Medina County Groundwater Conservation District

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Quick Handbook on Geologic Formations Related to Groundwater in Medina County, Texas

July 24th, 2023 Edition

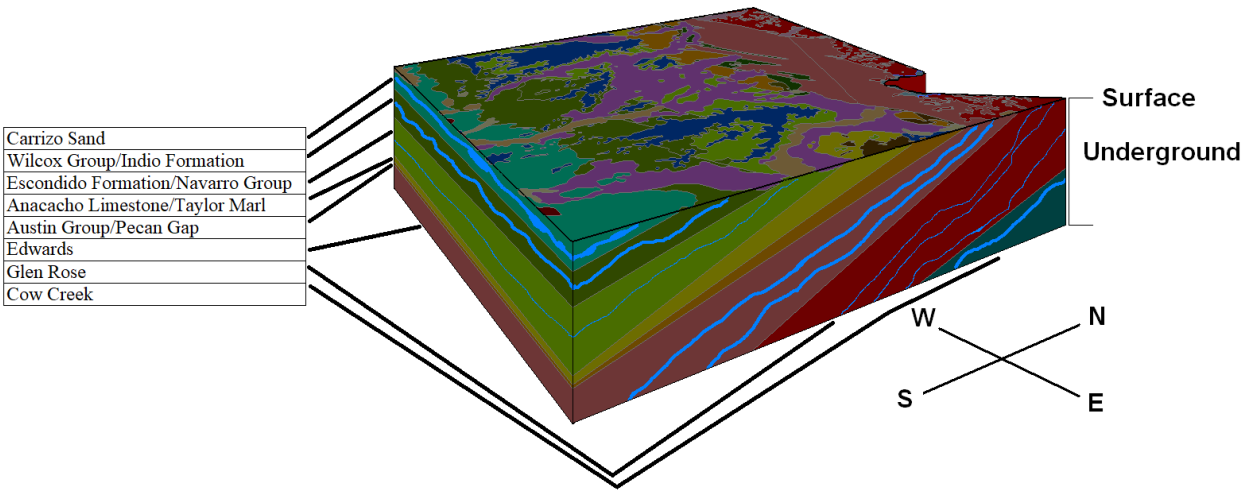
A Medina County Underground Water Conservation District Publication.
Commonly known as the Medina Count Groundwater Conservation District (GCD).

Water bearing Units Underground

The GCD contains multiple aquifers, and within certain aquifers, multiple strata which may contain water. Some examples are below.

The purple sections on the surface are Leona Gravel near surface deposits. This strata can contain water, but is generally shallow, and is not recommended for human consumption without specialized treatment, due to the high concentration of nitrates. Geologically, it is a recent deposit, and blankets across multiple older strata.

The squiggly blue lines are illustrative, and depict how the difference in water depth changes as one moves from north to south, within the GCD. They are not to scale, and certain areas have more pronounced change, especially due to faulting (see "Faulting" section, pages 10-11).



General Strata Thicknesses in Medina County

	FORMATION	THICKNESS	GROUP	GROUP	ID #
	Alluvium				10
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Information for table collected from select well averages, within Medina County.
Leona Gravel and Uvalde Gravel settled on top of multiple formations.
"U" is for Upper, "L" is for Lower. GYP is for Gypsum.
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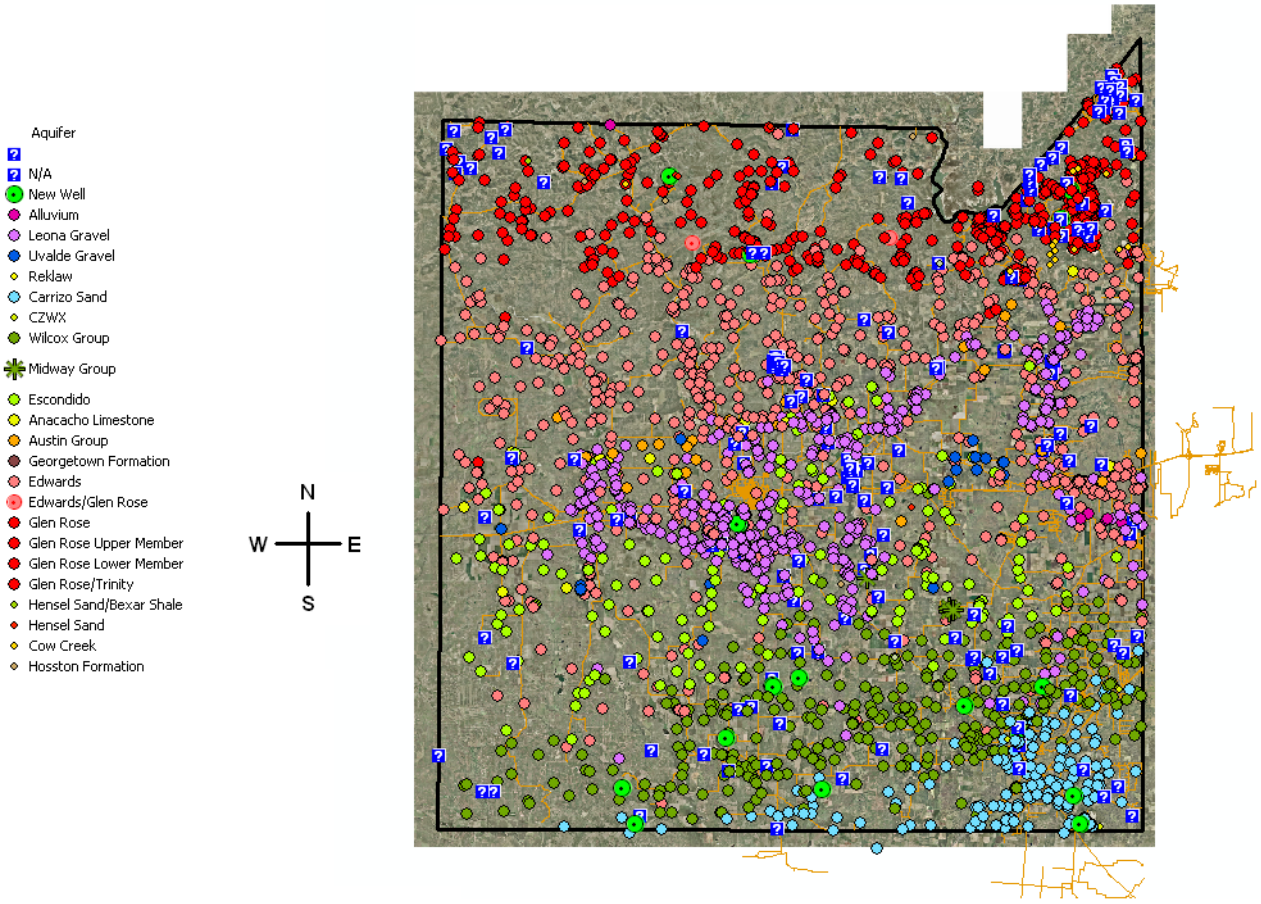
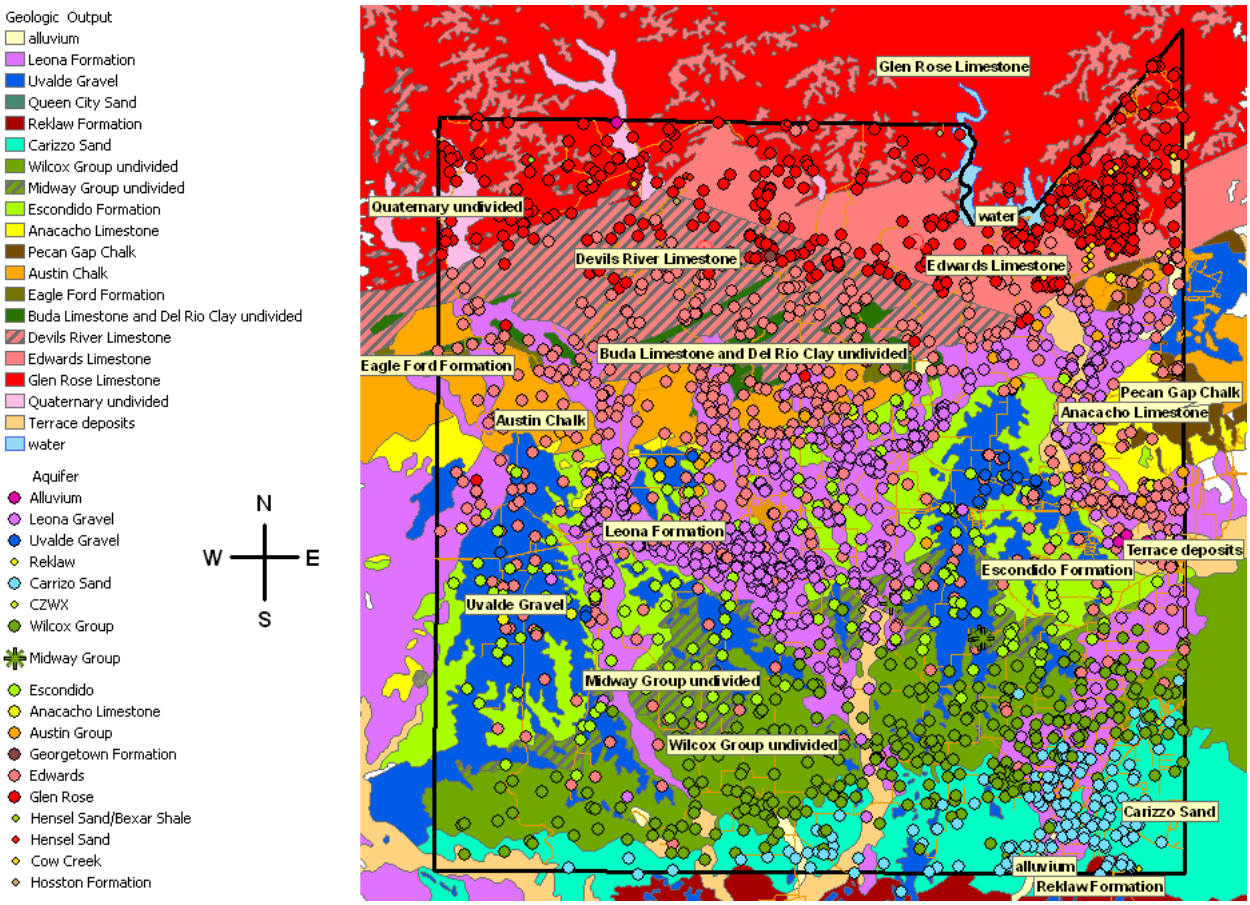
The following pages contain basic representations that help provide a description of the underground portion of Medina County, relevant to groundwater production. It's based on explaining common questions about what is down there, how does it work, and what is it like. It is not intended to be a scientific document, but explains the basic concepts.



Well types throughout Medina County

Wells (the dots, color coded by their source aquifer) vary on their water source throughout the county. Moving from north to south, wells encountered tend to change from being from one aquifer, to being generally from another aquifer. The Edwards aquifer tends to be the largest exception, with most of the wells located in the northern part of the county, but with wells extending well to the southern part of the county, usually from 300 feet deep in the north, deeper as one looks south, all the way to about 3,000feet deep in the southern part of the county.

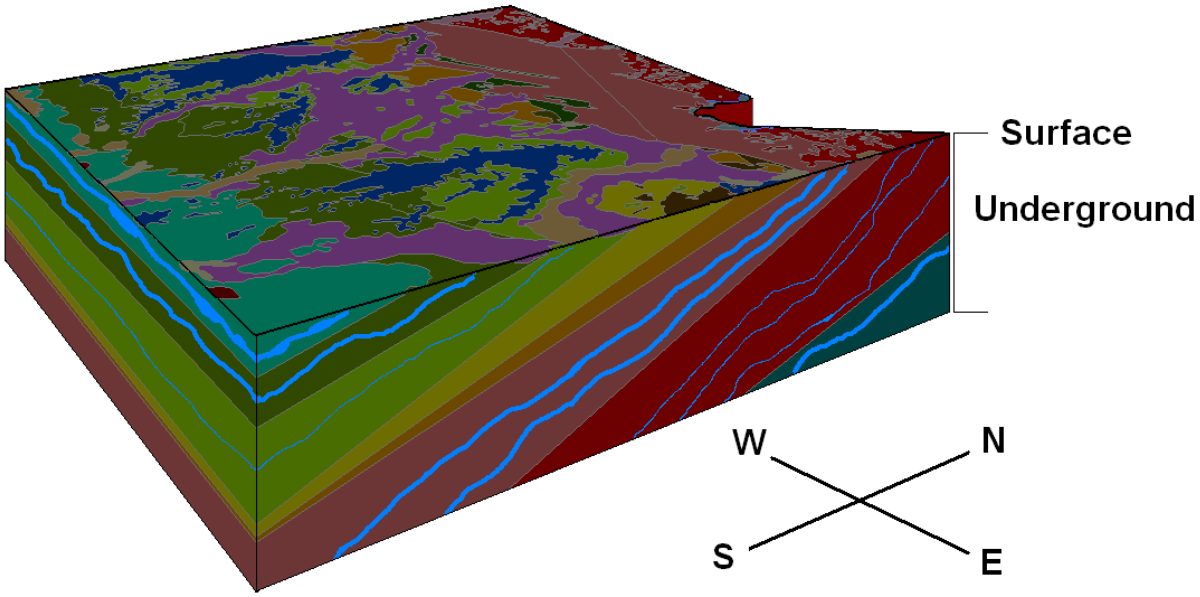
Some wells have a question mark. This is for wells which do not have enough information to identify the source aquifer, or for which the source aquifer is being determined.



Geology and Wells at the Surface

At the surface, a similar trend is noticed in the surface geology. From east to west, the surface seems to be made up of generally the same geologic material, and as you move from north to south, the type of surface materials tend to change from one to another. In the list portion of the above depiction, under "Geologic Output," the strata (layers of like or similar dirt, limestone, shale, and other material) are shown top to bottom in the order they can be found stacked in Medina County and just south of it.

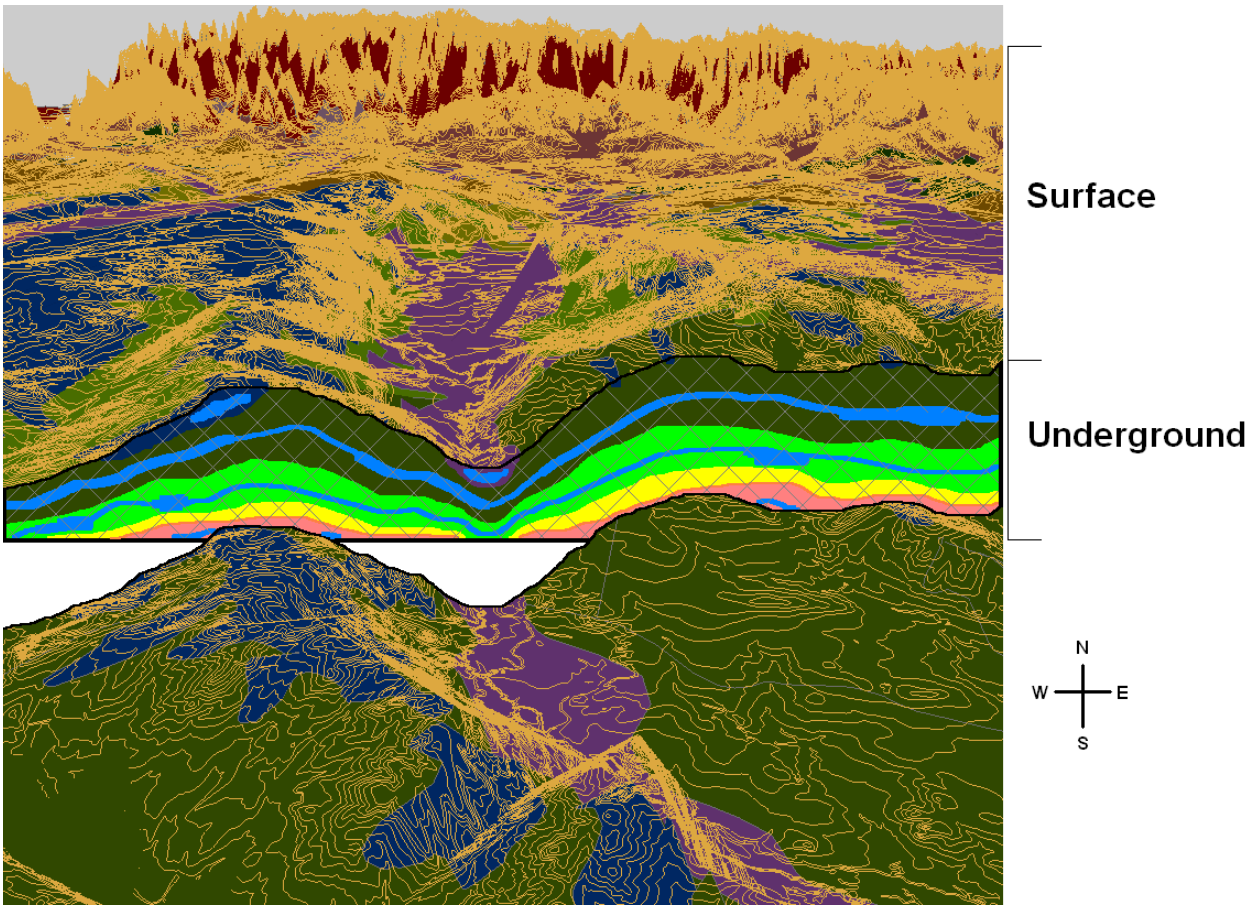
As can be seen in the depiction, wells from one aquifer, located in one strata, can be found south of the surface strata they receive their water from. This is due to strata at the surface diving under the strata to the south (as is explained further in this document). The well is drilled through the upper strata, to the strata containing the source aquifer underneath.



Geology and Aquifer Characteristics Below the Surface

Taking the surface geology map, and tilting and rotating it a little, a glimpse of how the geology underneath the surface can be seen. Surface geologic material tends to be sheared off or pinches out in the northern portion of the geologic material, and to the south, dives under more recently deposited material.

Water within a geologic formation (the light blue squiggly lines), likewise, tends to dive down under these newer formations as well, roughly following the same angle and path as the geologic formation it is in. The Leona Gravel (purple) and the Uvalde Gravel (dark blue), were both deposited on top of the other much older formations, much more recently, and so lays on the surface, across multiple geologic formations, but these gravel deposits are not generally more than 60 feet thick. The reason older formations have been sheered off at the surface is primarily due to erosion over time.



Erosion, Deposition, and Lairing of Strata and Aquifers

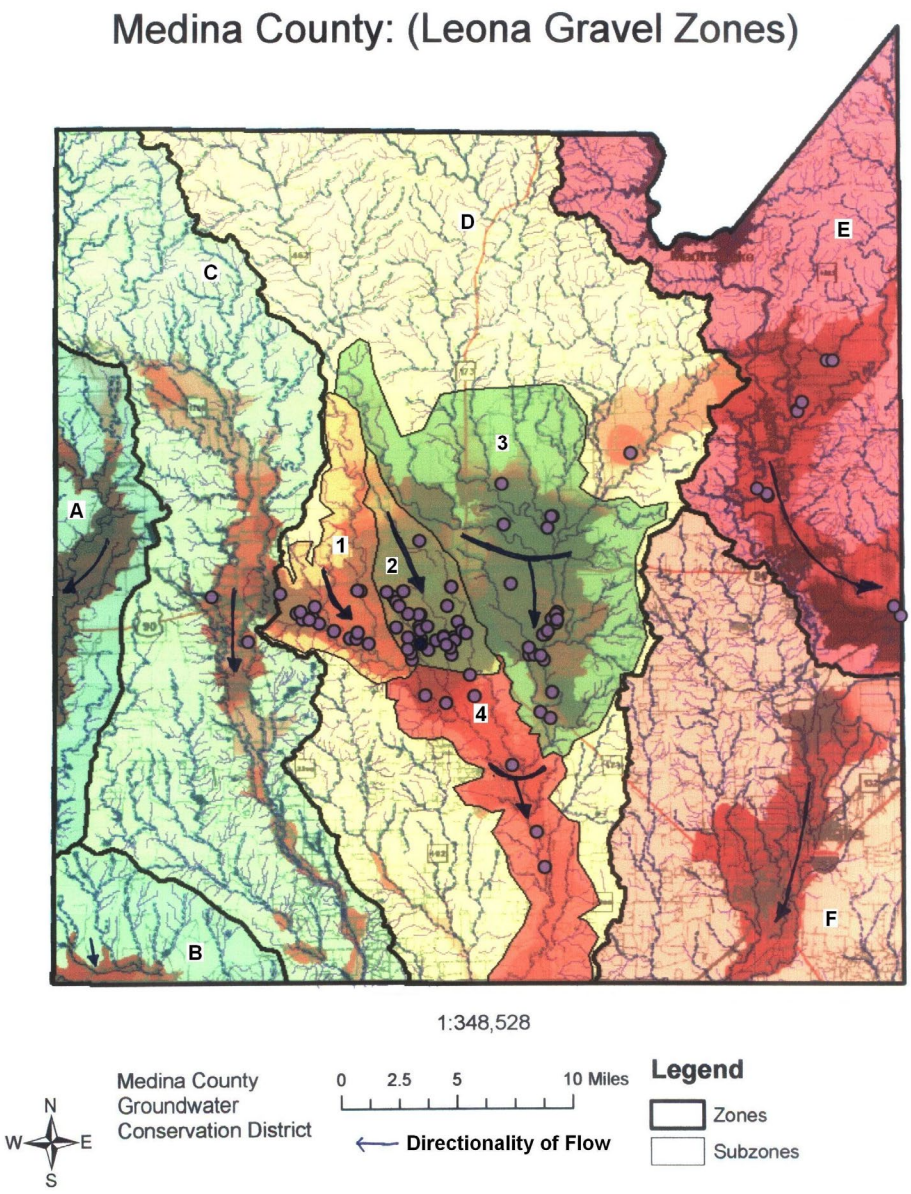
This is a look at the surface, from the south end of the county, looking up toward the north end. The depiction shows a cross section about a third of the way up, which gives a better idea of how the geologic strata are stacked, and how the water is distributed within the geologic strata.

Water underground tends to move through porous material, kind of like seeping through a sponge. The deeper water doesn't tend to resemble a lake (solid body of water), or a stream (channeled water), but might be thought of behaving much more like a marsh. As in a marsh, much of the surface is made up of water, with chunks and areas of somewhat soggy land that allows water to move, but more slowly than where there is no spongy land, and with some areas where the materials in the land are too dense to let water flow through them at all. This marsh like water flow is then sandwiched above and below by geologic material which is essentially waterproof. This description helps to explain why some places that are drilled in get a pretty good flow of water, why some areas nearby might not get as good a flow, and why some areas don't have any flow at all. The strata through which water moves is much more solid than a marsh, and is composed of hard porous material, but the marsh analogy helps to illustrate the difference in flow rates and patterns.

The shallower gravel water has two very different descriptions. The Uvalde gravel tends to be on higher ground and hilltops. Where material has settled around the edges and on the surface to confine water to within the gravel, some water may be found. In other areas, not enough material has settled to keep the

water in, or too much has accumulated on top to let water soak through to the gravel, and so there is no water available. Finding water in this gravel layer is an improbability, but it does happen rarely.

The other gravel description, for the Leona Gravel formation, tends to be the opposite of the Uvalde Gravel formation. Essentially, in the lower areas and valleys, there are creeks and small hills. When the Leona Gravel was deposited, it filled the creeks, settled across the lower plains within the valleys, and did not settle on top of hills or higher ground in the lower areas. Over time, this gravel was covered by newer surface materials, which themselves eroded and built up, altering the surface from how it looked before. Still, as a general rule, the surface terrain tends to provide a reasonable approximation of the slope and path of the gravel deposited below it.

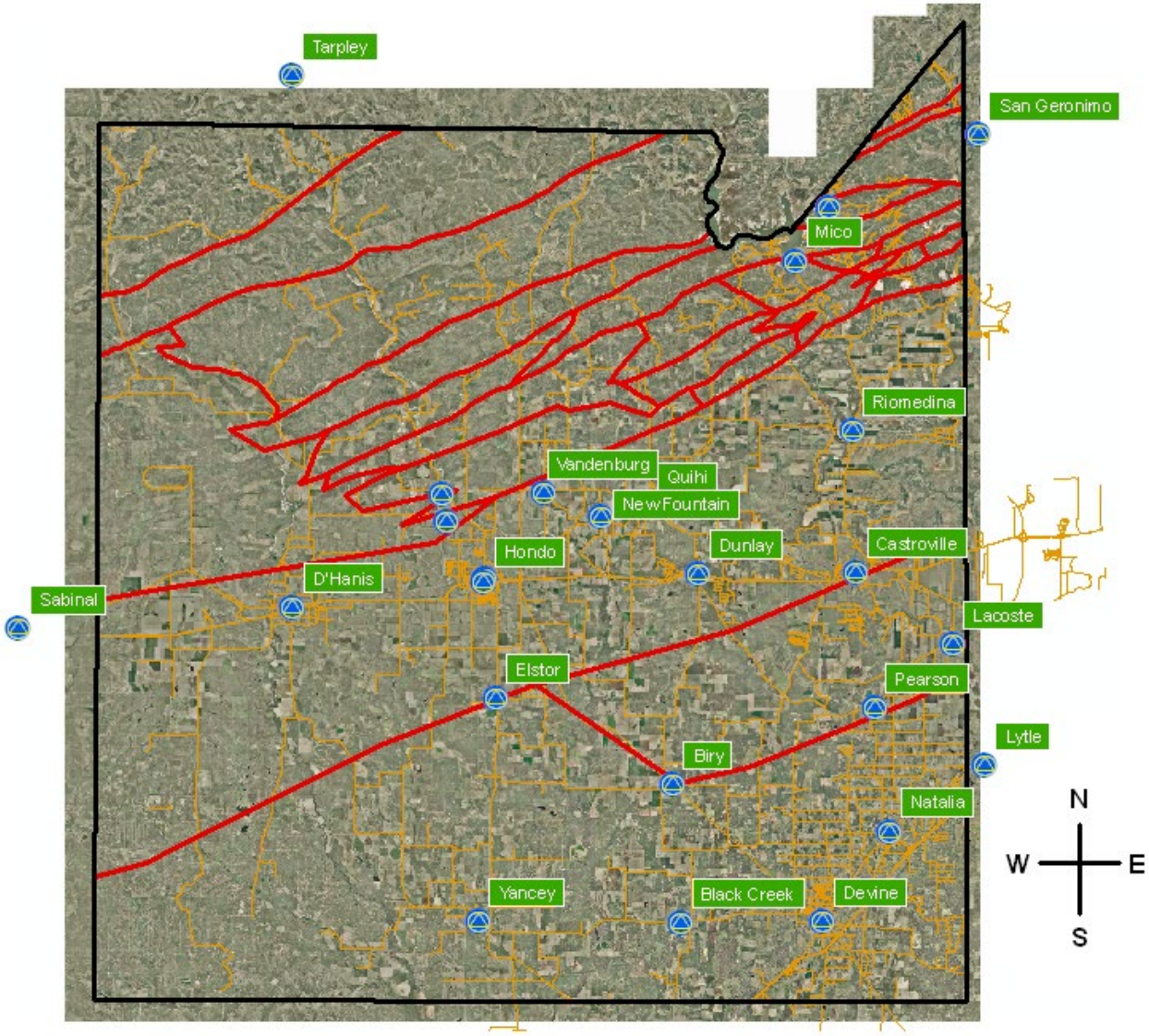


Leona Gravel Overview

Because of the way it settled, and it's proximity to the surface, water has essentially pooled in some areas, and flows through channels at others. Some of the gravel and material is packed, providing for a slower flow of water, some less packed, providing for a faster flow of water, and in some areas, is packed enough not to allow much flow of water, if any. The distance between a 300 gallons per minute (gpm) well and a 1,000gpm well can be as little as 300 feet from one another.

The dots on the depiction above are Leona gravel wells utilized for irrigation. The dark lines are ridgelines which separate the direction of runoff from rainfall (labeled zones A-F). The three areas encompassed by lighter lines are pools of Leona Gravel (labeled sub-zones 1-3) that seem to be separate from one another,

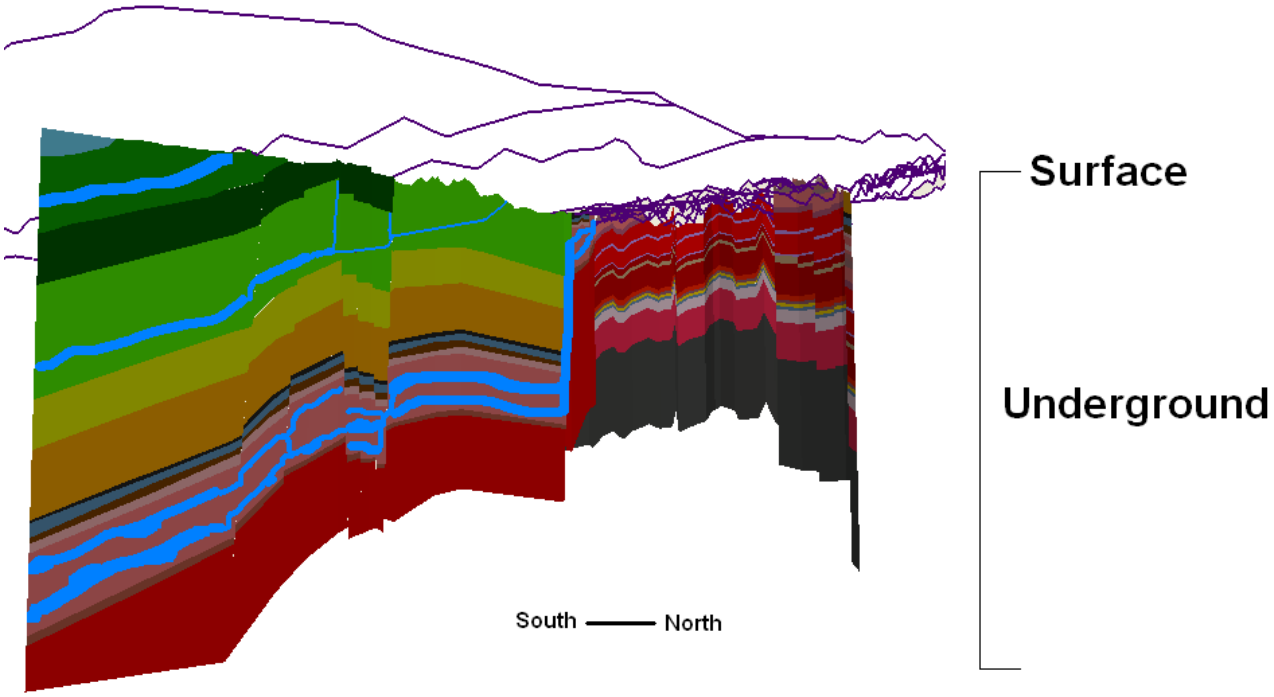
but which join up in the fourth area south of them (labeled subzone 4). Interestingly, sub-zones 1 and 2 seem to have a very limited area where runoff recharges them.



Faulting

Medina County has considerable faulting, with the larger faults generally as depicted by the red lines above. These faults are of more academic interest, than they are a hazard. They help to explain why water available at a certain depth north tends to suddenly be much deeper a little further south.

Within these faults, especially in the northern portion of the county, are many hills and valleys, each potentially with their own smaller faults. In this sense, faults within the county are not very similar to the San Andreas fault system which gives California so much concern because of the potential for earthquakes there. In Medina County, they do not build up those kind of stresses, and movement or shifts are measured over the course of hundreds or thousands of years, not in seconds.



Effects of Faulting

Looking through the underground, cross sections like this can be found, because some of the geological formation is higher or lower on one side of the fault, as compared to the geologic formation on the other side of the fault. Generally, the faults don't result in as drastic a difference between one side and the other as is depicted, but occur over a distance. The depiction though helps to illustrate why the differences over how deep the water is over that distance can be so great.

Water tends to flow along with the strata in a gentle downward angle, and then tends to follow the strata from the high point in a fault to the lower location on the other side of the fault. At these faults, depending on how deep the difference, water can be near the surface only a couple hundred feet beneath it on one side of the fault, and dive down several hundred feet deeper below the surface as little as a quarter of a mile away.

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Overall Picture

All of these conditions, the strata thickness, faulting, erosion and disposition, geology and aquifer characteristics, and the geology and characteristics at the surface all have an impact in well placement, flow from wells, and the costs associated with obtaining groundwater within Medina County. One of the most common questions is where one needs to drill to get water. The short answer is, in part it's a matter of where, but in part it's a matter also of how deep one can or is willing to drill.

Some aquifers tend to provide enough water for domestic and livestock use, and some aquifers provide enough for irrigation and municipal needs. And the capacity for any of these is dependant on the conditions hidden below the surface. Hopefully this publication makes understanding the fundamentals of groundwater in Medina County a little more familiar and a little less of a mystery.

For more detailed information, please feel free to contact this office.

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