2022 Near Surface Research Award Winner,

Heidi Harwick, University of Texas at San Antonio

BIOGRAPHY

Heidi Harwick attended high school in Arvada, Colorado, and then served in the U.S. Marine Corps as an intelligence analyst from 1996 to 2001. She has lived in the Floresville, Texas area since 2005, after moving from California. She worked in the administrative field from 2001 to 2008, then as a proposal production specialist for business development from 2008 to 2019. Heidi attended the Alamo Colleges in San Antonio beginning in 2008, graduating with an associate's degree in geology in 2012. She transferred to the University of Texas at San Antonio in 2013, graduating with a B.S. in geology in 2018. Heidi continued at UTSA for graduate school, earning her graduate certificate in GIS and M.S. in Geosciences in 2022. Her research interests include geology, geophysics, groundwater, and GIS. Her goals are to obtain her Texas Professional Geologist certification and apply her education to work as a professional geologist in the San Antonio area.

ABSTRACT

This project is a study of the University of Texas at San Antonio campus, which lies within the Balcones Fault Zone and the Edwards Aquifer in South Central Texas. It uses integrated methods to gather data using GIS, geological mapping, well information, and geophysical methods to characterize the structural geology that governs the water flow into the aquifer. This case study should provide information on recharge pathways into the aquifer, as well as show how integrated methods can more effectively describe a study area's hydrogeology and integrate geoscientific tools and methods.

Detailed subsurface models are needed to provide accurate information and inform decision making for groundwater suitability and geotechnical stability investigations. Research into faults and fractures in karst aquifers is needed to define how groundwater interacts with or moves through these features, which will result in better models of groundwater flow paths. Use of multiple research methods, rather than a singular technique, is beneficial due to unpredictable site characteristics and highly variable hydrogeological properties of faulted karst systems such as the Edwards Aquifer. Incorporating geophysical data with traditional geologic methods enables broader data gathering on groundwater flow paths and contributes to more comprehensive models. Structural features, including fractures and faults,

direct groundwater flow paths by concentrating or restricting flow, resulting in complex flow circulation patterns. Understanding how faults control groundwater flow will contribute to improved models for faulted karst systems, giving insight into what factors are related to their variability. While karst topography is variable depending on the study location, groundwater flow for all karst systems is affected by regional faulting, changes to the flow cross-sectional area, and karst features related to dissolution.

In the Edwards Aquifer in San Antonio, Texas, karst development plus faulting and fracturing in the Balcones Fault Zone have compartmentalized the aquifer and created unique groundwater flow paths. Regional faulting partially controls groundwater flow, which generally moves down dip before being redirected northeast. Faulting reduces the cross-sectional area of the aquifer, especially in areas with greater vertical dislocation. Fault offsets place permeable rock adjacent to less permeable rock, decreasing the aquifer's effective thickness as displacement increases. Additionally, secondary porosity such as that found at fault intersections or karst features are the likely cause of discontinuous high transmissivity zones. The focus of this research will be the underlying structure of the study area. The goal is to better understand the fault block located between the two northeast-trending fault strands and associated structures. This study's findings will identify the relationship between these structures, variations in the stratigraphy, and their effect on the movement of groundwater in the study area.