Groundwater

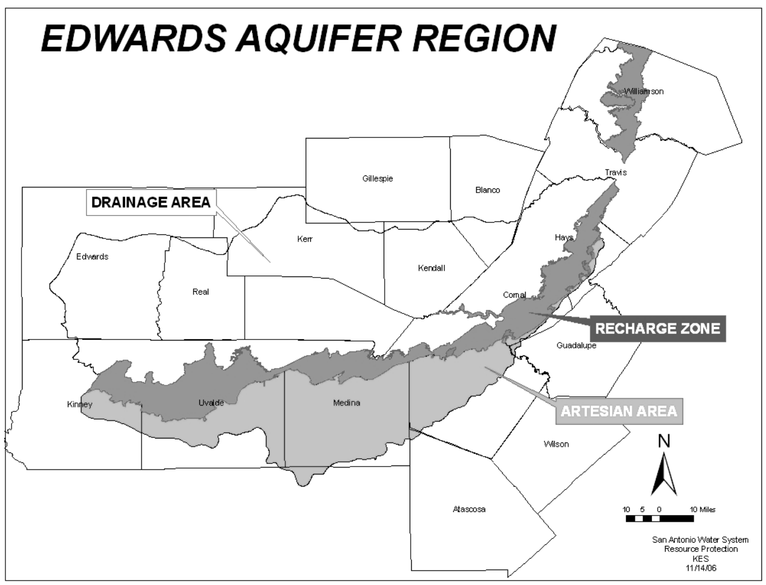
Groundwater is the largest freshwater resource in the world. Hydrologists estimate that there is enough fresh groundwater lying within 800m (half a mile) of Earth's surface to form a lake that could cover the states of Texas, New Mexico, Colorado, Kansas, Nebraska, Wyoming, South Dakota, North Dakota, and Montana to a depth about 1500m. Approximately half of the people living in the US depend on groundwater for their drinking water. Groundwater is also one of the most important sources of irrigation water.

Groundwater is part of the hydrologic cycle. When the water from precipitation reaches the earth, some of it will flow along the surface as runoff while the rest of it soaks into the soil until it becomes groundwater and is stored in an aquifer. An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can be usefully extracted with a well.

The Edwards Aquifer: Our Local Groundwater Story

The Edwards Aquifer is a unique groundwater system. It is one of the greatest natural resources on Earth, serving the diverse agricultural, industrial, recreational, and domestic needs of almost two million users in south central Texas. Water from the Edwards is the reason that 18th century Spanish missionaries were able to establish footholds like the Alamo on the New World frontier. The Edwards is also the reason that San Antonio and many other cities in the surrounding region were able to grow and prosper for over two centuries without developing surface water or other water resources.

The San Antonio section of the aquifer extends in a 180-mile arc-shaped curve from Brackettville in the west to Kyle in the east. The aquifer is divided into three hydrologic and geologic zones: the Contributing Zone (also referred to as the Drainage Area or Catchment Area), the Recharge Zone and the Artesian Zone. The Contributing Zone occurs on the Edwards Plateau, also called the Texas Hill Country. When it rains over the Contributing Zone, the rainfall enters streams and rivers which then flow south toward the Recharge Zone.



Once the rainwater reaches the Recharge Zone, it flows over fractured limestone forcing the water to flow underground and down into the aquifer. In the Recharge Zone, sedimentary limestone is exposed at the surface and provides a pathway for water to be transported underground into the aquifer. Water that recharges the aquifer comes from two primary sources: rainwater that falls over the Hill Country and surface water (such as streams, rivers and creeks) that travels over the Hill Country limestone and then goes underground. Only about 3% of the Recharge Zone occurs within Bexar County's boundaries.

The water is now in the Artesian Zone which is generally located south of the recharge zone and is the area where the water is contained underground. In the Artesian Zone, the water in the Edwards Aquifer is confined, both above and below, by impermeable rocks which can be thought of as “waterproof” layers. The water flows underground through small cracks and holes in the limestone rock called a karst formation. This karst area is formed by an erosion process that removes the calcium carbonate from the rocks through a chemical reaction. Above the surface it is characterized by sinkholes and caves and below the surface, by underground drainage. Because the water is confined in this zone, it is under pressure.

In a balanced system, the amount of water being removed from the aquifer does not exceed the amount going in as recharge. There are two ways that water is removed from the aquifer. The first way is by drilling wells into the aquifer and the second way is through natural spring flow. Flowing springs in this area include the San Marcos Springs and Comal Springs in the northeast and San Antonio Springs and San Pedro Springs in the southwest. The largest springs are in New Braunfels at Comal Springs and in San Marcos at the San Marcos Springs.

No one really knows exactly how much water is in this aquifer, but it is generally agreed that if you took the water out of the aquifer, you would be able to cover the state of Texas to about 1 foot in depth. Although San Antonio receives 22-24 inches of rain a year, the recent droughts in South Texas combined with increased population growth has put a strain on this groundwater source.

Measuring the Edwards Aquifer

The J-17 index well is located in the small building at the base of the large water tower near the national cemetery at Fort Sam Houston in San Antonio. It is on a major Edwards flowpath and responds quickly to pumpage and recharge. It has been used since 1956 to record changes in the level of the Aquifer in the San Antonio area. The level of the J-17 well has ranged from 612 feet during the 1950's drought to 703 feet after historic rains in 1991 and 1992. There is much confusion about what the reported Aquifer level means. When weathercasters say the Aquifer stands at 650 feet, it does NOT mean there is 650 feet of water left or that it is 650 feet to the top of the Edwards formation. The number is simply an indication of relative pressure being exerted on water at the location of the test well.

The Edwards formation is between 400 and 600 feet thick, so it is about as thick as the Tower of the Americas is tall. Out to the west in the recharge zone, the Edwards outcrop at the land surface is higher than the top of the Tower. Water tends to flow downhill, and it so happens that "downhill" is directly under most of San Antonio. Water is heavy, and as new water enters the formation in the recharge zone, it places tremendous pressure on water already deep inside, forcing water up through cracks and wells toward the land surface. So water rises in the test well because of pressure being exerted by water higher up in the Edwards formation out to the west. It does not rise all the way to the elevation of water to the west because of friction. When water does rise all the way to the top of a well in this manner, the well is called artesian and water flows out without pumping. A good index well such as J-17 is one in which pressure is never sufficient to cause the well to become artesian. To get water out of J-17, it would have to be pumped.

There is a good relationship between the level of the J-17 well and flows at Comal Springs. Most of the water that becomes Comal springflow originates with recharge far to the west of the springs and moves past the J-17 well on its way toward New Braunfels. In contrast, much of the water discharging at San Marcos Springs originates from recharge in the vicinity of the springs and does not move past the J-17 well. This is why the relationship between the J-17 well and San Marcos Springs is not as pronounced.

Flows at Comal Springs become intermittent when the level of the J-17 monitoring well drops below 620 feet. All flow at Comal ceases at an elevation of 618 feet. During the '50s drought, the springs were dry from June to November of 1956. In a repeat of the 1950's drought, Comal Springs would be dry for a number of years.

History does not record a time when the San Marcos Springs have ceased to flow. The lowest recorded flow rate was 46 cubic feet per second in August of 1956. San Marcos Springs would cease to flow with a water elevation of about 574 feet at the springs.
(Information courtesy of the Edwards Aquifer Homepage-Gregg A. Eckhardt)