible for regulating water well construction in the State of Texas. Minimum well construction standards and siting specifications are found in Title 16 Chapter 76 of the Texas Administrative Code (TAC). There are nine major aquifers and twenty-two minor aquifers in Texas, all with different hydrogeologic properties, and wells are constructed differently depending on the local aquifer properties. TDLR has implemented minimum well construction standards that are feasible and applicable to the entire state. Locally, Groundwater Conservation Districts (GCDs) may have additional well construction standards for water wells in their districts that are better suited for their local aquifer conditions (e.g., water quality, hydrogeology, water use, etc.) that apply to any well construction within their jurisdiction (Texas Water Code Ch. 36.117(h)). Any well construction rule that a GCD adopts must be at least as stringent as the TDLR rule.

Millions of water wells have been installed in Texas, with more than 624,000 being installed since 2002 (TDLR Submitted Drillers Reports (SDR) Database, <https://www.twdb.texas.gov/groundwater/data/drillersdb.asp>). If constructed correctly, a water well can last for many decades. Over time, water wells are abandoned when they are no longer needed for their intended purpose (e.g., land use change, home connected to community water supply, etc.), quit working (e.g., water level drops in an aquifer, water quality degrades, etc.), or are damaged and replaced with a new well. If an abandoned well is neglected long enough it will deteriorate and become a threat to groundwater quality and safety. Water wells that are in use can become deteriorated for a variety of different reasons through normal wear and tear. Some wells can be considered deteriorated solely because they were not constructed properly in the first place. A deteriorated well, by definition, is an abandoned well. In Chapter 1901.255 of the Texas Occupations Code (<https://statutes.capitol.texas.gov/Docs/OC/htm/OC.1901.htm#1901.255>), abandoned and deteriorated wells are defined as:

- (1) "Abandoned well" means a well that is not in use. A well is considered to be in use if:
  - (A) the well is not a deteriorated well and contains the casing, pump, and pump column in good condition;
  - (B) the well is not a deteriorated well and has been capped;
  - (C) the water from the well has been put to an authorized beneficial use, as defined by the Water Code;
  - (D) the well is used in the normal course and scope and with the intensity and frequency of other similar users in the general community; or
  - (E) the owner is participating in the Conservation Reserve Program authorized by Sections 1231-1236, Food Security Act of 1985 (16 U.S.C. Sections 3831-3836), or a similar governmental program.
  
- (2) "Deteriorated well" means a well that, because of its condition, will cause or is likely to cause pollution of any water in this state, including groundwater.

Examples of a working, abandoned, and deteriorated water well are shown in Figure 2. Abandoned and deteriorated water wells pose not only a significant threat to groundwater resources in the state, but they also pose a safety hazard to humans and livestock. In this document we will discuss how abandoned and deteriorated water wells pose a threat to groundwater, the challenges in locating and plugging them, and the efforts the State of Texas has taken to address them.

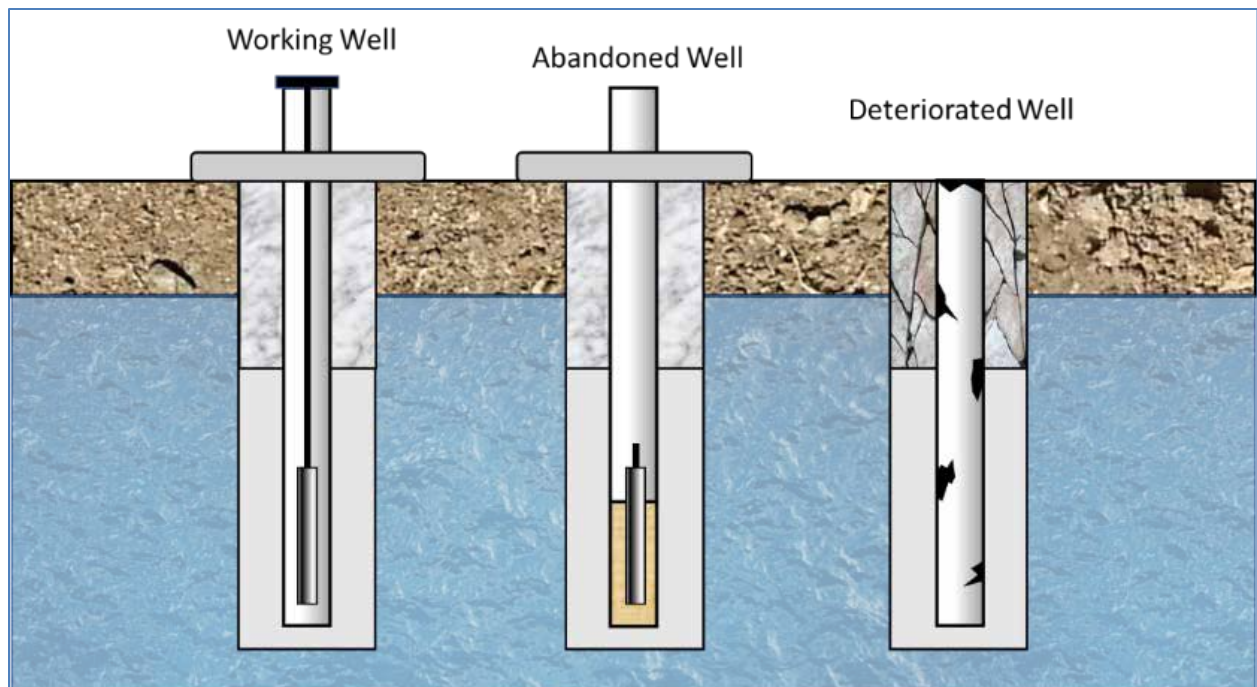


Figure 2. Illustration showing examples of a working well, an abandoned well, and a deteriorated well. In this example the abandoned well has a stuck pump and is uncapped, while the deteriorated well is missing its surface completion and well cap and has a failing annular seal and deteriorated casing.

## Full Issue Information and Discussion

### *Threat to Groundwater*

Under natural conditions, water recharges into aquifers through soil and sediment over long periods of time, sometimes many, many years. Soil and sediment act as natural filters that help remove contaminants from the recharging water. An uncapped or improperly sealed abandoned water well bypasses this process and creates

a direct conduit from the surface to the underlying aquifer(s), allowing surface contaminants (e.g., contaminated surface water, agricultural chemicals, etc.) to enter underlying aquifer(s) without any natural filtration. Additionally, an abandoned water well that is not properly sealed can allow shallow contaminated groundwater to migrate downward into the underlying aquifer. As shown in Figure 3, abandoned and deteriorated water wells can pose a threat to nearby wells that might be used for domestic or public supply.

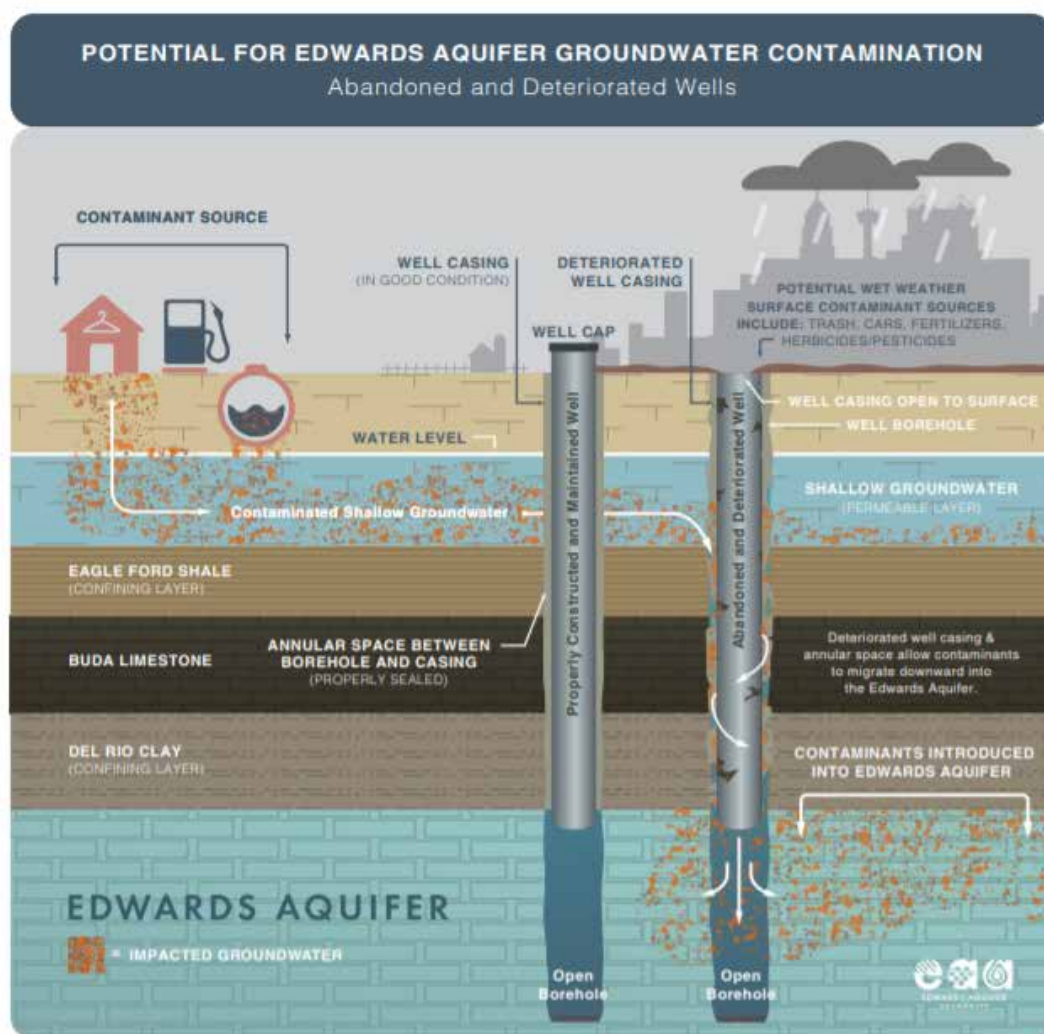


Figure 3. Illustration showing how an uncapped abandoned and deteriorated water well can introduce contaminants to an aquifer and have negative impacts on nearby working wells. (Graphic provided by the Edwards Aquifer Authority)

Another less visible impact that an abandoned and deteriorated water well can have on groundwater quality is when a well is allowing the commingling of waters from different aquifers. In many areas of Texas, there are multiple aquifers present at a particular vertical location. If an abandoned water well is open to more than one aquifer, either through deteriorated casing or an unsealed annulus, water from the aquifer under higher pressure will flow to the aquifer under lower pressure. If the groundwater quality in the aquifer under higher pressure is poor (e.g., high Total Dissolved Solids (TDS), high iron, etc.) it can have detrimental effects on the other aquifer and any wells completed in it. One example of this occurred within the Gonzales County GCD where, in 2015, they began to see concentrations of TDS increase in monitoring wells near a Public Supply Well (PSW) field. After conducting an investigation, it was determined that the source of the increased TDS was from several improperly sealed deteriorated water wells in the immediate vicinity of the well field. Most of these water wells were subsequently plugged resulting in an improvement in groundwater quality.

An artesian water well is a well that flows to the surface under natural pressure. Uncapped abandoned artesian water wells can cause pressure loss in an aquifer that may result in water level decline in nearby wells. They may also cause water quality issues depending on where the water originates from and where it flows to. Boehmer Lake, in far West Texas (Pecos County), is a good example of the negative impacts that an abandoned artesian well can cause. A wildcat well – one that never produced oil or gas but did produce a large amount of fresh water – near the center of the lake was once used for agricultural purposes in the early to mid-1900s. By the late 1900s the water flowing from the well had turned salty and the well was capped. Over the subsequent decades, the salty water corroded the casing and began discharging onto the land surface. The water flowing from the well has now created a lake that is almost ½-mile wide and growing (Figure 4). Water samples collected by the United States Geological Survey (USGS) in 2015 from the lake directly above the well head had a TDS concentration of 130,131 ppm, almost four times that of seawater, in addition to elevated levels of arsenic, radionuclides, hydrogen sulfide, hydrocarbons, and other constituents (Straub, 2022). Concerns are growing that the water from the lake may be contaminating the Pecos Valley Alluvium. Middle Pecos GCD, the GCD in Pecos County,



has identified dozens of similar wells throughout the County, and there are other incidences of uncapped artesian wells causing problems in other parts of the state.



**Figure 4. Aerial images of Boehmer Lake (Pecos Co, 31° 13.380'N, 102° 43.856'W). The photo on the left is from 2003. The photo on the right is from 2015.**

Uncapped abandoned water wells, especially if they are large diameter wells, present a danger to humans and livestock. There have been several instances where small children have fallen into abandoned water wells including “baby Jessica” in Midland, in 1986, and in 2020 a young boy fell into an abandoned water well while out walking with his family on a ranch in Starr County. There have also been documented cases of septic waste and household trash being dump into abandoned large diameter wells.

### *Challenges in locating and plugging abandoned and deteriorated water wells*

The actual number of abandoned and deteriorated water wells in Texas is unknown, however it is thought to be very high. A group of state agencies in the early 1990s conservatively estimated 150,000 of them across the state. Since then, many more water wells have almost certainly been abandoned or become deteriorated, so the actual number is most likely much higher than that original estimate. For example, state officials in North Dakota, a state roughly 1/4<sup>th</sup> the size of Texas, estimated there are approximately 100,000 abandoned water wells in that state (North Dakota, 2016).

Texas would benefit from a comprehensive statewide survey of abandoned wells to determine the scope and scale of the problem.

Locating abandoned water wells is often difficult and the older the well is, the less likely the well location was accurately documented. Since 1965, water well drillers have been required to submit a well report for any new water well installation. Well reports include how the water well was constructed and the location of the well. These well reports often included the address of the water well, but sometimes only a vague description of the well's location was given (e.g., near intersection X, block or section number, etc.). Water well reports submitted since 2002 include the Global Positioning System (GPS) coordinates of the well, which gives the exact location of the well.

As urban areas continue to grow and development occurs on lands previously used for farming or other purposes, abandoned irrigation and farmhouse wells are sometimes damaged, destroyed, or buried during the land clearing phase. Often times, the new landowner does not even know that they have an abandoned water well on their property, especially if the well has been buried. These pose a significant risk if the new landowner installs a new water well or septic system near the unplugged abandoned water well. If a landowner suspects there is an abandoned water well on their property, there are clues they can look for to help locate them. These include pipes and wiring sticking out the ground, old windmills, an underground vault or pit, or a small building that may have been a well house. Past aerial photos (e.g., Google Earth images) or old maps, plans, and property title documents can also be useful in locating older water wells. The TGPC offers additional information on how to locate and identify abandoned wells (<https://tgpc.texas.gov/water-wells/#7>). Once a water well has been located, TDLR has created an abandoned water well checklist that landowners can use to determine if a well is abandoned or deteriorated (<https://www.tdlr.texas.gov/wwd/Abandoned%20Well%20Determination%20Checklist.pdf>).

When a residential property is sold in Texas, the seller is required to disclose to the buyer if a water well is supplying water to the property and any known issues with the water well (Texas Property Code § 5.008(b),

<https://statutes.capitol.texas.gov/Docs/PR/htm/PR.5.htm>), but there is no requirement to report abandoned water wells on the property to the buyer. Furthermore, there is no requirement to report the abandoned water well to the local GCD or State. Legislation requiring sellers to disclose abandoned water wells to the buyer and report them to the local GCD or State would be beneficial.

Once a water well is determined to be abandoned or deteriorated, and the landowner does not want to bring it back into compliance, the well needs to be plugged in compliance with 16 TAC § 76 water well plugging specifications. The definition of plugging is “An absolute sealing of the well bore”. The well bore (i.e., borehole) includes the well casing and any unsealed annulus. It is important that an abandoned or deteriorated water well be plugged properly and with the appropriate materials. If not done properly, the water well could continue to be a threat to groundwater.

The cost of plugging a water well can be extremely high depending on the construction of well (which may or may not be known) and access to the well head. In general, the deeper and wider the water well is, the more expensive it is to plug. A landowner can plug a water well themselves; other times they need to hire a licensed individual with specialized equipment to plug the well correctly, which increases cost. The TGPC has created a document called the “Landowner’s Guide to Plugging Abandoned Water Wells” for assisting a landowner who choose to plug a well themselves (TGPC, 2021).

The high cost of plugging a water well usually deters well owners from voluntarily plugging an abandoned water well as they are required by law to do. Currently, there is no state program or fund to assist landowners in plugging abandoned water wells. Some GCDs offer financial assistance or in-kind services for plugging water wells. There are currently 24 GCDs (of the 101 in Texas) that have some type of program to provide landowner financial assistance to landowners for this purpose. However, the assistance is modest, and these programs are not designed to address particularly problematic or complex wells. The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) offers some assistance with decommissioning (i.e., plugging) agricultural wells (Conservation Practice Standard Well Decommissioning (Code 351),

[https://efotg.sc.egov.usda.gov/api/CPSFile/16588/351\\_TX\\_CPS\\_Well\\_Decommissioning\\_2015](https://efotg.sc.egov.usda.gov/api/CPSFile/16588/351_TX_CPS_Well_Decommissioning_2015)). From 2018 through 2022, the Texas NRCS funded well decommissioning on 19 to 35 wells annually with the amount per well varying greatly (due to well depths, the number of other participants in this voluntary program, etc.).

When a water well is plugged, the person who plugged it is required to submit a plugging report to TDLR. In 2002, The Texas Water Development Board (TWDB) and TDLR developed the Texas Online Well Report Submittal and Retrieval System (TWRERS). This database contains the number of wells plugged by well type. From 2002 to 2022, over 48,000 wells have been plugged (Note: this value does not include Dewatering, Injection, or Monitoring/Environmental wells plugged). Table 1 shows the breakdown of types of water wells plugged.

**Table 1. Number of water wells plugged, 2002 – 2022.**

Total	48,774
Withdrawal of Water	31,660
Domestic	9,669
Rig Supply	2,344
Irrigation	1,946
Unknown	1,706
Stock	1,623
Other	1,196
Public Supply	672
Industrial	404
Fracking Supply	233
Extraction	223

### *Efforts to Address Abandoned and Deteriorated Wells*

For several decades, the State of Texas has passed legislation and created programs to attempt to address the ongoing threat of abandoned and deteriorated water wells. In 1987, the 70<sup>th</sup> Texas Legislature enacted House Bill 1347 ([https://lrl.texas.gov/LASDOCS/70R/HB1347/HB1347\\_70R.pdf#page=57](https://lrl.texas.gov/LASDOCS/70R/HB1347/HB1347_70R.pdf#page=57)) requiring landowners who possess an abandoned or deteriorated water well to have the well plugged or capped under standards and procedures adopted by the Water Well Drillers

Board at the Texas Natural Resource Conservation Commission (TNRCC, now the Texas Commission on Environmental Quality (TCEQ)). In 1997, Senate Bill 1955 ([https://lrl.texas.gov/LASDOCS/75R/SB1955/SB1955\\_75R.pdf](https://lrl.texas.gov/LASDOCS/75R/SB1955/SB1955_75R.pdf)) transferred the Water Well Driller Board from the former TNRCC to the TDLR.

Since then, TDLR, through the Water Well Driller/Pump Installer Program, has administered the Abandoned Well Notification and Enforcement Program. Once a water well is determined to be abandoned or deteriorated, TDLR staff will identify the landowner, usually through the County Appraisal District (CAD), and notify them of the condition of the well. Texas Occupations Code Chapter 1901.255(c) (<https://statutes.capitol.texas.gov/Docs/OC/htm/OC.1901.htm>) states that “*Not later than the 180th day after the date a landowner or other person who possesses an abandoned or deteriorated well learns of its condition, the landowner or other person shall have the well plugged or capped under standards and procedures adopted by the commission.*” If the water well is not plugged or capped within 180 days, TDLR may take enforcement action against the landowner. Given the high cost of plugging a water well, as previously mentioned, TDLR may grant extensions if the landowner demonstrates they are actively trying to address the situation.

In 2003, the 78<sup>th</sup> Texas Legislature enacted Senate Bill 279 ([https://lrl.texas.gov/LASDOCS/78R/SB279/SB279\\_78R.pdf#page=1886](https://lrl.texas.gov/LASDOCS/78R/SB279/SB279_78R.pdf#page=1886)) authorizing TDLR, TCEQ, and GCDs to enter into a Memorandum of Understanding (MOU) to coordinate efforts relating to investigative procedures for referring complaints regarding abandoned and deteriorated water wells. Senate Bill 279 also gave GCDs the authority to enforce abandoned water well compliance. With an MOU in place, information and documentation gathered on an abandoned or deteriorated water well by TCEQ or a GCD can be used by TDLR to initiate the notification process, thus saving time and resources. GCDs have referred water wells to TDLR when they have trouble notifying the landowners or the GCD does not have the resources to investigate the well. TCEQ field staff have referred abandoned PSWs and other wells found during program inspections (e.g., Concentrated Animal Feeding Operations (CAFOs), contaminated sites, etc.) that they believe may be abandoned or deteriorated.

Additionally, TDLR offers training to any state or local agency with field inspectors on how to identify and report abandoned and deteriorated water wells. This training is available upon request. In recent years, TDLR staff have focused on providing this training to city and county health departments around the state.

In 2004, TDLR developed an online Abandoned Well Reporting System (AWRS, <https://www.tdlr.texas.gov/abwells/default.aspx>), giving the public and other water-related agencies and entities the ability to report concerns about possible abandoned or deteriorated water wells. Once a complaint is submitted, the landowner is contacted, and an inspection is performed on the well. If the water well is determined to be abandoned or deteriorated, the landowner is notified of the condition of the well and any corrective actions needed. As of November 2022, TDLR had received 589 complaints on possible abandoned or deteriorated water wells (note that this does not include departmental complaints or referrals on abandoned and deteriorated water wells). Table 2 shows the status of those 589 complaints. The majority of complaint wells were either corrected (i.e., capped, plugged, or recompleted) or referred to GCDs, while 170 complaints were closed for various reasons (e.g., the water well was determined not to be abandoned or deteriorated, insufficient information was provided with the complaint, or the landowner could not be located on the CAD), and 120 are currently in various stages of investigation, review, or notification.

**Table 2. Status of AWRS complaints, 2004 - 2022.**

Capped	60
Plugged	189
Recompleted	48
Referred to Local GCD	2
Closed	170
In Progress	120
Total	589

## Continuing Research Needs

- An updated comprehensive statewide survey of abandoned and deteriorated water wells to determine the scope and scale of the problem.
- Studies related to data collection and reporting of groundwater quality impacts from abandoned and deteriorated water wells.

## Recommendations

- Require sellers to disclose all known water wells, whether active or abandoned, during the real estate disclosure process (e.g., Seller's Disclosure Notice), and require that TDLR or the local GCD be notified if an abandoned water well is identified. Information should include the condition, location, and permitting status of each water well.
- Provide positive incentives for landowner-initiated closure of abandoned and/or deteriorated water wells through the establishment of a statewide abandoned water well plugging fund.
- Require County Health and Environmental Departments and On-site Sewage Facility (OSSF) licensed professionals to notify TDLR when an abandoned or deteriorated water well is found during septic inspections.

## TGPC GWI Subcommittee

TGPC GWI Subcommittee members include, but are not limited to:

- Texas Commission of Environmental Quality (TCEQ);
- Texas Water Development Board (TWDB);
- Railroad Commission of Texas (RRC);
- Texas Department of State Health Services (DSHS);
- Texas Department of Agriculture (TDA);
- Texas State Soil and Water Conservation Board (TSSWCB);
- Texas Alliance of Groundwater Districts (TAGD);

- Texas A&M AgriLife Research (AgriLife Research);
- Bureau of Economic Geology of The University of Texas at Austin (UTBEG);
- Texas Department of Licensing and Regulation (TDLR);
- Texas Parks and Wildlife Department (TPWD);
- Texas Tech University (TTU);
- Texas A&M AgriLife Extension Service (AgriLife Extension); and,
- United States Geological Survey (USGS).

The primary goals of the TGPC GWI Subcommittee are to:

- Facilitate interagency communication for assessment programs addressing groundwater contamination;
- Coordinate and assist member agencies with monitoring programs for:
  - Ambient groundwater conditions;
  - Pesticides; and,
  - Emerging contaminants or constituents of concern.
- Support the intent of the *Texas Groundwater Protection Strategy* (<https://www.tceq.texas.gov/downloads/groundwater/publications/as-188-texas-groundwater-protection-strategy.pdf>) by:
  - Reviewing published data reports, and evaluating data independent of published reports, to assist in the determination of the effectiveness of existing regulatory programs and to identify potential groundwater contaminants not addressed by existing regulatory programs;
  - Developing recommendations for consideration by the TGPC to address potential groundwater contamination identified through monitoring and data review; and,
  - Developing white papers on the groundwater issues listed in their biannual *Activity Plan* which summarize the best available scientific data on a specific groundwater issue, identify areas where there is insufficient scientific data to thoroughly assess the issue, evaluate the effectiveness of existing regulatory programs to address the issue, and provide recommendations or policy options to the TGPC regarding the issue.

The above recommendations or policy options represent the opinion of the TGPC GWI Subcommittee and do not necessarily reflect the views and policies of each participating organization. The United States Geological Survey (USGS) may have contributed scientific information, only.



For more information about this white paper, please contact the TGPC (<https://tgpc.texas.gov/contact-us/>).

### Subject Matter Experts

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- David Gunn (Texas Department of Licensing and Regulation, david.gunn@tdlr.texas.gov, 512-334-5539)

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