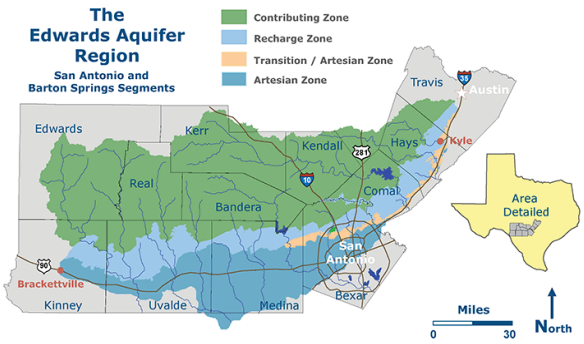
How Best Management Practices Can Protect the Edwards Aquifer

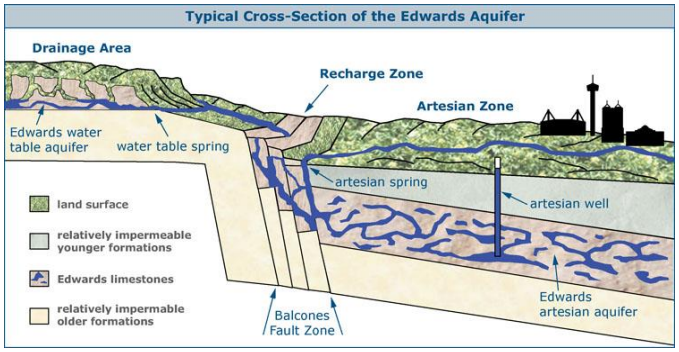
By Sarah Hernandez, St. Mary's Hall student

Introduction

Serving as the main source of drinking water for the growing San Antonian population, the Edwards Aquifer is one of Texas' most valuable natural resources. The Edwards Aquifer reaches across nearly twelve counties in South-Central Texas, having acted as their populations' main water source throughout history. Resting beneath the Balcones Fault Zone and southeast of the Edwards Plateau, the Edwards Aquifer is characterized by a unique and complex system of water drainage, filtration, and artesian wells and springs. The image to the right displays the geographical location of the Edwards Aquifer.



The Edwards Aquifer is a karst aquifer, meaning its underground structure is characterized by porous, permeable limestone that allows rainwater to quickly travel underground. The aquifer can be divided into three zones: the drainage area, the recharge zone, and the artesian zone. During and after a precipitation event, rain runoff collects on the drainage area, where it soaks into the water table and later emerges as spring-fed streams that flow towards the recharge zone. In the recharge zone, about 1,250 square miles of Edwards Limestone is exposed at the ground surface, allowing water to enter the aquifer through cracks, crevices, caves, and sinkholes. That water then flows into the artesian zone, a network of underground interconnected caverns, pores, and conduits that are sandwiched and stored between layers of less permeable rock formations. The artesian zone is under pressure, causing water to be forced back to the surface as springs or wells. The image to the right illustrates the underground structure of the Edwards Aquifer.



The Edwards Aquifer is deeply important to the health and sustainability of the greater San Antonio area. Not only do citizens depend upon the aquifer's water for drinking, many also depend upon artesian wells for domestic, livestock, municipal, agricultural, recreational, and industrial purposes, uses that are critical to economic stability. Moreover, the Edwards Aquifer, as well as being a water source for animals on land, is home to more than 40 species of subterranean creatures, including amphipod crustaceans, gastropod snails, and certain vertebrates such as the blind catfish.

Today, the Edwards Aquifer faces many threats. The aquifer's karst qualities allow it to respond quickly to rainfall events and to times of drought. While this may be beneficial during wetter seasons, the increasingly dry summers of South-Central Texas present problems with maintaining spring water flow which many people, plants, and animals depend upon. Furthermore, much of the runoff flowing into the aquifer contains contaminants that threaten water quality, and, thus, the survival of many under- and above-ground endangered species. Protecting the Edwards Aquifer can prevent further ecological damage and preserve the future of South-Central Texas' water supply.

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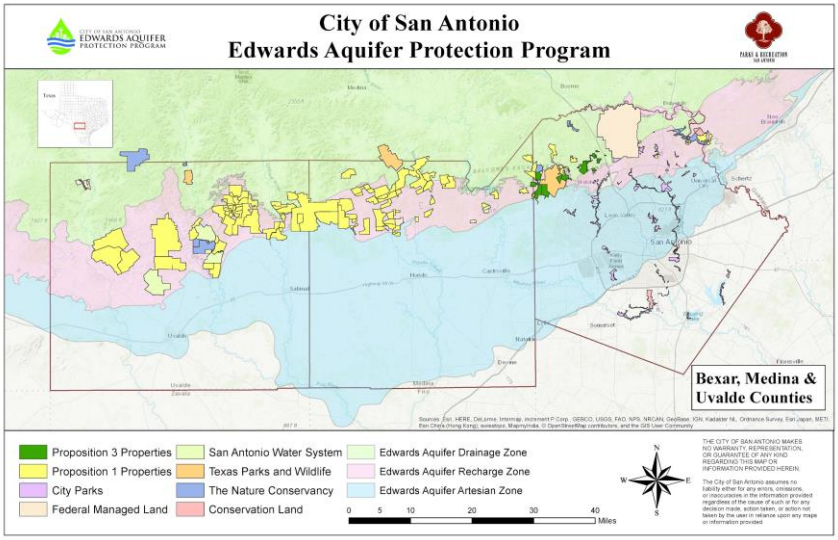
Government Action

The Edwards Aquifer Protection Program is supervised by the Conservation Advisory Board (CAB) which is composed of 9 members appointed by the San Antonio City Council for two-year terms. The board was created on April 6, 2000, to provide input and advice to the City Council on the development of the watershed protection and preservation projects. In 2000, voters approved a ⅛-of-a-cent addition to the local sales tax in Proposition No. 3 entitled "Park Development and Expansion Venue Project." This augmented sales tax collected $45 million that was then used to purchase and protect lands vulnerable to polluted runoff located in the Edwards Aquifer recharge zone. This was the first program designed to identify and protect sensitive land located over the aquifer in San Antonio. Similar sales taxes were instituted in 2005, 2010, and 2015 to further the protection of the city's drinking water. These programs yielded a total of 170,000 acres of protected lands above the Edwards Aquifer as of May 2020. The image to the right highlights properties that were acquired in and around Bexar County through this effort.



In an attempt to protect the Edwards Aquifer, the Texas Commission on Environmental Quality (TCEQ) instituted a set of regulations under their Edwards Aquifer Protection Program, which requires builders to formulate and submit an Edwards Aquifer Protection Plan to be approved by the EAPP. These plans include water pollution abatement, sewage collection, underground and aboveground storage tank, and contributing zone plans. Once construction is completed, the TCEQ performs regular inspections to ensure compliance to the given plan. To further protect the aquifer, the San Antonio City established the Edwards Recharge Zone District (ERZD). The district includes the recharge zone in Bexar county where the karst formations are often at the surface, allowing stormwater to enter directly into the aquifer. To control the quality of water entering the aquifer, the City instituted certain regulations with regards to land uses in the ERZD. A collection of said regulations pertained to instituting best management practices, preventative actions that are taken to limit the entry of polluted runoff into the aquifer. Such best management practices are applied in the design and construction processes of a given building project and may include measures such as street, drainage, and lot layouts which reduce storm runoff.

Best management practices, or BMPs, are methods used to reduce and keep pollution out of storm drains. To protect the Edwards Aquifer from contamination, BMPs are required, as they manipulate water flow and filter out potentially hazardous materials from runoff and prevent further pollution of the water supply. One of the most important BMPs is the water quality basin, a reservoir that collects and filters stormwater before it enters the aquifer. These basins filter the first 1 to 1.5 inch of stormwater runoff to remove silt, sediment, oil, hydrocarbons, heavy metals, and other contaminants. As stormwater flows through these structures, pollutants are filtered out so the cleaned water can safely recharge the Edwards Aquifer while the remaining portion of the stormwater passes into drain systems. The image below showcases the structure of a maintained water quality basin.

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These basins are composed of a piping system, a sand filtration layer, and an impermeable layer. After a rainfall event, the stormwater is directed towards, collects, and is filtered within these basins before contaminants can enter the aquifer.

Sometimes, certain additional structural choices are made to slow the flow of runoff and to separate larger units of pollution, such as with the use of concrete blocks or a rock gabion as shown in the image to the right.

In order for these water quality basins to serve their purpose, however, they must be maintained. The San Antonio Water System (SAWS) is in charge of performing annual inspections of all the sand filtration basins within the Edwards Aquifer recharge zone. When SAWS locates a basin that is not being maintained, they work with the property owner and the contracted maintenance company responsible for the given basin to produce an action plan and to enforce best management practices. Still, many basins fail to meet maintenance requirements. To the right is an image of a basin that fails to meet maintenance requirements.

This basin is not functioning, as it is retaining the stormwater for over 48 hours past a given rainfall event rather than allowing it to infiltrate into the ground. The basin no longer has the capacity to collect the designed amount of stormwater (1.5") and is not allowing collected stormwater to filter properly. Another maintenance task is to ensure that the orifice, the main pipe allowing stormwater to enter the basin, does not become blocked or clogged with debris. Other maintenance includes: identifying and repairing areas of erosion; removing sediment and debris, especially from the drainage pipes and in and around the pond; and maintaining vegetation so that infiltration is still possible. The following images show a basin overgrown with vegetation and backed-up with sediment and debris.

Due to sediment buildup, the basins shown do not allow the stormwater that is flowing into these ponds to flow or infiltrate the aquifer at a steady rate. Furthermore, the sediment in the basin forms a hard crust which prevents the basin from collecting the designed amount of stormwater and allowing it to be filtered and discharged into the aquifer properly. Basins that are not maintained cause the same problems that uncontrolled runoff can, including flooding around the basins and residential areas, an unchecked spread of debris, and further contamination of waterways and the aquifer.

Greater Edwards Aquifer Alliance Water Quality Basin Project

In an attempt to maintain protection of the Edwards Aquifer, the Greater Edwards Aquifer Alliance (GEAA) launched an investigation into how water quality basins are recorded and maintained in San Antonio. Through GEAA's efforts, a main issue was identified: water quality basins have been located that are not in compliance with maintenance requirements and therefore do not function properly in protecting water

quality within the Edwards Aquifer. The images shown above in the previous section highlight some of the water quality basins that GEAA identified as out of compliance. BMPs could reach this condition for a number of reasons, the first being that they are not listed on SAWS' or another city organization's list of basins to maintain. Another possible reason includes a chronic non-compliance on the part of the party responsible for its maintenance. In this case, the issue could possibly have been sent onto TCEQ who can levy stronger penalties. Finally, insufficient inspections can be credited for a basin's lack of maintenance, as recent and or short-term non-compliance is not noted.

To further understand why the basins failed to be maintained, GEAA contacted staff at the Aquifer Protection Department at SAWS who are responsible for ensuring the basins are compliant. In this process, GEAA realized that requesting information such as location and maintenance history regarding the residential basins would require an Open Records Request (ORR). Once the initial ORR was made, fees to have information made available were prohibitable at $610. GEAA contacted a SAWS board member to assist in obtaining this information. Subsequently, a compromise was reached to develop a map with each known residential water quality basin labeled. SAWS staff supplied PDF documents of 6 maps that highlighted the ERZD and the basins, as well as one all-encompassing map, free of charge. In addition, they made the GIS file containing the basins and their locations available to GEAA. To continue their efforts of protecting the aquifer, a GEAA intern will begin visiting the sites to determine compliance and if there are missing basins from SAWS list.

Conclusion

The Edwards Aquifer is a priceless asset to the greater San Antonio region, yet it continues to be at risk to pollution. While many organizations including GEAA and SAWS are taking steps to protect the Edwards Aquifer, individuals must also act. Citizens can support their Edwards Aquifer through advocacy, by volunteering, and by voting. As more people get involved in the protection of the Edwards Aquifer, the future of San Antonio's main water source becomes more secure.

Sources:

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