USGS
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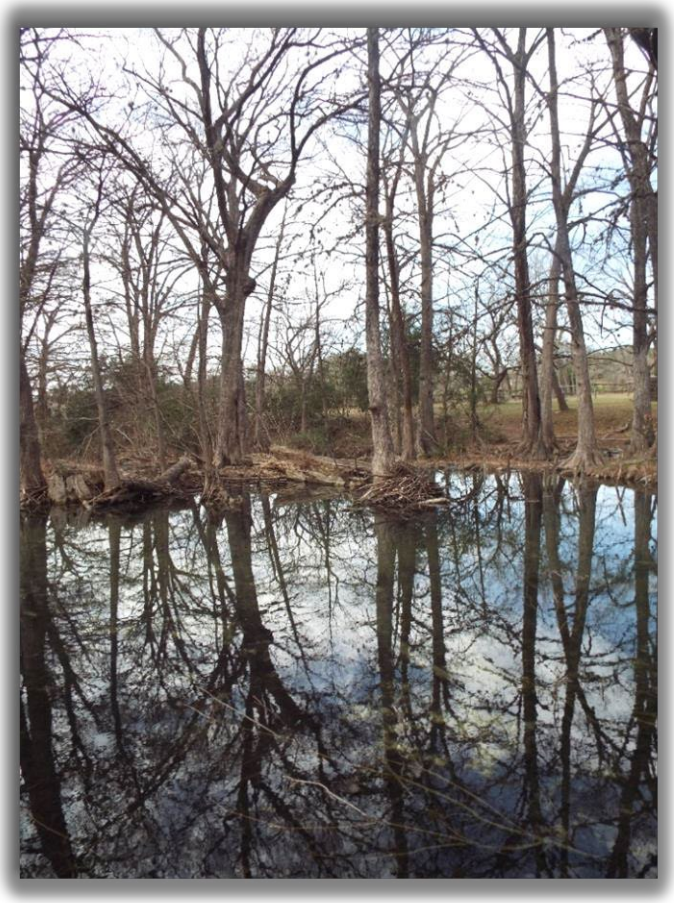
A PROPOSAL SUBMITTED TO:

Potentiometric study of the Edwards and Trinity aquifers within the boundaries of the Camp Bullis Sentinel Landscape area in parts of Bandera, Bexar, Blanco, Comal, Kendall, and Medina Counties, Texas



U.S. Department of the Interior
U.S. Geological Survey

Background

The karstic Edwards and Trinity (upper, middle, and lower zones, hereinafter referred to collectively as the Trinity aquifer) aquifers are major sources of water for agriculture, industry, military, and communities in south-central Texas (fig 1). Most recharge to the Edwards and Trinity aquifers occurs as seepage from streams, such as Cibolo Creek, as they flow across the outcrops of the geologic units that contain these aquifers (Sharp and Banner, 1997). Karstic systems, like the Edwards and Trinity aquifers, typically can accept large volumes of recharge while providing little to no filtration, thus increasing susceptibility of the water resources to contamination. The rapid flow of water through the aquifers could transport contaminants from areas of recharge into the aquifers, which ultimately supply water to groundwater wells and springs. Understanding the potentiometric (water-level) surface of the Edwards aquifer and individual zones within the Trinity aquifer is fundamental to understanding the recharge quantity and groundwater flow paths within the aquifers and is critical for anticipating and mitigating issues related to surface water, groundwater, the environment, and land use.

The Edwards and Trinity aquifers are vital water resources for Bandera, Bexar, Blanco, Comal, Kendall, and Medina Counites (fig 1). However, the area of recharge for the aquifers is rapidly urbanizing, which could negatively affect the quantity and quality of the water entering the aquifer system (Opsahl and others, 2020). Increasing growth and development throughout this region brings increased risks to the aquifer system and to the wildlife and people that depend on it.

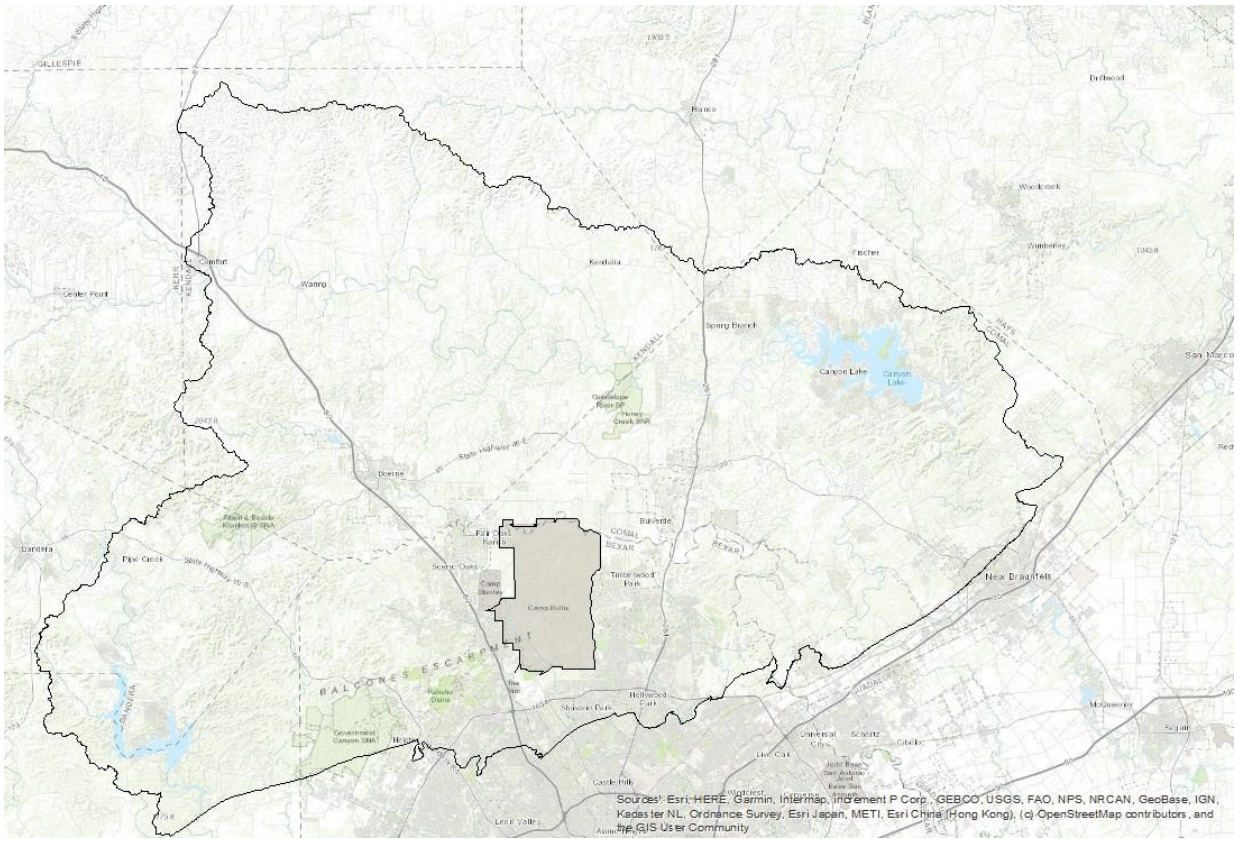


Figure 1. Proposed boundaries of the study area.

Problem

There is a lack of comprehensive water-level data in both the Edwards and Trinity aquifers within the CBSL study area. Specifically, there is a lack of comprehensive potentiometric data with which to compare water-levels in the Edwards aquifer to those in the upper, middle, and lower zones of the Trinity aquifer. These data are needed to understand where depletion, recharge, groundwater communication between aquifers, and groundwater communication within the zones of the Trinity aquifer are occurring.

Objective

The objective of the study is to obtain comprehensive water-level data within the Edwards and Trinity aquifers within the CBSL study area. This water-level data will be used to build maps of the potentiometric surface of the aquifers to aid in identifying groundwater flow paths within and between the Edwards and Trinity aquifers and gain an understanding of where areas of groundwater depletion and recharge might be affecting the aquifers.

Scope

The scope of the study will be within the outcrops and parts of the confined Edwards and Trinity aquifers in parts of Bandera, Bexar, Blanco, Comal, and Medina Counties (fig 1). The boundaries will coincide with the boundaries established by the CBSL study area (fig 1). Synoptic water-level surveys events will occur over a four-year period beginning in the winter of year one. A mini-synoptic event will occur during the summer and will occur over a four-year period beginning year two. The mini-synoptic will be run on 10-15% of the total wells used in the full synoptic.

Approach

An multitiered approach will be used to provide water resource managers information on water-levels within the Edwards and Trinity aquifers.

The project will be divided into 3 tasks:

1. Well inventory, establish groundwater monitors, data compilation, and creation of synoptic working group (Years 1 & 2)
2. Borehole data collection (Years 1 & 2)
3. Synoptic water-level measurements and potentiometric map development (Years 1, 2, 3, 4)

Task 1: Well inventory, establish groundwater monitors, data compilation, and creation of synoptic working group

An initial well inventory and data compilation are needed prior to synoptic water level measurements. Data from the Texas Water Development Board (TWDB), Edwards Aquifer Authority (EAA), Bandera County River Authority and Groundwater District (GCRAGD), Trinity Glen Rose Groundwater Conservation District (TGRGCD), Comal Trinity Groundwater Conservation District (CTGCD), Cow Creek Groundwater Conservation District (CCGCD), Guadalupe Blanco River Authority (GBRA), San Antonio Water Systems (SAWS), Medina County Groundwater Conservation District (MCGCD), Wimberly Valley Watershed Association, USGS, and others agencies and organizations will be compiled from previously published reports and available datasets (Ferrill and others, 2003, Zara environmental, 2011, Hunt and Smith, 2009, Opsahl and others, 2020, Clark and others, 2016a and 2016b) . Other relevant historical data to be compiled might include drilling records, geophysical logs and available records of pumping, precipitation, and information on springs. In addition, hydrogeologic properties such as transmissivity, hydraulic conductivity, effective porosity, permeability, and specific yield will be compiled, if available. Selected records will be converted from hard copy to digital format, if necessary. Once data is compiled, a well inventory will be conducted, which will be used for a data-gap analysis to identify where data are most critical to address project needs. Wells will be identified for monitoring in areas identified during the data-gap analysis. Up to 10 groundwater wells will be equipped with pressure transducers to monitor groundwater levels at a 15-

minute interval. The wells to be monitored on a 15-minute interval will be identified during the data gap analysis. Placement of the pressure transducers will be determined after the well inventory is complete and a data gap analysis can be completed.

A synoptic working group will be established between the USGS, State and local agencies. All persons not employed by the USGS will have to sign waivers releasing the USGS of financial responsibilities in case of injuries or death. Water levels will be obtained utilizing steel tapes, e-lines, or sonic water-level meters. All equipment used to obtain water levels must be calibrated prior to conducting any synoptic water-level measurements. The steel tapes, e-lines, and sonic water-level meters may have to be loaned by the USGS to agencies that do not have access to either device. A proof of calibration for each steel tape, e-line, or sonic water level meter will have to be supplied to the USGS prior to use in the synoptic survey. The proof of calibration must include the serial number of the device, date of calibration, and person/agency doing the calibration, and method of calibration. Field forms (paper or digital) used in the study must include a section to record the serial number and proof of calibration information. The USGS will conduct a 1–2-day class on collecting water-level data for members of the agencies collecting data. These agencies will be utilized both during the well inventory and the synoptic water-level measurements to maximize the number of wells at which water-level measurements can be made. The project approach was designed with the expectation that using multiple agencies to measure water-levels will enable the collection of a much greater number of measurements in a short timeframe. All relevant well information obtained by or for the USGS will be reviewed by Oklahoma-Texas Water Science Center personnel. All discrete groundwater data obtained for the study will be stored in ScienceBase.

Task 2: Borehole data collection

Available borehole geophysical data will be used to verify the hydrostratigraphy of individual groundwater wells. The borehole data could also be used in a possible future project to build a 3-D hydrostratigraphic model of the study area. Existing borehole geophysical data will be collected from the USGS, TGRGCD, CCGCD, EAA, CTGCD, the San Antonio Water System, and the TWDB. Borehole geophysical data will provide additional information to fill in data gaps in existing surface and subsurface geology and structural interpretations (Clark and Others, 2020; Clark and others, 2017; Clark and others, 2016a; Clark and others, 2016b; Clark and others, 2015).

Task 3: Synoptic water-level measurements

Four synoptic water-level surveys will be conducted to build potentiometric maps of the study area. Four synoptic water-level surveys will be performed during the winter of the first, second, third, and fourth years of the project to correspond the TWDB synoptic measurements. The synoptic measurements will be coordinated with the various agencies managing water collection activities within the study area, these might include citizen purveyors, groundwater districts, cities, State and Federal agencies. The data from the synoptic water-level surveys will be used to develop up to 4 potentiometric maps per year, one for each aquifer. Over the 4-year period up to 32 potentiometric maps could be produced for the study. The exact number of potentiometric maps cannot be determined until the well

inventory is completed (Task 1). The potentiometric maps will aid in defining areas that experience substantial changes in water-levels and to help define groundwater flow paths within the aquifers. If groundwater flow paths can be determined, they will be highlighted on the various potentiometric maps.

Additionally, 3 mini-synoptic surveys will be conducted in the summer by staff of the USGS. The mini-synoptic surveys will account for 10-15% of the wells used in the full synoptic. This data along with transducer data (Task 1) will be used to characterize the percent change from the summer to winter within the select wells as a proxy for understating changes across the study area.

Quality Assurance Plan

Quality assurance and quality control (QA/QC) measures will be followed to ensure the quality, precision, accuracy, and completeness of the data generated during the project. The quality-assurance objectives are to provide data that: (1) withstand scientific scrutiny, (2) are obtained by methods appropriate for their intended use, and (3) are representative and of known precision, accuracy, and comparability. The USGS Oklahoma-Texas Water Science Center's Quality Assurance Plan (QAP) for collection of groundwater data will be followed to ensure the quality, precision, accuracy, and completeness of the data generated during the study. The QAP describes the USGS-approved methods and procedures used to collect hydrologic data (Cunningham and Schalk, 2011). All data will be reviewed and archived by the USGS Oklahoma-Texas Water Science Center. The project and project budget will be reviewed by USGS management and cooperators on a quarterly basis to ensure project timelines are meet.

Relevance and Benefits

This study will aid in the understanding of potentiometric surfaces and groundwater flow paths of the aquifer system in the CPSL study area within parts of Bandera, Bexar, Blanco, Comal, Kendall, and Medina Counties. The water resources of both the Edwards and Trinity aquifers are vital for many users; results from the study will provide the public and local resource managers, such as the Comal Trinity GCD, Cow Creek GCD, Edwards Aquifer Authority, Guadalupe Blanco River Authority, San Antonio River Authority, and the Trinity Glen Rose GCD with information needed to optimize resource management strategies with water-resource partners and water purveyors. The results of this project would provide the most comprehensive science resource linking the geology, structure, and hydrostratigraphy to variations in potentiometric surfaces within the study area.

In addition, the study has transferability to other areas across the country on a national scale (karst hydrogeology, water use and availability, and surface water and groundwater interaction). Groundwater is a priority of the USGS's Water Resources Mission Area in the area of Integrated Water Availability Assessments (https://www.usgs.gov/mission-areas/water-resources/science/integrated-water-availability-assessments-iwaas). The goals of the USGS's Integrated Water Availability Assessment are to provide accurate assessment of available water resources, determine the quantity of water available, quantify comprehensive trends in water availability, explore factors that limit water availability or that can lead to conflict, and forecast water availability

Deliverables

Project updates will be provided to the cooperators on a quarterly basis, presentations will be delivered at public meetings as needed or requested. A yearly potentiometric map will be produced and made available on-line. Upon conclusion of all tasks of the project a USGS Scientific Investigations Map (SIM) will be published summarizing the results of the entire project including maps of the potentiometric surfaces. All basic data, digital databases and spatial datasets collected and produced during the study will be summarized and published as a citable USGS data release on ScienceBase.

Timeline

The project timeline will begin at the time of funding from cooperators.

	Quarters from beginning of project																			
Tasks	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
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