

## Aquifer Exemption Data

EPA’s Aquifer Exemption map allows users to view aquifers that have been approved for exemption by EPA under the Safe Drinking Water Act Underground Injection Control regulations. This interactive map brings together data previously available only in paper form or at the Regional and state level. The map and accompanying data can be used by states, businesses, communities, and others to view exempted aquifers in the United States. The map provides accompanying aquifer exemption information like depths of injection, local geology, and injected fluid characteristics. This data can assist with Underground Injection Control permit applications and approvals.

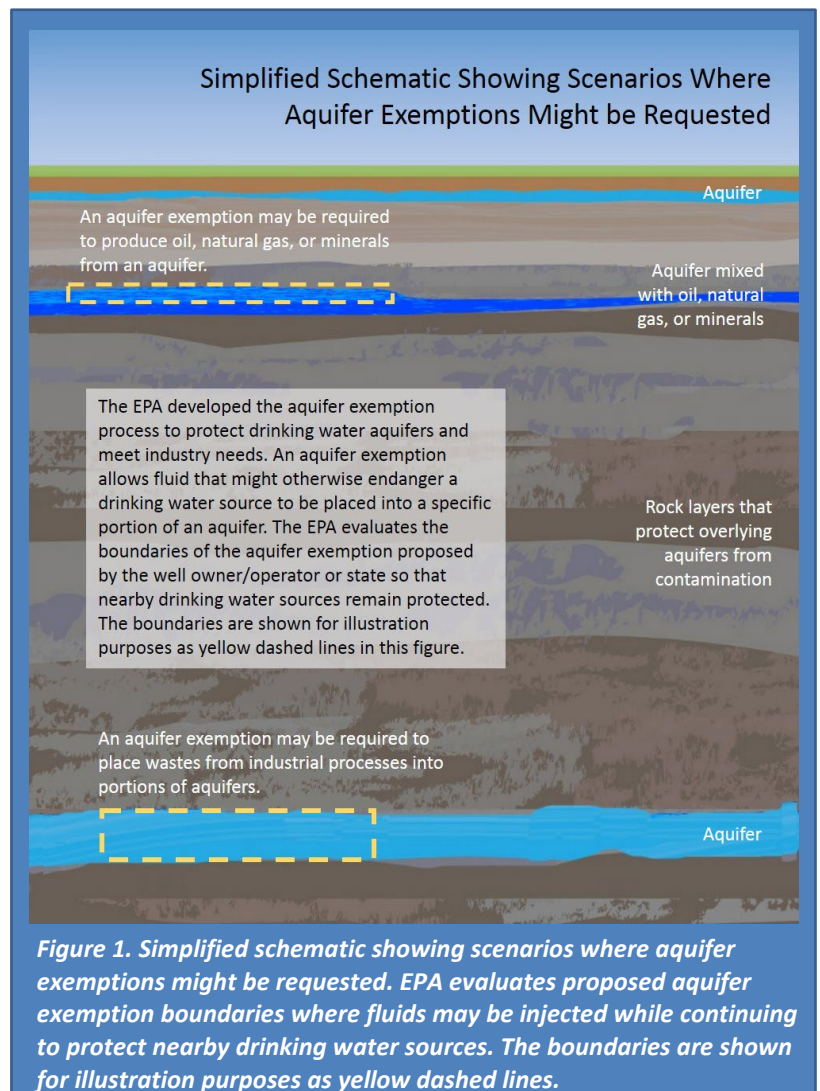
## Background on Aquifer Exemptions

An aquifer is an underground body of rock that contains or can transmit groundwater. The Underground Injection Control regulations allow EPA to exempt aquifers or portions of an aquifer that do not currently serve as a source of drinking water and will not serve as a source of drinking water in the future, based on certain criteria. Aquifer exemptions allow these underground sources of water to be used by energy, mining and other companies for oil or mineral extraction or disposal purposes in compliance with EPA’s Underground Injection Control requirements under the Safe Drinking Water Act. Figure 1 shows simplified scenarios where a well owner/operator or a state might request EPA to approve an aquifer exemption.

The process begins when EPA receives information about the aquifer proposed for exemption from a state agency or well owner or operator. EPA approves the aquifer exemption request if it meets the necessary criteria, including a demonstration that fluids will not migrate outside of the exemption boundary. Injection of fluids can begin only after EPA approves an aquifer exemption and an underground injection control permit is granted.

## Aquifer Exemption Data Initiative

EPA developed an interactive Aquifer Exemption Map that allows users to find locations of aquifers approved for exemption under the Safe Drinking Water Act. The website also provides geospatial files and data in a Microsoft Excel spreadsheet with this accompanying user guide. The map shows the approved aquifer exemption boundaries, when available, in two dimensions and information such as the depth of injection, local geology, and injected fluid characteristics. The map will assist EPA and states in maintaining a consistent data set of exemptions across the nation. The Excel spreadsheet provides descriptive information from the geospatial file without geospatial data. Users may download the datasets, a fact sheet, and this user guide from the website.



## *How EPA Developed the Aquifer Exemption Dataset*

When developing the dataset of aquifer exemption information, EPA gathered information about approved aquifer exemptions from the respective Regional office or state agency. The Agency collected the aquifer exemption information from paper files, spreadsheets, and databases generated over the past 35 years. The national dataset was created with the collected information. EPA assessed the quality of the dataset by comparing it to the original documents to confirm the accuracy of the data. EPA continues to update this dataset annually as new data is collected and/or new aquifer exemptions are approved.

EPA also developed a geospatial dataset that allows users to view or create a map of the aquifer exemption locations. For some aquifer exemptions, the location of each exempted aquifer was converted from text descriptions to geospatial data. Other geospatial data were provided by states, regions, or operators. A table of attributes associated with each aquifer exemption polygon includes information on the state, county, depth, geologic formation, lithology, approval date, and regulatory criteria met. More information on each attribute can be found in the data dictionary (Table 1).

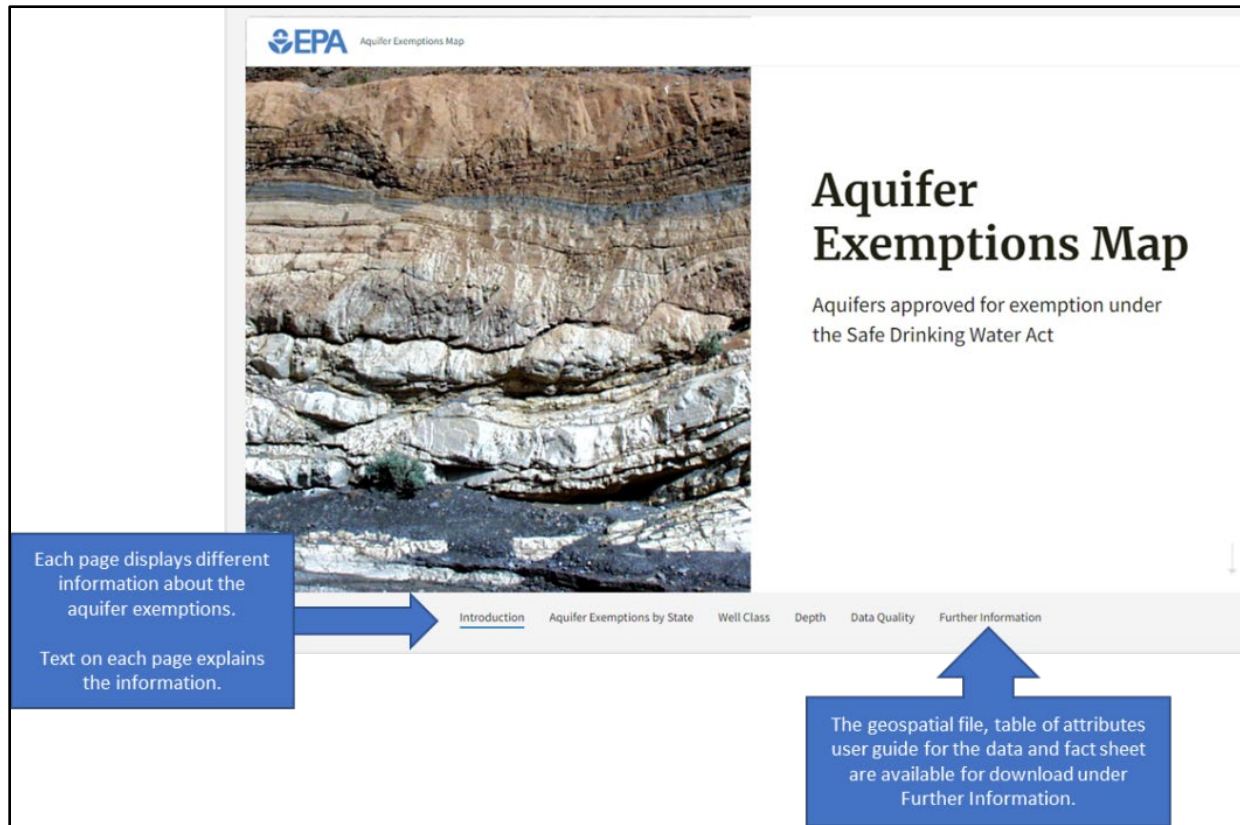
Some gaps in information exist for many aquifer exemptions. EPA continues to gather additional information to enhance the coverage of aquifer exemption information across the nation. The dataset will be periodically updated in the future with new information on existing exempted aquifers and newly approved exempted aquifers. Users who want additional specific information on aquifer exemption locations or attributes should contact the EPA Regional Office that approved the aquifer exemption.

Both the geospatial data and the attribute data are shown in the Aquifer Exemption Map. Users can explore the data in the Aquifer Exemption Map or by downloading the files to create their own maps.

## **Aquifer Exemption Map**

The Aquifer Exemption Map shows the locations and boundaries of aquifer exemptions with various descriptions of the exempted aquifers. The aquifer exemptions can be described in multiple ways, and users can view the information by clicking on the links at the top of the map or scrolling through the pages, as shown in Figure 2.

The first map shows the number of approved aquifer exemptions in each state for which geolocational data are available; the states are color coded to reflect the number of approved aquifer exemptions in each state. Other maps present information on well class, depth, and data quality. On each map, zooming in allows users to see individual aquifer exemptions or several aquifer exemptions within a small geographic area. The pop-up boxes on the Aquifer Exemption Map, as shown in Figure 4, describe certain attributes about the aquifer exemption. Locational information such as county, state, and tribe, are also found in the pop-up box.

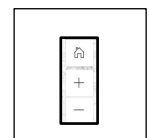


**Figure 2.** Each page on the Aquifer Exemption Map allows users to view different information about the exemptions. Users can access this information by clicking on the links or scrolling through the pages. Users may download data, this user guide, and the fact sheet under Further Information. Text panels on each page give the user context about the data presented.

## Aquifer Exemption Boundaries

Aquifer exemption boundaries are determined in a variety of ways. Some aquifer exemptions are defined as a radius (typically  $\frac{1}{4}$  or  $\frac{1}{2}$  mile) around the well associated with the exemption and are circular. Exemption boundaries can also be irregularly shaped and follow the dimensions of an aquifer, oil or gas field, or mining area. The exemption areas range in size from thousands of square feet to more than a thousand square miles.

When the user first visits the Well Class, Depth, and Data Quality maps, the map scale is set to show the entire United States. Aquifer exemptions are indicated as points at such a small scale so that all the exemption locations are visible. The map scale may be changed by clicking on the scale adjustment tool represented by Figure 3 in the Aquifer Exemption Map. As the user changes the map scale to show more detail, the aquifer exemption boundaries will begin to change from points to polygons where data is available. The polygons represent the two-dimensional aquifer exemption boundaries. For example, locations described by a radius around a specific latitude and longitude, as shown in Figure 4, appear as a circle. Some aquifer exemptions are defined by one or more grids in the Public Land Survey System and have a square or rectangular appearance, as shown in Figure 4. The Public Land Survey System, regulated by the U.S. Bureau of Land Management, describes an area using a grid system with numbered townships, ranges, and sections.



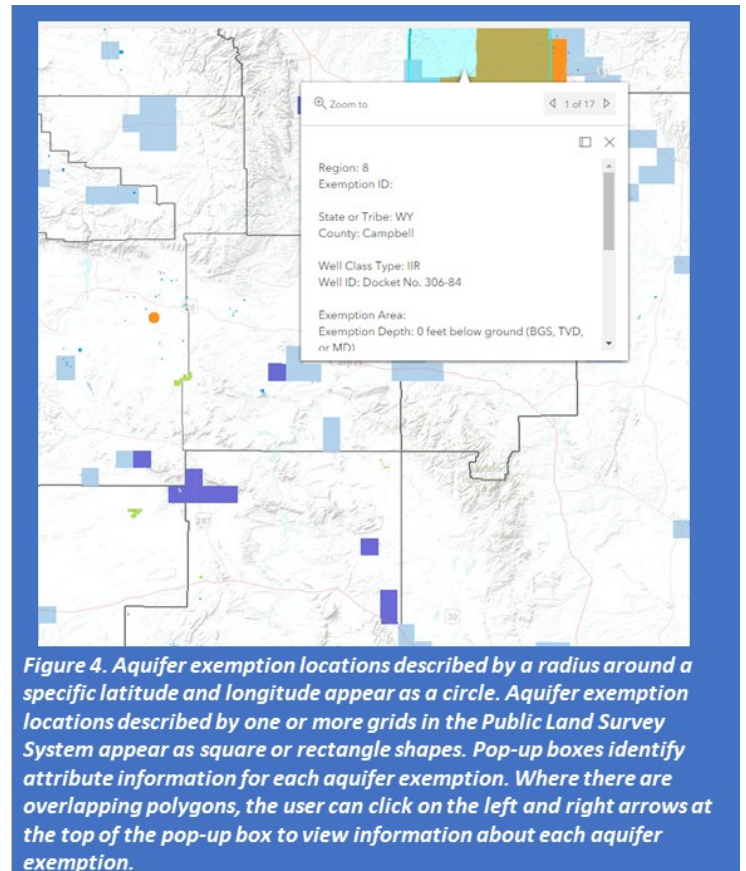
**Figure 3.** The scale adjustment tool

## Data Quality Map

EPA continues to assess the quality of the aquifer exemption records. While the majority of records are complete, some aquifer exemption information is incomplete or aquifer locational information is imprecise. The incomplete or imprecise information is a result of different methods of documenting the data over the more than three decades that EPA approved exemptions.

As EPA seeks to make as much information as possible available to the public, the aquifer exemption polygons are color-coded to reflect the varying levels of certainty in the locational data. EPA continues to collect information about these aquifer exemptions, and new information will be added to the geospatial file as it becomes available.

A small number of aquifer exemptions are not included in the geospatial data (23 aquifer exemptions, less than 1%). These aquifer exemptions were excluded from the map because there is some missing locational information. The Excel spreadsheet available for download under “Further Information” contains information on the aquifer exemptions found in the geospatial data as well as the aquifer exemptions without locational information.



**Precise location:** EPA has a high level of confidence in the location of the aquifer exemption and the attribute table is complete for the exemption. In the current dataset, 5,462 aquifer exemptions, or 84%, have a precise location and complete attribute record.



**Less precise location and some attributes missing:** EPA has a moderate level of confidence in the location of the aquifer exemption and continues to collect information to improve aquifer exemption boundaries. In the current dataset, 636 aquifer exemptions, or 10%, fall into this category.



**Imprecise location or several attributes missing:** EPA has information that an aquifer exemption exists, but the location is imprecise or unclear. Locations with accuracy to the township-level, which is a six-square-mile area as defined by the Public Land Survey System are shown on the map. In the current dataset, 294 aquifer exemptions, or 5%, are described as imprecise.



**County locations available only:** The current dataset contains 106 aquifer exemptions (2%) that have only county-level locations. While EPA is unable to draw polygons for these aquifer exemptions, the counties containing these exemptions are outlined on the map. EPA continues to collect information about these aquifer exemptions.

## Attribute Table

EPA maintains a variety of information about the attributes of aquifer exemptions. Each row in the table describes the attributes of an individual aquifer exemption. For example, if two aquifers in the same area were exempted, the aquifers will be described in two separate rows. The polygons that represent the aquifer exemption boundaries on the Aquifer

Exemption Map may overlap in cases where there is more than one aquifer in an area. Users may also download the attribute table as a Microsoft Excel spreadsheet under “Further Information.”

### Data Dictionary

The data dictionary shown in Table 1 describes the column headings in the attribute table of the geospatial file and the Microsoft Excel spreadsheet.

### For More Information

For additional information on aquifer exemptions, including the requirements at 40 CFR 146.4, see <https://www.epa.gov/uic/aquifer-exemptions-underground-injection-control-program>.

For additional information on the Underground Injection Control Program, see <https://www.epa.gov/uic>.

To download the geospatial file and related materials, visit <https://www.epa.gov/uic/aquifer-exemptions-map>.

To contact EPA with questions or comments about aquifer exemptions, please visit <https://www.epa.gov/uic/forms/contact-us-about-underground-injection-control>.

**Table 1. Data dictionary for the attribute table of the geospatial file and the Microsoft Excel spreadsheet.**

Attribute	Description
Region	EPA Regional Office that approved the aquifer exemption request
Number	A sequential number for each record within the EPA Regional records
ID	A unique identifier for each record that combines the data in the “Region” column and the “Number” attributes
Injection Well ID	The Well ID(s) of individual wells associated with an exemption or the name of a common area, such as a mine or oil field, associated with the exemption
Well Class	The injection well class associated with the aquifer exemption at the time the exemption was approved
Injection Activity	A narrative description of the activity with which the injection is associated, e.g., brine disposal
State	The state in which the exempted aquifer (or the center point of the delineated exempted area) is located
County	The county in which the exempted aquifer (or the center point of the delineated exempted area) is located
Tribe	The name of the tribe in which the exempted aquifer (or the center point of the delineated exempted area) is located, if the aquifer is located on Indian country
State or Tribe	A field used specifically for the pop-up boxes in the Aquifer Exemption Map to indicate either the state or tribe in which the exempted aquifer is located
AE Centroid (Latitude)	The latitude of the center of the exempted area, in decimal degrees
AE Centroid (Longitude)	The longitude of the center of the exempted area, in decimal degrees
AE Area	The numerical extent/boundary of the exempted aquifer (e.g., radius, acreage, etc.)
AE Area Units	The specific units describing the exempted area. The units reported to EPA include acres and square miles
Depth	The depth, in feet, to the top of the exempted aquifer or its elevation relative to mean sea level
Depth Units	The specific units describing the shallowest depth of the exempted aquifer. The units reported to EPA include feet below ground surface (BGS), feet true vertical depth (TVD), feet mean sea level (MSL), and feet measured depth (MD).
Injection Zone	The name of the formation into which injection is planned or the aquifer identified for exemption
Formation Thickness	The thickness of the exempted aquifer
Lithology	A brief description of the type of rock that comprises the exempted aquifer
Injectate Characteristics	A narrative description or salinity of the fluid planned to be injected into the exempted formation. The units reported to EPA indicate the concentration of total dissolved solids (TDS) in milligrams per liter (mg/L) of fluid.
Decision Date	The date that EPA approved the aquifer exemption request.
Data Quality Category	<p>A brief description of the data quality for each aquifer exemption. The categories include the following:</p> <ul style="list-style-type: none"> <li>• “Precise location”: EPA has a high level of confidence in the location of the aquifer exemption and the attribute table is complete for the exemption.</li> <li>• “Less precise location and some attributes missing”: EPA has a moderate level of confidence in the location of the aquifer exemption and continues to collect information to improve aquifer exemption boundaries.</li> <li>• “Imprecise location and several attributes missing”: EPA has information that an aquifer exemption exists, but the location is imprecise/unclear.</li> <li>• “County locations available only”: EPA is unable to draw actual boundaries for these aquifer exemptions because only county location information is available. The counties containing the exemptions are outlined on the map.</li> </ul>