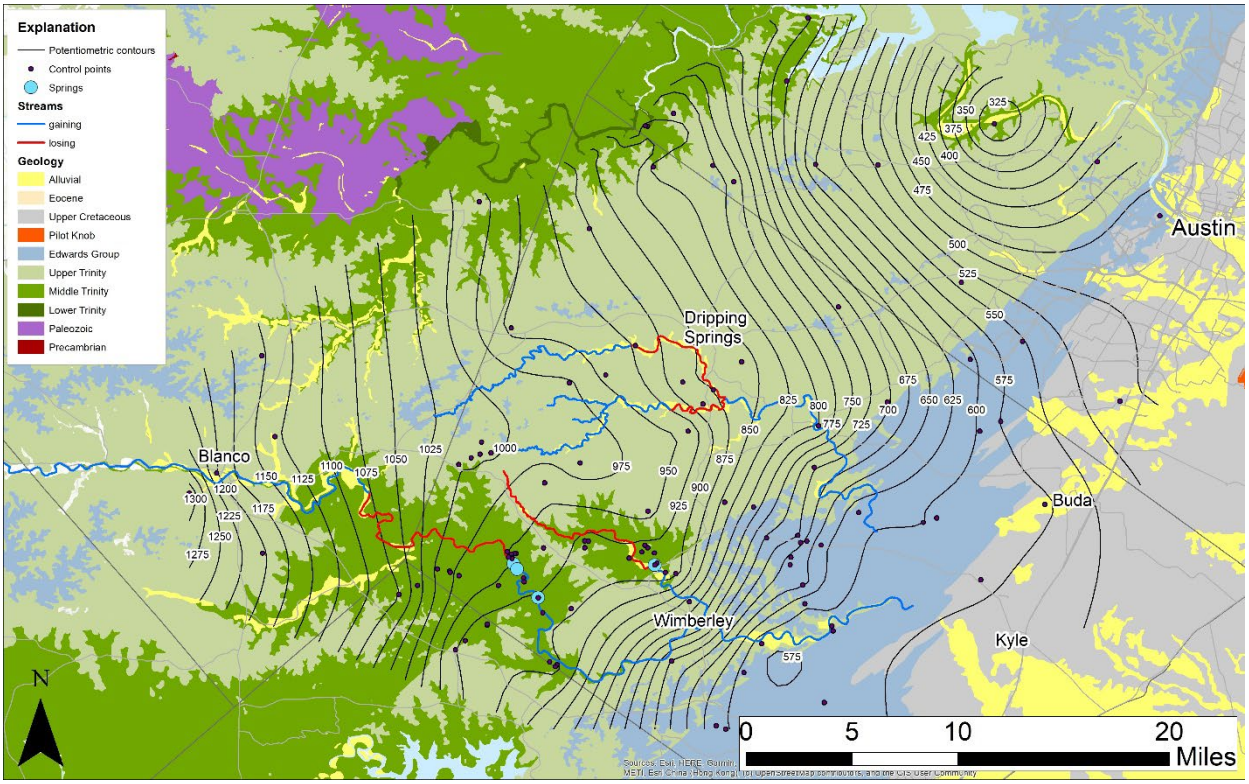
Barton Springs
Edwards Aquifer
CONSERVATION DISTRICT

SEPTEMBER 2023 POTENTIOMETRIC STUDY OF THE MIDDLE TRINITY AQUIFER, CENTRAL TEXAS



BSEACD Report of Investigations 2024-0220
February 2024

Barton Springs/Edwards Aquifer Conservation District
1124 Regal Row
Austin, Texas

Top left: Justin Camp pulling a pressure transducer from a well; Top Right: Jacob Newton taking an e-line measurement; Bottom: Shay Hlavaty measuring depth to pool level at Borheim Quarry.

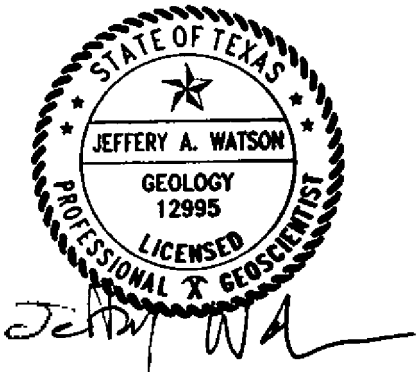
Disclaimer

All of the information provided in this report is believed to be accurate and reliable; however, the Barton Springs/Edwards Aquifer Conservation District and the report's authors assume no liability for any errors or for the use of the information provided.

Cover: September 2023 potentiometric map of the Middle Trinity Aquifer, central Texas.

SEPTEMBER 2023 POTENTIOMETRIC STUDY OF THE MIDDLE TRINITY AQUIFER, CENTRAL TEXAS

Jeffery A. Watson, P.G., and Justin P. Camp
Barton Springs/Edwards Aquifer Conservation District



A COLLABORATIVE REPORT WITH:

Radu Boghici
Hays Trinity Groundwater Conservation District

Marcus O. Gary, Ph.D., P.G.
Edwards Aquifer Authority

Lane P. Cockrell
Southwestern Travis County Groundwater Conservation District

Paul Babb, P.G.
Blanco-Pedernales Groundwater Conservation District

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Introduction

The Middle Trinity Aquifer is a critical groundwater resource in Hays County, providing the sole source of drinking water to many residents living in the county. It is also the source of ecologically and culturally important artesian springs that provide baseflow to the Blanco River, which is the primary source of recharge to the Barton Springs segment of the Edwards Aquifer during times of severe drought.

Synoptic water level studies provide valuable information on groundwater storage and flow dynamics within aquifers. Conducting multiple synoptic studies within a given aquifer at different times shows how groundwater levels and flow dynamics change over time, improving our understanding of how the aquifer responds to climatic stressors such as drought and anthropogenic stressors such as groundwater pumping. Synoptic potentiometric maps are also important datasets for calibration and validation of numerical groundwater models.

Hunt et al., (2019) produced a potentiometric surface of the Middle Trinity from data collected in March 2018, a month which represented approximately "average" hydrologic conditions. In September 2023, staff from the BSEACD, cooperating with other staff from other groundwater conservation districts (GCDs), land owners, and students from the University of Texas at Austin, conducted a synoptic water level study of the Middle Trinity Aquifer to assess aquifer conditions during a severe drought which was occurring at the time, and its still ongoing at the time of publication of this report. Data and preliminary analyses from the 2023 data collection efforts are provided in this report.

Hydrogeologic Setting

The study area is primarily Hays County with portions of Travis, Comal, and Blanco counties, and covers portions of the Texas Hill Country (HC) and the Balcones Fault Zone (BFZ) physiographic provinces characterized by extensive faulting and downward displacement to the east (Figure 1). A detailed description of the background hydrogeology is beyond the scope of this report and the reader is referred to Wierman et al. (2010); Hunt et al. (2017a), and Smith et al. (2018) for additional hydrogeologic background.

Hydrostratigraphy

The data collected in this report is from wells and springs of the Middle Trinity Aquifer, which is composed of Lower Cretaceous carbonate units. The Middle Trinity Aquifer is composed of, from stratigraphically highest to lowest, the Lower Glen Rose, Hensel, and Cow Creek formations (Figure 2). On a regional scale, the Middle Trinity Aquifer is generally considered to be a single aquifer system. However, differences in water level between the Cow Creek and Lower Glen Rose have been observed locally, and the magnitude of these differences are generally larger in the eastern, BFZ portion of the study area, indicating that the Hensel is acting as a partially-confining unit at these localities. The topmost water-bearing zone of the Middle Trinity is generally found about 50 ft below the top of the Lower Glen Rose Formation.

The Hammett Shale is a regional confining unit that underlies the Middle Trinity Aquifer and separates it from the underlying Lower Trinity Aquifer. The lower Trinity Aquifer is composed of the Sligo and Hosston formations.

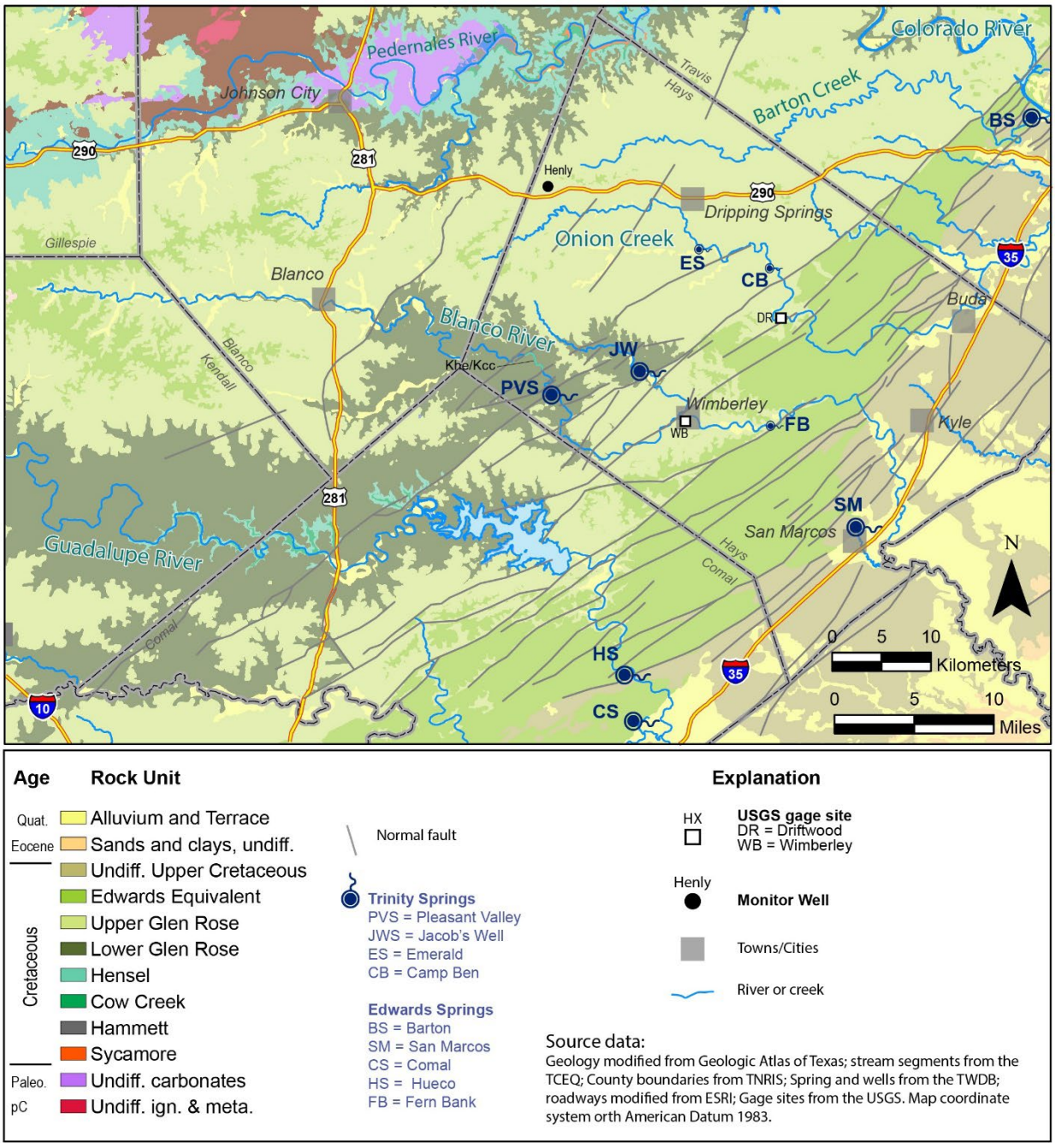

Figure 1. Geologic map of the study area. Modified from Hunt et al., 2017a.

Overlying the Middle Trinity Aquifer is the Upper Trinity Aquifer, which covers most of the Upper Glen Rose member. Recent studies have demonstrated that the upper-most 100-150 ft of the Upper Glen Rose is in hydrologic communication with the Edwards Aquifer in the BFZ (Wong et al., 2014). Argillaceous and

evaporite-rich sediments between the Middle and Upper Trinity aquifers provide hydraulic separation between these two systems. Stratigraphically above the Upper Trinity Aquifer is the Edwards Aquifer and associated units, which are in turn overlain and confined by Upper Cretaceous limestones and clays (Figure 2).

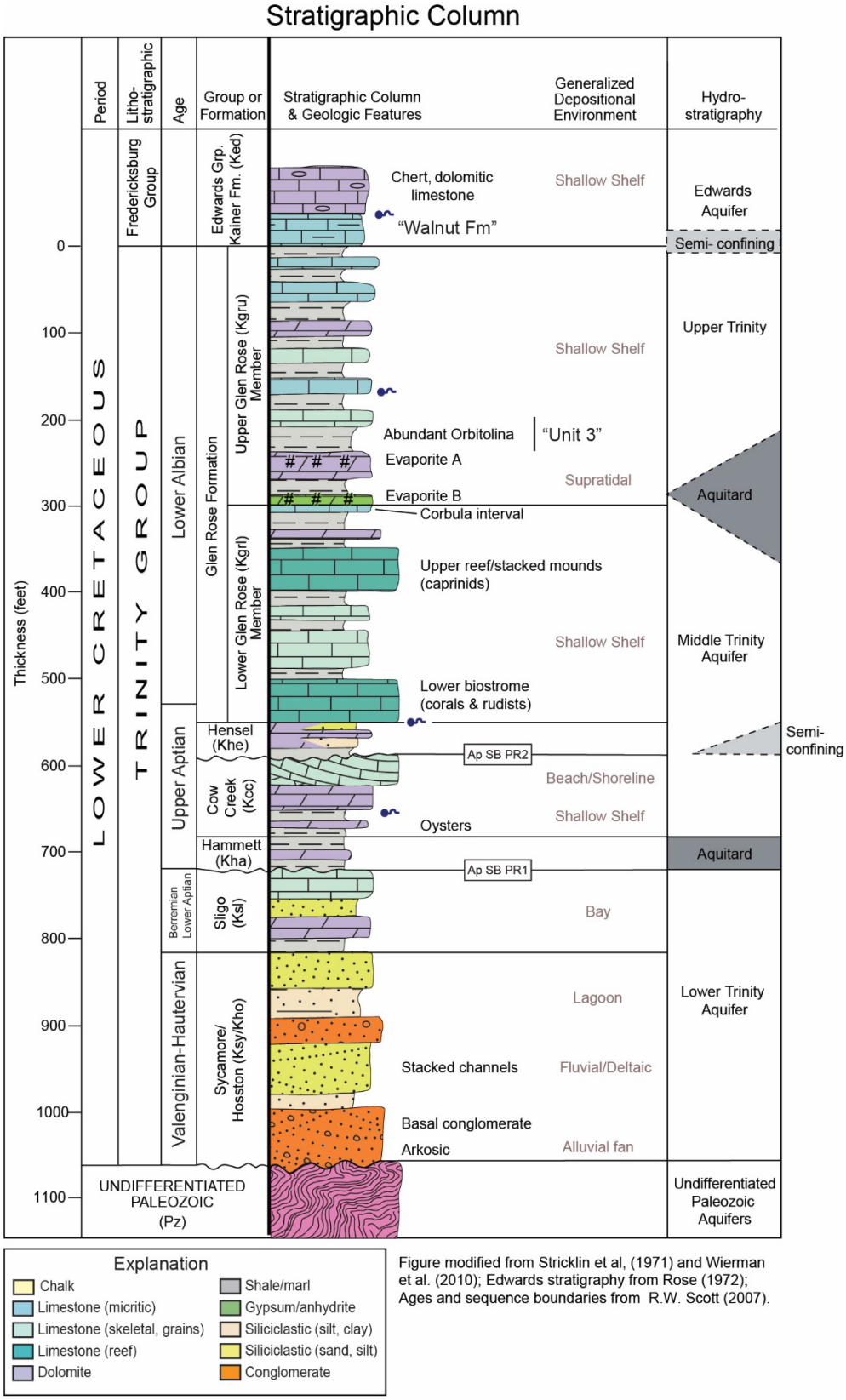

Figure 2. Hydrostratigraphic column of the Trinity. Figure modified from from Hunt et al., 2017a.

Conceptual Model

The units of the Middle Trinity gently dip to the east or southeast across most of the study area (Hunt et al., 2019). In the eastern portion of the study area the BFZ dramatically changes the structural gradient and, in some locations, dip direction. The BFZ is composed of a series of NE-SW trending en-echelon, normal faults that displace Middle Trinity strata downward to the east (Figure 3). BFZ faults may act as barriers to groundwater flow, redirecting and/or compartmentalizing flow between fault blocks. BFZ faulting has also produced relay ramp structures which can provide lateral continuity across/around barrier faults (Hunt et al., 2017b). Figure 3 illustrates the change in structure observed in the BFZ that generally delineate two hydrogeologically distinct, but interconnected aquifer zones: 1) the Hill Country HC Middle Trinity to the west, and 2) the BFZ Middle Trinity to the east (Hunt et al., 2017a; Wierman and

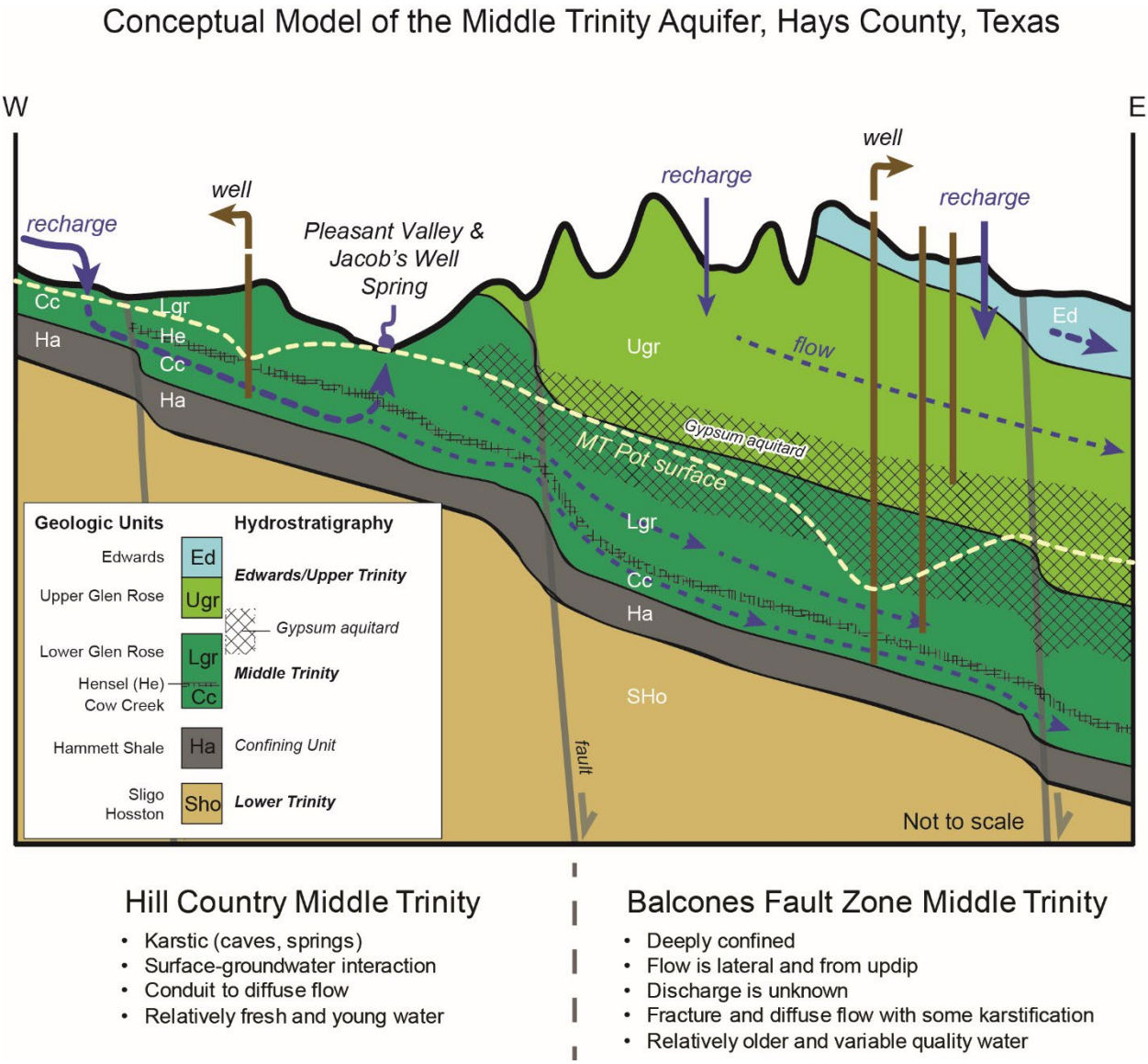

Figure 3. Schematic conceptual model of the Middle Trinity Aquifer. Modified from Hunt et al., 2017a.

Hunt, 2018). These two areas may respond differently to hydrologic stresses, as the Hill County Middle

Trinity has the potential for recharge, and the BFZ aquifer is deeply confined. Furthermore, the Hill Country Middle Trinity in the study area has heterogeneous hydraulic properties at the sub-regional level, resulting in very different aquifer responses to hydrologic stress. For example, the Middle Trinity Aquifer in most of southwestern Travis County is largely experiencing depletion of storage (groundwater mining), in contrast to the aquifer around Wimberley (Jacob's Well) experiencing capture resulting in diminishing springflows (Gary et al., 2019; Hunt et al., 2020; Hunt and Smith, 2021). Recent studies in southwestern Travis County have further revealed the complexity of the Middle Trinity aquifer system with a small segment of the Middle Trinity Aquifer in the Hamilton Pool area containing perennial springs within small watersheds flowing into the Pedernales River (Hunt, 2023).

Previous Synoptic Studies

A summary of previous Middle Trinity synoptic studies conducted in the HC and BFZ Trinity regions can be found in Hunt et al., (2019). A modified 2018 potentiometric map for northern hays and southwestern Travis County is presented in Hunt et al., 2020. A localized potentiometric map delineating the Hamilton Pool Segment of the Middle Trinity is provided in Hunt (2023).

Hydrologic Conditions

Synoptic measurements were collected during September 2023, a period of severe drought (Figure 4). During the synoptic study the entirety of the study area was classified in the D4-Exceptional drought by the U.S Drought Monitor (USDM 2023). At the beginning of September 2023 the BSEACD had been in Stage III drought for 316 consecutive days since initial declaration in October 2022. Following completion of this synoptic study, the BSEACD declared Stage IV drought in December 2023, after the Lovelady index well fell below the drought trigger threshold for the first time in the District's history. Hays Trinity Groundwater Conservation District (HTGCD) was in Stage IV declared drought, with maximum possible pumping curtailments. Blanco River flow, an important indicator of Middle Trinity Aquifer conditions and one of HTGCD's two drought trigger thresholds, was consistently below 5 cubic-feet-per second at the USGS Wimberley Gage (USGS 2023). Jacob's Well Spring ceased flowing June 24, 2023 through January 22, 2024.

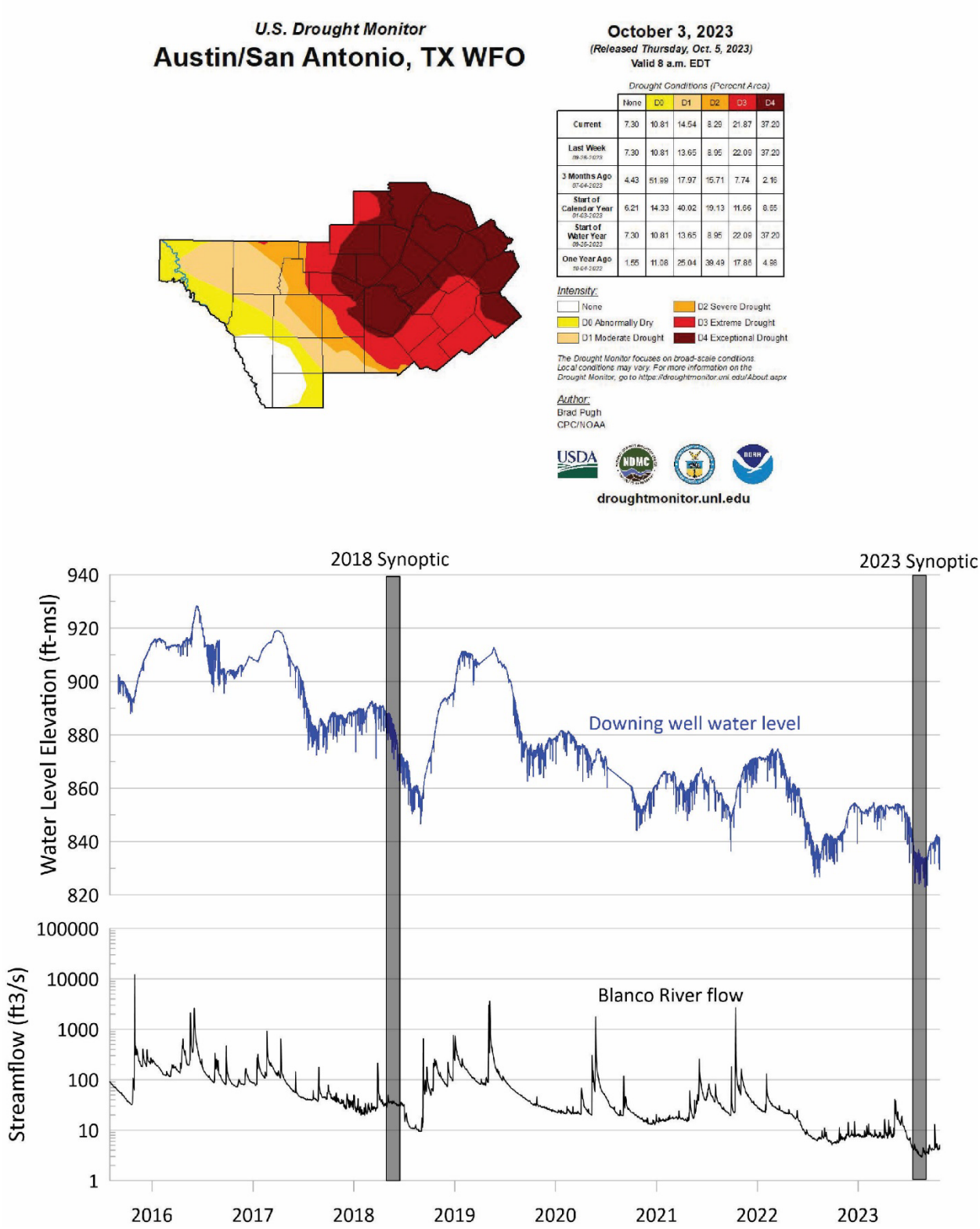

Figure 4. Hydrologic conditions during the 2023 synoptic water level study. Top: The study area was classified as D4-Exceptional drought by the U.S. Drought Monitor (USDM 2023). Bottom: Downing well (Middle Trinity) water levels and Blanco River flow during the seven years prior to the synoptic study.

Methods and Data

Synoptic water level measurements were collected using a combination of manual measurements and automated recorders. Most manual measurements were collected with a calibrated electric tape (e-line). Less frequently, manual measurements were taken using a sonic meter where specific well conditions prevented use of an e-line. E-line measurements are generally accurate to within +/- 0.01 feet, and sonic measurements have an error of +/- 2 feet. The elevation of two springs (Jacob's Well Spring and Pleasant Valley Spring) were also included as a water level data points.

Automated recorder measurements were pulled from the Texas Water Development Board automated recorder wells network (TWDB 2023).

Water level measurements from BSEACD's Westbay multiport monitoring wells were also included in the synoptic dataset. These wells allow water level measurements from discreet vertical zones sealed by inflatable packers, allowing for multiple water level measurements at different depths within a given sub-aquifer. For the potentiometric map, the upper zone of the Cow Creek was used as a data point for each of the multiport wells included in the study.

Data Compilation, Validation, and Quality Assurance

Data were compiled into a spreadsheet and mapped using GIS software (ESRI ArcMap). Water level elevations were contoured and compared to the historic published potentiometric maps of Hunt et al., 2019, and Watson et al., 2014. Comparison to historic maps allowed general quality assurance and control on the 2023 data. Data were carefully reviewed and were omitted from the compilation if suspected of questionable well completion, significant influence from pumping, or other apparently anomalous or non-representative conditions.

Contouring and Mapping

All water-level data were gridded using a kriging interpolation (linear model) algorithm within Goldenware's Surfer® software. Potentiometric contours were then generated from the resulting grid for mapping. Contours were manually adjusted along the portions of northern Hays County/southwestern Travis County to follow the shape of potentiometric contours and a distinct potentiometric trough in a 2022 potentiometric study (Hunt 2023). This portion of the Middle Trinity Aquifer is known to discharge into the Pedernales River, and thus it is reasonable to assume contours roughly parallel to the river.

Potentiometric data were plotted both as water level referenced to sea level, and water level referenced to the top of the Middle Trinity Aquifer. For the map of water level referenced to the top of the Middle Trinity Aquifer, a raster for the top of the aquifer was generated from the BSEACD's geologic database (Cockrell et al., 2018). The top of the Middle Trinity Aquifer was assumed to be 50 feet below the top of the Lower Glen Rose formation, which is where the top of the upper most water-bearing zones of the Middle Trinity generally occur. The resulting raster was then combined with 2023 synoptic water level data to generate a water level value referenced to the top of the Middle Trinity Aquifer. This allows evaluation of confined and unconfined aquifer conditions across the study area.

In addition to potentiometric maps, a map plotting change in Middle Trinity water level between the 2018 and 2023 was created by gridding and contouring all of the data points where water level measurements were available from both the 2018 and 2023 synoptic studies (n=67 data points). 2023 water level elevation was subtracted from 2018 water level elevation for each data point, providing a calculated change in water level from March 2018-September 2023.

Datums and Coordinates

Horizontal coordinates in the 2023 synoptic database are in latitude and longitude, reported in decimal degrees. Many of the sites had locations that were previously recorded by the TWDB or within other published sources (Hunt et al., 2010; Watson et al., 2014; Hunt et al., 2019). New sites and verification of existing sites was done using Google Earth imagery. Horizontal datums in GIS are in North American Datum 1983 (NAD83). Horizontal accuracy of the locations is likely within about 20 feet or better. Water-level measurements are made in reference to a measurement point (MP) at the well head. Commonly, the MP corresponds to the top of casing (TOC). The MP measurement is subtracted from the depth-to-water measurement to reflect a depth from the land surface datum (LSD). LSD is generally defined as the top of the concrete slab around the casing, or from ground level if no slab exists. All depth-to-water measurements are referenced to LSD (in feet). Elevations for LSDs are in feet above mean sea level and were generally obtained from existing databases (TWDB 2023), or published reports (Hunt et al., 2010; Watson et al., 2014; Hunt et al., 2019). For new sites, elevations were obtained using either Google Earth, or measured in-situ using a Leica Zeno 20 Global Positioning System unit with a reported accuracy of +/- 10 cm (0.328 ft). Vertical datums are either National Geodetic Vertical Datum 1929 (NAVD29) or National Geodetic Vertical Datum 1988 (NAVD88). The accuracy of the LSD of a well is the largest source of error for the elevation data in this report and is likely less than 10 feet.

Results

A contoured potentiometric map from the 2023 synoptic water level study is presented in Figure 5. A separate map of the same 2023 water levels, but referenced to the top of the Middle Trinity Aquifer (top of Lower Glen Rose), is presented in Figure 6. A water level difference map between April 2018 and September 2023 aquifer conditions is presented in Figure 7. Data collected in the September 2023 synoptic study are presented in Table 1.

Discussion

Groundwater Flow

The 2023 potentiometric map shows similar overall patterns of inferred groundwater flow directions to the Hunt et al., (2019) potentiometric map, with potentiometric contours indicating a west-to-east flow in western Hays County and transitioning to a more northeasterly flow direction in Travis County (Figure 5). Also similar to Hunt et al., (2019), the potentiometric gradient is relatively small within the Onion Creek and Cypress Creek basins, coincident with known reaches of surface stream loss and groundwater/surface water interaction. Gradients from the 2023 potentiometric surface increase significantly east of the Mount Bonnell fault, indicating that BFZ faults are acting as a barriers to groundwater flow.

Water Level Above top of Aquifer

September 2023 water levels plotted in reference to the top of the Middle Trinity Aquifer generally show a larger head above aquifer top values in the eastern BFZ Trinity within BSEACD than in the HC Trinity to the west (Figure 6). Head-above-aquifer top contours are negative in much of western Hays County and southwestern Travis County. Negative values indicate locations where Middle Trinity water levels are below the top of the aquifer, indicating the potential for unconfined aquifer conditions. This condition is expected in the Blanco River Basin upstream of Wimberley, coincident with known reaches of groundwater/surface water interaction, and where the Lower Glen Rose has been partially or fully incised and eroded and Middle Trinity units are outcropping on the surface. In northern Hays County and

southwestern Travis County, these negative values indicate locations where the saturated column of the Middle Trinity has been partially dewatered. Hunt et al., (2020) shows large areas of the Middle Trinity that have been depleted (mined) compare to 1978 in SWTGCD.

Potentiometric head above the top of the Middle Trinity increases significantly from west-to-east in the BFZ Middle Trinity, where the aquifer is more deeply confined. However, it should be noted that this a large amount of head above the aquifer does not necessarily indicate a large amount of water availability at a given location. Additional analytical and numerical modeling is required to determine the potential impact of pumping in this more deeply confined portion of the aquifer.

2023 Drought Water Level Declines

Comparison of 2018 water levels from Hunt et al., (2019), which represent average hydrologic conditions, with 2023 drought water levels, shows the extent and magnitude of water level declines due to drought and pumping across Hays County and portions of Blanco and southwestern Travis County (Figure 7). Middle Trinity water level declines varied from 3-117 feet across the study area. The largest declines were observed in the Rolling Oaks neighborhood (max decline: 95.5 feet), the City of Dripping Springs (max decline: 117.2 feet), the Oak Hill area in south central Travis County (max decline: 118.5 feet), and the city of Blanco (max decline: 112.6 feet). Areas with the smallest water level declines (<10 feet) were in southwestern Hays County in the Blanco River Basin, and along the Pedernales River in northern Hays and western Travis County. The smallest observed well decline was the Baker Well (2.4 feet), located on the property adjacent to Jacobs Well Spring. The smallest head decline is also coincident with the cessation of springflow at Jacob's Well.

The observed water level declines shown in Figure 7 demonstrate that the Middle Trinity is highly responsive to drought. Compounding these drought impacts is the impact from groundwater pumping, which has greatly increased in recent decades due to rapid population growth resulting in increasing demand for water in the region. The increased declines observed near the cities of Blanco and Dripping Springs are both nearby large non-exempt well production centers. Within BSEACD, the declines observed in the southwestern portion of the district and the Rolling Oaks neighborhood coincide with areas that have the highest concentration of both exempt and non-exempt Trinity pumping. However, the decline in the Oak Hill area of south-central Travis County is based on one data point, so additional data may be needed to characterize those declines.

Conclusion

The 2023 potentiometric data presented in this report are fundamental to understanding groundwater flow in the Middle Trinity aquifer at a regional level such as groundwater divides, recharge areas, barriers, and preferred pathways. Comparison of this data to the previous 2018 non-drought map demonstrates that the water levels in the Middle Trinity Aquifer have declined significantly due to the ongoing drought. In some areas this decline has likely been exacerbated by both exempt and non-exempt groundwater pumping. The maps and datasets in this report provide a valuable reference for groundwater planners. In addition, the 2023 synoptic data provides a key dataset for calibration and validation of numerical groundwater models which can be used to inform groundwater policymaking decisions.

Future work

There is much additional work to be done in quantifying water levels and variability in the Middle Trinity Aquifer. A few potential areas of focus for future work are provided below:

- A repeat of the map under wetter (non-drought) conditions will help evaluate the ability for the system to recover, and if the aquifer system is renewable, or if the aquifer is experiencing mining.
- Newly available data from multicompletion and multiport wells drilled by HTGCD and BSEACD has shown differences in water level between the Cow Creek and Lower Glen Rose, supporting the hypothesis that the Hensel is acting as a partial confining unit in some localities. Further analyses of these data could provide insight on how different water-bearing units within the Middle Trinity respond to stressors such as drought and pumping, and to what extent the Middle Trinity behaves as a single, hydraulically connected aquifer, as is usually assumed.
- Analytical and numerical modeling of the Middle Trinity could potentially help to quantify the relative impact of drought and pumping on water levels at different locations. The 2023 synoptic dataset should be used for calibration and validation of numerical models which simulate groundwater flow such as the BSEACD Trinity Aquifer Sustainability Model (TAS), which is currently being developed (Watson and Smith, 2023).
- Water level data within the Lower Trinity Aquifer is sparse, and the source of recharge to the Lower Trinity, particularly in the BFZ Trinity portion of the aquifer, is poorly understood. As the Lower Trinity is increasing targeted for production, additional work is needed to understand how this sub-aquifer is likely to be impacted by stressors due to drought and pumping.

Acknowledgements

This study required a collaborative data collection effort by the authors, collaborators from other GCDs, and a number of additional contributors including Jacob Newton, Kendall Bell-Enders, and Erin Swanson (BSEACD); Keaton Hoelscher (HTGCD); and students from the karst hydrogeology class at the University of Texas at Austin under supervision of Dr. Marcus Gary. We would like to acknowledge and thank all the land owners that provided access to their wells for data collection. We would also like to acknowledge the following hydrogeologists who provided expert review and feedback on this report: Brian Hunt, Doug Wierman, Brian Smith, and Radu Boghici.

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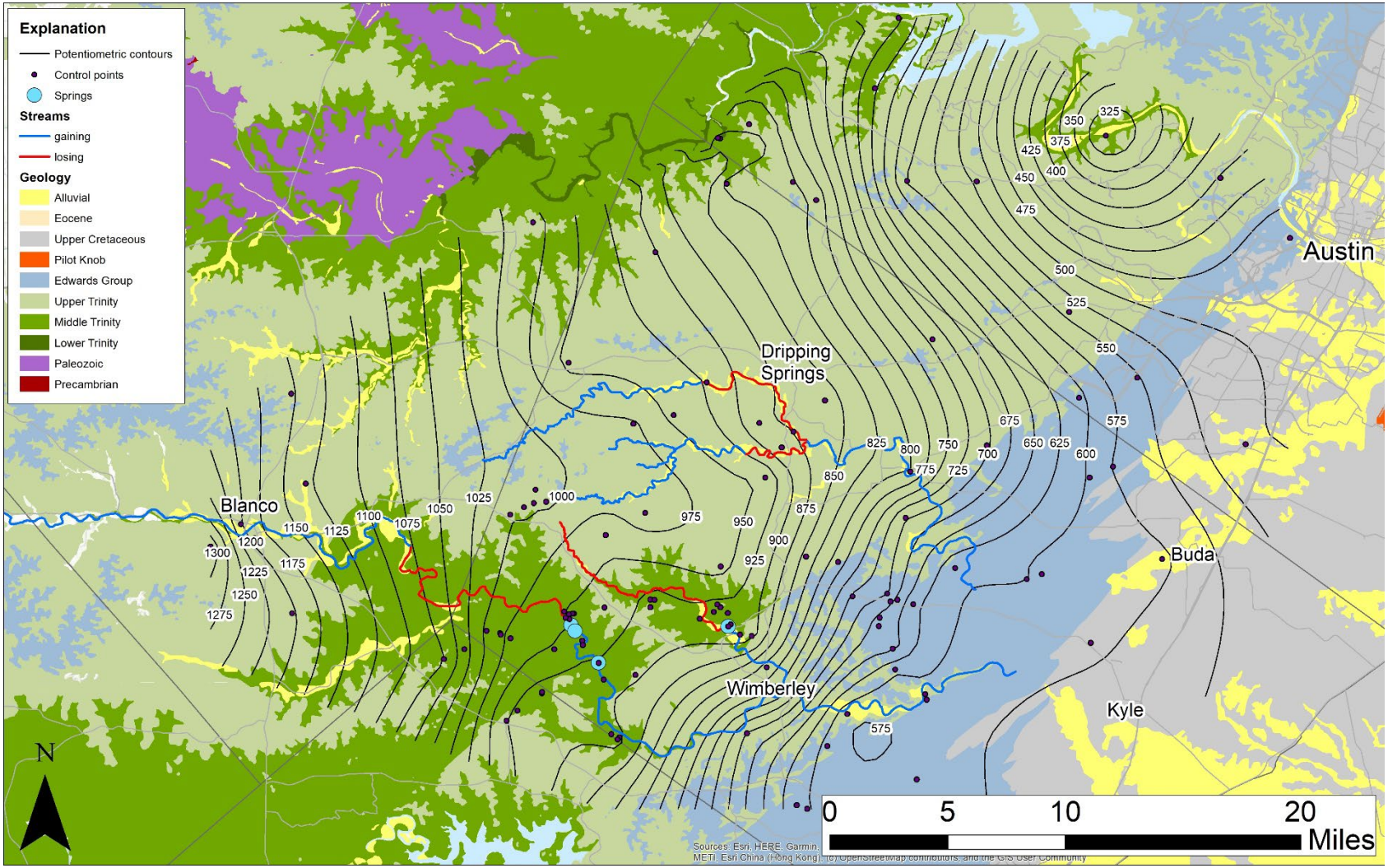

Figure 5. Potentiometric surface of the Middle Trinity from the September 2023 synoptic water level survey.

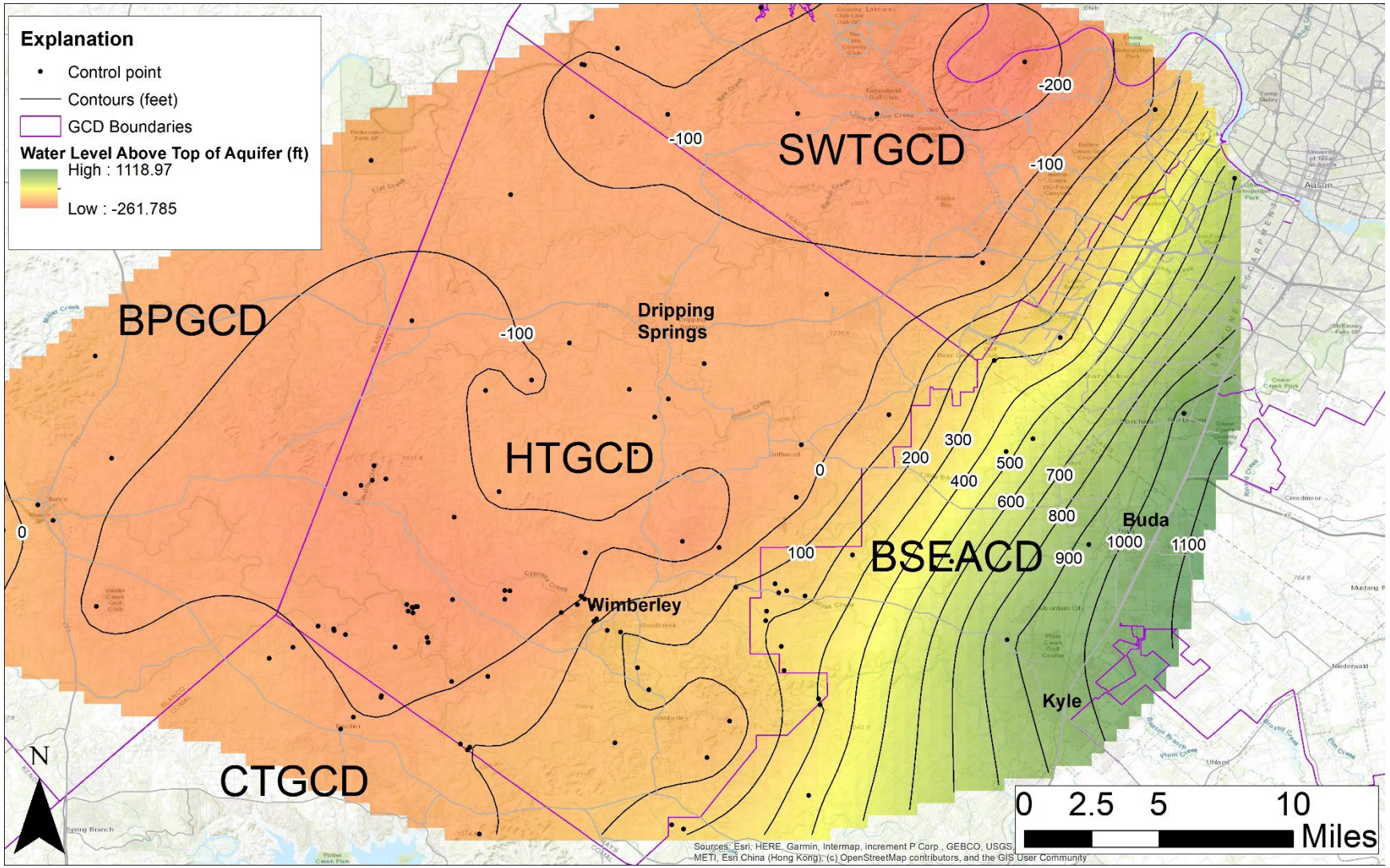

Figure 6. Map of plotted hydraulic head above top of the Middle Trinity Aquifer. Negative values indicate locations where water level is below the top of the aquifer.

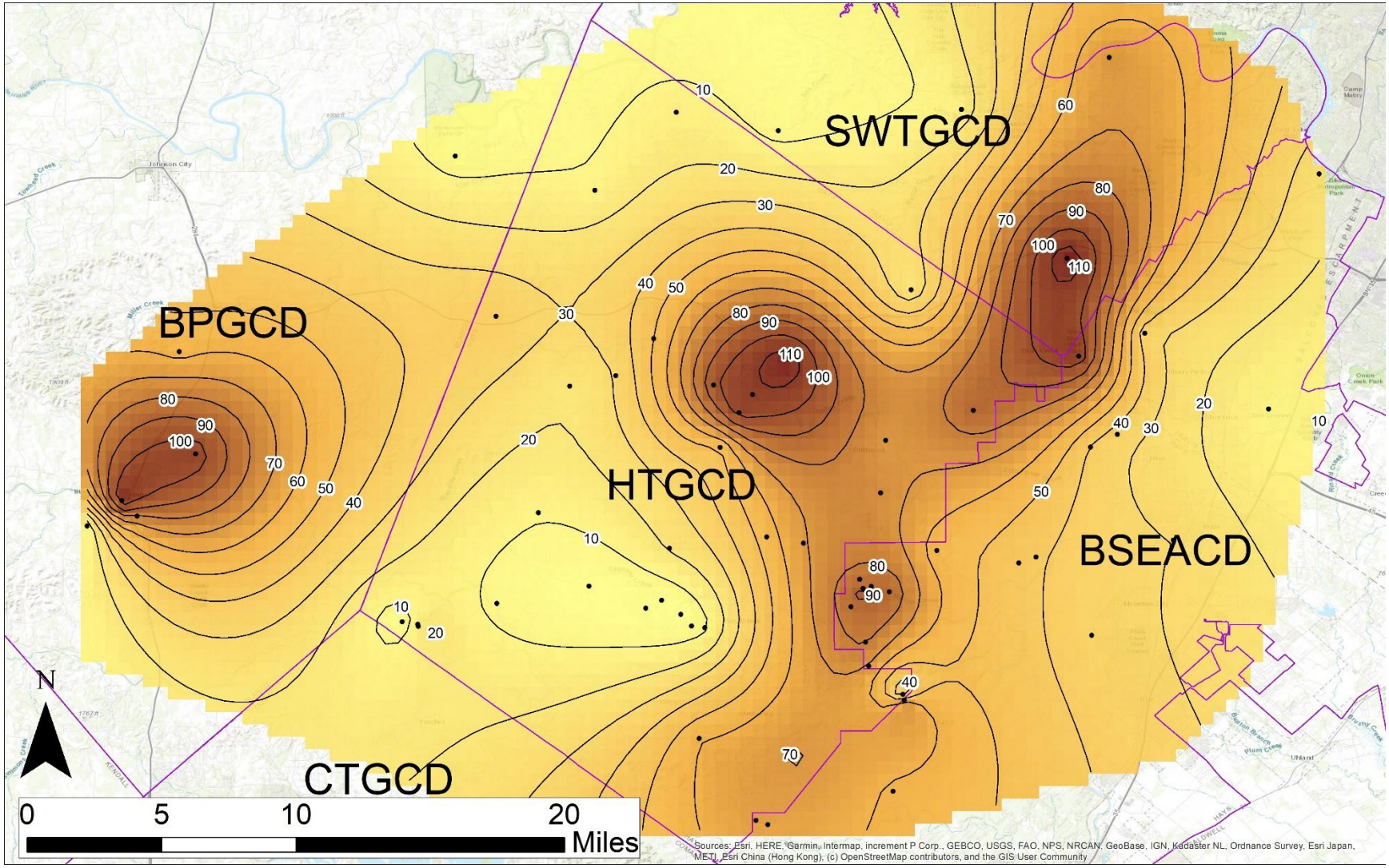

Figure 7. Map showing difference in water level between March 2018 potentiometric surface (Hunt et al., 2019) and September 2023 potentiometric surface (drought conditions). Positive values indicate a decline in water level.

Table 1. Water level data collected during September 2023 synoptic study

Well Name	SWN	DDLat	Ddlong	Surface Elevation	Aquifer	Well Depth	Measuring Point	2023 Date	2023 DTW	2023 Water Level Elevation (ft-msl)	2023 Potmap
Travis Co. Pct 3 Multiport	5841408	30.30791	-97.9734	989.00	Middle Trinity (Cow Creek)	717	2	8/31/2023	469.96	521.04	Y
Coleman's Multiport (Kcc)	5763610	30.04639	-98.131	1086.42	Middle Trinity (Cow Creek)	540	0	8/31/2023	167.04	919.38	Y
Coleman's Multiport (Kgrl)	5763610	30.04639	-98.131	1086.42	Middle Trinity (Lower Glen Rose)	540	0	8/31/2023	165.67	920.75	N
Driftwood Multiport	5764613	30.05084	-98.0221	1037.00	Middle Trinity (Cow Creek)	857	2.5	8/31/2023	371.20	668.3	Y
Ruby Westbay Well	5857513	30.06673	-97.9332	815.00	Middle trinity	1120	2.5	9/1/2023	229.31	588.19	Y
Antioch Westbay	5858431	30.07583	-97.8592	702.00	Middle Trinity (Cow Creek)	1375	2	9/1/2023	123.56	580.44	Y
Miller	5764908	30.02083	-98.025	1066.00	Middle Trinity (Cow Creek)	900	1.4	9/5/2023	406.00	661.4	Y
Hays Co Las Lomas (Kcc)	5764922	30.03473	-98.0335	1043.00	Middle Trinity (Cow Creek)	907	3	9/5/2023	382.80	663.2	Y
Hays Co Las Lomas (Kgrl)	5764922	30.03473	-98.0335	1043.00	Middle Trinity (Lower Glen Rose)	907	1.3	9/5/2023	348.70	695.6	N
Ochoa	5764605	30.04979	-98.0264	1074.00	Middle Trinity (Cow Creek)	810	1.7	9/5/2023	395.30	680.4	Y
Wood01	5764907	30.03999	-98.033	1065.00	Middle Trinity (Cow Creek)	790	1.84	9/5/2023	399.00	667.84	Y
Wood Deer Barn	5764818	30.03373	-98.0411	1084.00	Middle Trinity (Lower Glen Rose)	630		9/5/2023	393.50	690.5	Y
Lowe	5764607	30.05472	-98.0283	1085.00	Middle Trinity (Cow Creek)	860	1.3	9/5/2023	378.80	707.5	Y
Bowman	5764604	30.04806	-98.0123	1028.00	Middle Trinity (Cow Creek)	850	1.3	9/5/2023	398.00	631.3	Y
Anthem	5857918	30.02453	-97.9032	842.00	Middle Trinity (Cow Creek)	1460	3.3	9/5/2023	265.30	580	Y
JWNA (Kcc)	5763611	30.04268	-98.1265	1074.48	Middle Trinity (Cow Creek)	280	0.9	8/31/2023	156.26	918.64	Y
JWNA (Kgrl)	5763611	30.04268	-98.1265	1074.48	Middle Trinity (Lower Glen Rose)	194	0.9	8/31/2023	151.92	922.98	Y
Flocke	5763607	30.04347	-98.135	1021.00	Middle Trinity (Cow Creek)	-	0.71	9/28/2023	103.85	917.86	Y
Baker	5764723	30.03578	-98.1246	985.09	Middle Trinity (Cow Creek)	-	2.05	9/6/2023	65.98	921.163	Y
Montesino #1 (wellntel)	6808205	29.98064	-98.053	835	Middle Trinity (Cow Creek)	600		9/6/2023	254.92	580.08	Y
Amos	6808203	29.96107	-98.0651	1130.00	Middle Trinity (Cow Creek)	868	2	9/6/2023	541.50	590.5	Y
Sky Cow Creek	5857507	30.06358	-97.9425	884.00	Middle Trinity (Cow Creek)	-	0.8	9/6/2023	283.40	601.4	Y
Borheim Trinity	5849925	30.12594	-97.9038	789.86	Middle Trinity	1000	3.63	9/6/2023	196.00	597.49	Y
Onion Creek CC	5850864	30.14649	-97.8079	654.00	Middle Trinity	-	1.5	9/7/2023	152.40	503.1	Y
Spillar Test Well	5849615	30.175	-97.9103	891.00	Middle Trinity	840	2.1	9/6/2023	286.30	606.8	Y
Gandy	6808508	29.9225	-98.0777	1002.00	Middle Trinity	950	0.8	9/6/2023	400.62	602.18	Y
Freeman Ranch PWS	6808603	29.94056	-98.0103	884.00	Middle Trinity	-	2	9/6/2023	296.97	589.03	Y

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Pieter Luan	6808304	29.9895	-98.0041	888.00	Middle Trinity (Cow Creek)	970	2.7	9/6/2023	305.78	584.922	Y
Scott Robertson	6808402	29.92473	-98.0841	1032.00	Middle Trinity (Cow Creek)	910	1.5	9/19/2023	425.60	607.9	Y
Boltauzer		29.99278	-98.005	905.00	Middle Trinity	660	1.95	9/1/2023	310.85	596.1	Y
Ed Louk	5764911	30.00793	-98.0235	1039.00	Middle Trinity (Cow Creek)	960	1.45	9/19/2023	439.00	601.45	Y
Wildflower Center	5850424	30.18733	-97.8745	818.00	Middle Trinity (Cow Creek)	-	2.85	9/1/2023	268.40	552.45	Y
Jimmy Schroeder	5764916	30.01035	-98.0112	1039.00	Middle Trinity(Cow Creek)	780	1.4	9/1/2023	483.90	556.5	N
Nelson		30.07027	-97.9866	939.00	Middle Trinity (Cow Creek)	850	1.75	9/26/2023	333.35	607.4	Y
Aqua Tx-Cardinal Plant	5849910	30.13278	-97.8894	827.00	Middle Trinity	850	2.45	9/15/2023	257.10	572.35	Y
Grey Rock #5	5849616	30.18139	-97.9114	940.00	Middle Trinity	809	3	9/1/2023	412.30	530.7	N
KBDJ - Trinity Production Well	5857211	30.08558	-97.924	820.00	Middle Trinity	1100	2.05	9/21/2023	261.50	560.55	N
Brazil		30.07137	-98.1308	1272.83	Middle Trinity	-	1.6	9/5/2023	314.65	959.784718	Y
Hargrave	5763503	30.05103	-98.1741	1159.21	Middle Trinity (Cow Creek)	-	1.3	9/5/2023	243.20	917.311407	Y
Stude #2--Guest House		30.03044	-98.2665	1077.43	Middle Trinity (Cow Creek)	-	1.5	9/5/2023	102.65	976.282507	Y
Stude #3--Hill Top Solar		30.02726	-98.26	1121.03	Middle Trinity (Cow Creek)	-	1.9	9/5/2023	151.72	971.208691	Y
Stude #4--River Well	5762902	30.02948	-98.2661	1071.25	Middle Trinity(Cow Creek)	210	1.7	9/5/2023	94.14	978.808593	Y
Stude Windmill #2		30.03183	-98.2748	1091.07	Middle Trinity	-	0	9/5/2023	97.60	993.465896	Y
Pope	5763402	30.04181	-98.2238	1013.00	Middle Trinity (Cow Creek)	-	0.79	9/23/2023	61.87	951.923005	Y
Blue House	5763608	30.04796	-98.133	1054.12	Middle trinity	-	-	9/26/2023	-	918.888	Y
Jacobs Well	5763905	30.03449	-98.1261	919.38	Middle trinity	-	-	9/26/2023	-	919.378	Y
John Knox Well	6807201	29.96639	-98.1931	962.14	Middle Trinity	-	-	9/26/2023	-	906.968	Y
Camp Windmill		29.96509	-98.1942	959.96	Middle Trinity ?	-	-	9/26/2023	-	910.155	Y
Marcus & Robin Gary	6808405	29.91972	-98.1879	1027.41	Upper Trinity	-	-	9/27/2023	-	733.49	N
Camp Waloa	6808111	29.99753	-98.0965	843.32	Middle Trinity ?	-	-	9/27/2023	-	787.311	Y
Archer		30.11039	-98.2456	1273.00	Middle Trinity (LGR-CC)	350	1.95	9/23/2023	275.30	999.65	Y
Christian	5763406	30.04232	-98.2212	1055.00	Middle Trinity	280	1.38	9/23/2023	109.22	947.16	Y
Crow		30.02053	-98.2332	1115.00	Middle Trinity	280	0.55	9/23/2023	166.60	948.95	Y
Crowe		30.04632	-98.1741	1202.00	Middle Trinity ?	420	1.8	9/23/2023	284.21	919.59	Y
Davidson	5763811	30.02229	-98.1838	1118.00	Lower Trinity	-	1.6	9/23/2023	281.30	838.3	N
Davis		30.10317	-98.2602	1274.00	Middle Trinity (Cow Creek)?	-	1.2	9/23/2023	275.65	999.55	Y

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Elsey		30.00472	-98.1833	1112.00	Middle Trinity ?	-	2.2	9/23/2023	210.20	904	Y
Gunnarson		30.05083	-98.1714	1117.00	Middle Trinity (Cow Creek)?	~270	1.45	9/23/2023	203.50	914.95	Y
Hobbs		30.04239	-98.2221	1042.00	Middle Trinity	-	1.65	9/23/2023	105.20	938.45	Y
King		30.04303	-98.2059	1215.00	Upper Trinity?	-	1.47	9/23/2023	199.20	1017.27	N
Prima Vista	5763405	30.04944	-98.2144	1136.00	Lower Trinity/Middle Trinity	-	2	9/23/2023	204.60	933.4	N
Loschiavo		30.04772	-98.2181	1096.00	Lower Trinity	440	2.2	9/23/2023	168.60	929.6	N
Lundgren		30.00195	-98.2028	993.00	Middle Trinity ?	-	2	9/23/2023	90.90	904.1	Y
Mozisek	5763812	30.01982	-98.1874	1099.00	Lower Trinity	-	2.2	9/23/2023	259.45	841.75	N
Nicholson		30.01444	-98.3011	1249.00	Middle Trinity	-	1.13	9/23/2023	171.60	1078.53	Y
John knox Well	6807201	29.96669	-98.193	960.00	Middle Trinity (Lower Glen Rose)	285	2.09	9/23/2023	56.61	905.48	N
Pixley		30.04363	-98.227	1039.00	Middle Trinity	-	1	9/23/2023	85.64	954.36	Y
Plata 1		30.02575	-98.216	1011.00	Middle Trinity (Cow Creek)	-	0.8	9/23/2023	73.92	937.88	Y
Plata 2 (Glenn1)	5763708	30.02306	-98.2156	1028.00	Middle Trinity (Cow Creek)	-	1.8	9/23/2023	99.92	929.88	Y
Plata 3 (Glenn Hippie well)		30.03111	-98.2283	1079	Lower Trinity?	-	1.5	9/23/2023	175.65	904.85	N
Pousson		30.1184	-98.2446	1346.00	Middle Trinity (Cow Creek)	450	2.2	9/23/2023	334.50	1013.7	Y
Regante		30.02644	-98.2304	1079.00	Lower Trinity	510	1.84	9/23/2023	183.90	896.94	N
Roberts		29.98275	-98.2557	1105.00	Middle Trinity (Cow Creek)?	-	2.5	9/23/2023	187.80	919.7	Y
Rockefeller		29.96832	-98.1981	978.00	Middle Trinity	-	0.6	9/23/2023	76.80	901.8	Y
Sampsel		30.11124	-98.2382	1283.00	Middle Trinity (Lower Glen Rose)?	-	1.65	9/23/2023	277.80	1006.85	Y
Smith		30.03907	-98.2237	1023.00	Middle Trinity	-	0.55	9/23/2023	69.88	953.67	Y
Stancliff		30.02049	-98.2884	1165.00	Middle Trinity	244	2.05	9/23/2023	130.80	1036.25	Y
Stang		30.0399	-98.2262	1026.00	Middle Trinity	260	0.76	9/23/2023	79.53	947.23	Y
Stewart	5763208	30.10429	-98.1772	1375.00	Middle Trinity (Cow Creek)	500	2.2	9/23/2023	385.70	991.5	Y
Weinberg		30.10769	-98.2517	1304.00	Middle Trinity (?)	-	1.35	9/23/2023	294.70	1010.65	Y
Zoboroski 1		29.99343	-98.2408	1140.00	Middle Trinity	-	2.25	9/23/2023	235.50	906.75	Y
Zoboroski 2		29.99433	-98.2407	1144.00	Middle Trinity	-	1	9/23/2023	231.20	913.8	Y
Fischer Community Center	6806306	29.97649	-98.2626	1202.00	Middle Trinity	354	1.2	9/23/2023	278.35	924.85	Y
Whit Hanks	5755607	30.18447	-98.1393	1128.00	Middle Trinity	381	1.6	9/22/2023	203.97	924.03	Y
Wood Creek 23	5763908	30.03917	-98.1436	1050.00	Middle Trinity (Cow Creek)	284	1.5	9/15/2023	133.64	916.36	Y

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Bachardy	5764503	30.07417	-98.0586	1207.00	Middle Trinity(Cow Creek)	690	1.58	9/15/2023	419.03	787.97	Y
Camp Ben McCulloch	5756907	30.12962	-98.0143	953.00	Middle Trinity	360	2.42	9/23/2023	151.00	802	Y
Camp Young Judaea	5764714	30.02953	-98.1188	958.00	Middle Trinity	250	2.3	9/14/2023	44.30	913.7	Y
Dreyer	5755803	30.15889	-98.1844	1325.00	Middle Trinity	-	1.87	9/13/2023	346.20	978.8	Y
DSISD 1 (Kcc)	5756716	30.14453	-98.0933	1089.00	Middle Trinity(Cow Creek)	-	2.6	9/15/2023	210.63	878.37	Y
DSISD 2 (Kgrl)	5756718	30.14459	-98.0933	1089.00	Middle Trinity (Lower Glen Rose)	-	0	9/15/2023	206.94	882.06	N
DSWS Well #1	5756702	30.15425	-98.086	1051.00	Middle Trinity(Cow Creek)	345	0	9/15/2023	175.00	876	Y
Glenn	6808107	29.96889	-98.1147	1080.00	Middle Trinity	680	1.2	9/14/2023	383.74	696.26	Y
Grolnic	5756305	30.21085	-98.0005	1178.00	Middle Trinity (Lower Glen Rose)	450	1.5	9/13/2023	459.28	718.72	Y
Hog Hollow (Dupuy)	5756714	30.15944	-98.1069	1167.00	Middle Trinity	480	1.7	9/15/2023	289.26	877.74	Y
Mandola		30.10125	-98.017	981.00	Middle Trinity (Cow Creek)	620	2.33	9/13/2023	282.33	698.67	Y
O'Neil Ranch Road	5756710	30.12587	-98.1034	1195.00	Middle Trinity	420	1.1	9/14/2023	247.92	947.08	Y
Prochnow	5755907	30.16442	-98.1597	1347.00	Middle Trinity	-	1.91	9/13/2023	405.20	941.8	Y
Roberts	5763205	30.09063	-98.2015	1347.00	Middle Trinity	-	1	9/14/2023	393.30	953.7	Y
Roman		30.26438	-98.171	1211.00	Middle Trinity (Cow Creek)	360	2	9/13/2023	310.00	901	Y
Skipton	5755405	30.19644	-98.2243	1362.00	Middle Trinity (Cow Creek)	506	1.21	9/15/2023	419.21	942.79	Y
Stars Hollow	5756521	30.17333	-98.0667	1184.00	Middle Trinity	505	1.5	9/15/2023	320.02	863.98	Y
Tom Hegemier		30.30645	-98.1271	1066.00	Middle Trinity (Cow Creek)	320	1.2	9/13/2023	249.20	816.8	Y
WC Maintenance 2		30.02861	-98.1117	964.00	Middle Trinity	446	2	9/15/2023	53.24	910.76	Y
Wizard Academy	5849715	30.14569	-97.9671	1059.00	Middle Trinity?	-	0.7	9/13/2023	354.40	704.6	Y
Downing	5764502	30.0775	-98.0783	1218.00	Middle Trinity (Cow Creek)	600	1.9	9/15/2023	377.32	840.68	Y
Amil Baker Well	5753614	30.1775	-98.395	1510.00	Middle Trinity	-	1.5	9/15/2023	356.10	1153.9	Y
Anne Wynn Well	5761311	30.12228	-98.3861	1348.00	Middle Trinity	-	1.8	9/15/2023	219.40	1128.6	Y
Blanco County Yard Monitor Well		30.08883	-98.4176	1335.00	Middle Trinity	-	2.4	9/15/2023	147.60	1187.4	Y
City of Blanco River Well	5761217	30.09444	-98.4322	1321.00	Middle Trinity	-	4	9/15/2023	155.00	1166	N
City of Blanco Yard Well	5761223	30.09722	-98.4258	1340.00	Middle Trinity	-	2.7	9/15/2023	139.50	1200.5	Y
Pedernales Falls State Park	5747705	30.28278	-98.2461	1177.00	Middle Trinity	-	1.8	9/15/2023	191.84	985.16	Y
Rockin J Ranch Monitor Well 2	5761624	30.04255	-98.3944	1438.00	Middle Trinity	-	2	9/15/2023	233.00	1205	Y
Rockin J Ranch Monitor Well 4	5761624	30.04692	-98.4006	1385.00	Middle Trinity	-	3.2	9/15/2023	286.40	1098.6	N

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Rosa Winn Well	5761507	30.08353	-98.4446	1423.00	Middle Trinity	-	1	9/15/2023	99.20	1323.8	Y
ESD	5763504	30.04613	-98.2023	1237.00	Middle Trinity (Cow Creek)	380	-	9/15/2023	295.09	941.91	Y
Old 100	5764725	30.00944	-98.1025	918.00	Middle Trinity (Cow Creek)	560	-	9/15/2023	-	812.44	Y
Burton Kcc	5764505	30.05292	-98.0496	1162.00	Middle Trinity (Cow Creek)	857	-	9/15/2023	444.02	717.98	Y
Burton Kgrl	5764505	30.05292	-98.0496	1162.00	Middle Trinity (Lower Glen Rose)	720	-	9/15/2023	430.22	731.78	N
TWDB_Hamilton Pool	5747312	30.33965	-98.1282	833.00	Middle Trinity (Cow Creek)	244	-	9/19/2023	79.67	753.33	Y
TWDB_Murphy	5748505	30.29647	-98.0721	1150.00	Middle Trinity (Lower Glen Rose)	-	-	9/19/2023	356.78	793.22	Y
Commons Ford PWS	5841311	30.33603	-97.8938	588.00	Middle Trinity	399	2	9/22/2023	295.22	294.68	Y
Travis Co. Pct 3 Multiport	5841408	30.30791	-97.9734	989.00	Middle Trinity (Cow Creek)	717	2	9/19/2023	464.10	526.9	Y
Hunt	5849326	30.22771	-97.9164	1012.00	Middle Trinity (Lower Glen Rose)	480	0.85	9/19/2023	470.72	541.28	Y
Buddy's Backyard RV Resort	5747316	30.33428	-98.1312	971.00	Middle Trinity - Cow Creek	210	2.25	9/19/2023	-	816.4	Y
Burer	5748608	30.30816	-98.0162	1125.00	Middle Trinity - Hensel and Cow Creek	630	1.4	9/19/2023	-	572	Y
Johannsen MW#2	5747314	30.33465	-98.1326	979.00	Middle Trinity - Cow Creek	215	2.8	9/19/2023	158.25	820.75	Y
Reimers MW#1	5748113	30.34321	-98.1133	1062.00	Middle Trinity - Cow Creek	310	1	9/19/2023	247.80	815.2	Y
Wild Basin	5842517	30.31018	-97.8234	886.00	Middle Trinity - Hensel and Cow Creek	600	1.2	7/31/2023	458.98	428.22	Y
Lakeside MW#1 Kcc	5748308	30.36514	-98.0359	726.00	Middle Trinity - Cow Creek	125	1	9/12/2023	75.40	651.6	Y
Lakeside MW#1 Khe	5748308	30.36514	-98.0359	726.00	Middle Trinity - Hensel	45	1	9/12/2023	38.70	688.3	N
Dalton	5740915	30.40849	-98.0214	852.00	Middle Trinity - Cow Creek	265	0.75	9/19/2023	-	681.72	Y
Griffith	5748412	30.30758	-98.0863	1210.00	Middle Trinity - Cow Creek	586	1.3	9/30/2023	-	802.76	Y