# Data Compilation and Database Structure for the Geodatabase Accompanying the Hydrogeologic Atlas of Southwest Travis County, Central Texas

BSEACD
Data Series Report 2020-0721
July 2020

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

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**Cover**: Aerial drone photograph of Hamilton Pool, Hamilton Pool Preserve, Travis County, TX. Photo taken by Lt. Adam Griggs, Lake Travis Fire Rescue, on 3/16/2019.

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## SUGGESTED CITATION

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## INTRODUCTION

The Barton Springs/Edwards Aquifer Conservation District (BSEACD), in cooperation with Travis County, compiled existing and new hydrogeologic data to evaluate groundwater resources in southwestern Travis County (SWTC). Analysis and interpretation of these data provide the foundation for hydrogeologic evaluations presented in the *Hydrogeologic Atlas of Southwest Travis County, Central Texas* (Hunt et al., 2020), which refines the area's hydrogeologic framework and conceptual model, establishes current aquifer conditions, and estimates groundwater use in SWTC.

A geodatabase was created to provide a single repository of the source data for that study. This report describes the development of the geodatabase, documents data sources, and describes the data analyses performed. The geodatabase may help provide baseline data for future groundwater studies of the region.

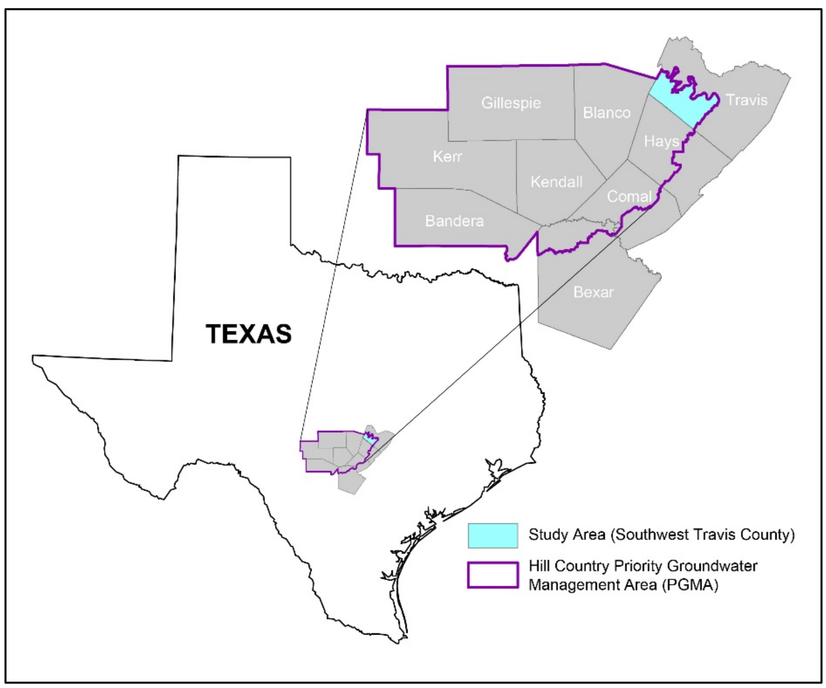


***Figure 1. Hill Country Priority Groundwater Management Area (PGMA) and Study Area.*** *The Hill Country PGMA was defined in 1990 in response to existing and projected groundwater availability issues (Cross and Bluntzer, 1990). Figure from Hunt et al., 2020.*

### Study Area

The regional extent of the study includes portions of five central Texas counties (Travis, Hays, Blanco, Burnet, and Williamson) covering about 1,250 square miles. However, the focus of this study is SWTC, which covers approximately 212 square miles and is coincident with the Travis County portion of the Hill Country Priority Groundwater Management Area (PGMA) and the boundaries of the Southwestern Travis County Groundwater Conservation District (SWTCGCD) (**Figure 1**).

### Geologic and Hydrogeologic Nomenclature

A brief overview of the hydrostratigraphy of the study area is provided in the annotated stratigraphic column in **Figure 2**. A more detailed overview can be found in Sections 2 and 3 of the Atlas (Hunt et al., 2020).

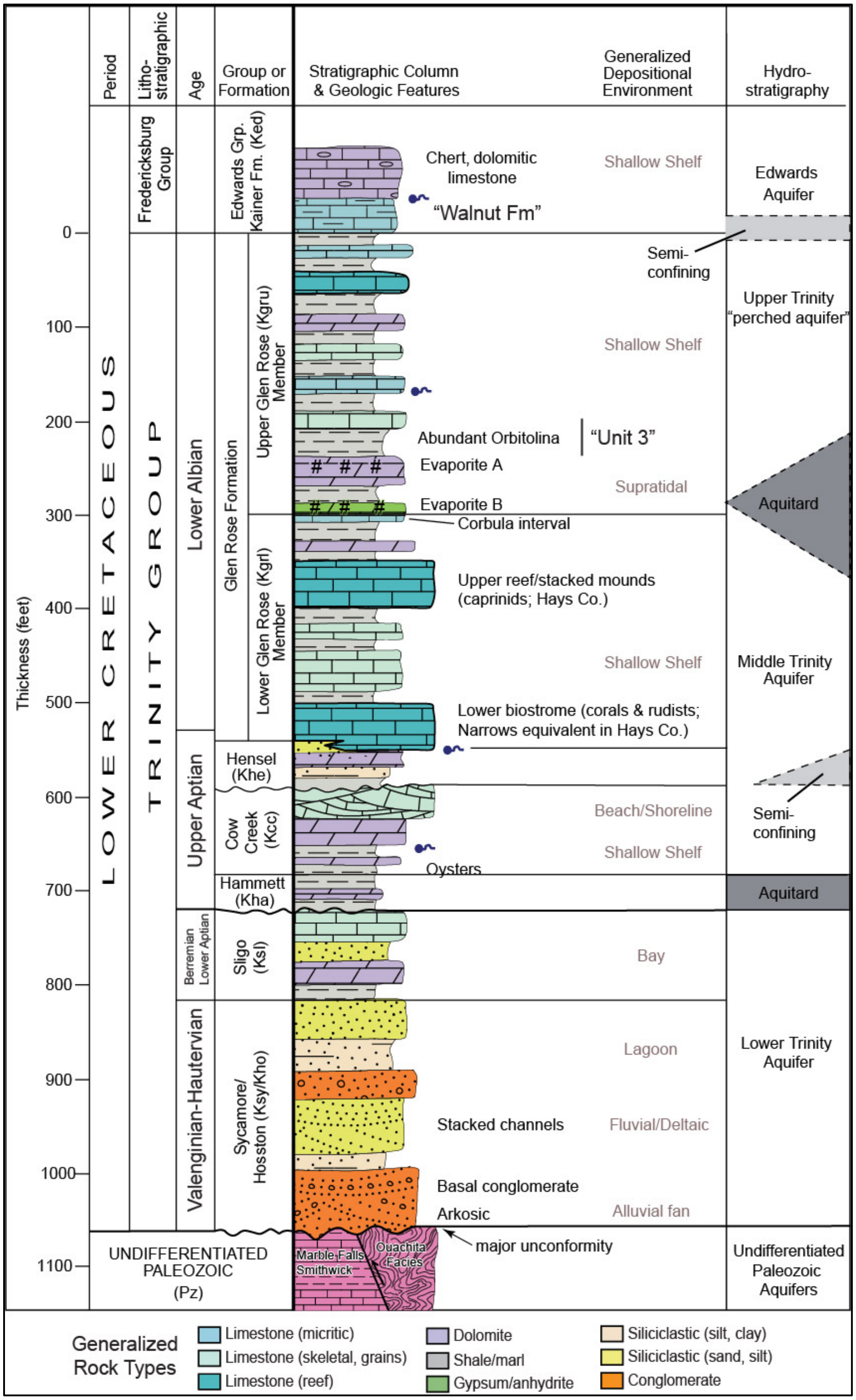


***Figure 2. Stratigraphic Column Showing the Stratigraphy and Hydrostratigraphy of the Study Area.*** *Figure modified from Stricklin et al., 1971 and Wierman et al., 2010; Edwards stratigraphy from Rose, 1972; ages and sequence boundaries from Scott, 2007. Figure from Hunt et al., 2020.*

# DATA SOURCES

Geologic, hydrogeologic, and other data were compiled for this study from a variety of sources. The geodatabase includes publicly available data from: state agencies such as the Texas Water Development Board (TWDB) and the Texas Commission on Environmental Quality (TCEQ); groundwater conservation districts, including BSEACD, Hays Trinity Groundwater Conservation District (HTGCD), Blanco-Pedernales Groundwater Conservation District (BPGCD), and the Edwards Aquifer Authority (EAA); the U.S. Geological Survey (USGS); the University of Texas at Austin's Bureau of Economic Geology (UTBEG); and other published scientific reports. The scope of work also included the collection of new information to fill data gaps, which was accomplished through over 100 water well site visits and geologic field investigations. Previously unpublished data were also included (BSEACD, 2019).

## Geologic Data

Examples of geologic data compiled for this study include geophysical logs, drillers' logs and drill-cuttings descriptions, core samples, geologic outcrops, and geologic maps. This study utilized and built upon an existing geodatabase developed by the BSEACD for the purpose of storing geologic data, primarily depth and elevation data for the tops of geologic formations at discrete control points, for central Texas (Cockrell et al., 2018). Newly acquired geologic data were added to this geodatabase for use in the detailed geologic analyses of this study. The interpretation of these data provided the foundation for hydrogeologic evaluations in the Atlas.

### *Geophysical Logs*

When combined with other geologic and hydrogeologic data such as cuttings descriptions, core samples, and geologic outcrops (discussed below), geophysical logs can provide valuable information about aquifer characteristics and can be used to characterize groundwater resources. The primary type of geophysical log used for subsurface lithologic interpretation in hydrogeological evaluations is the gamma ray (GR) log. GR logs measure the natural radioactivity of geologic formations, which tends to be concentrated in shales that contain radiogenic elements such as potassium (Asquith and Krygowski, 2004). Geologic units in the study area have characteristic GR signatures that can be used to correlate with other wells to develop geologic cross sections, and structure contour and isopach maps.

Sources of geophysical logs in the geodatabase include: new logs funded by this study; logs previously compiled by the BSEACD; the TWDB Groundwater Database (GWDB) and Brackish Resources Aquifer Characterization System (BRACS) Database (TWDB, 2019a and 2019c); the USGS GeoLog Database (USGS, 2018); HTGCD; BPGCD; EAA; UTBEG; geologic reports published by various agencies and consultants; and independent geophysical log service providers. Details related to the compilation and interpretation of logs are described by Wierman et al. (2010) and Cockrell et al. (2018).

### *Drill Cuttings and Drillers' Logs*

The TWDB GWDB and Submitted Drillers Reports (SDR) Database (TWDB, 2019a and 2019b) contain drillers' descriptions of geologic material encountered during drilling. These "drillers' logs" can be used to establish the depth and thickness of geologic units, particularly shale or clay units that are easily identified by their lithology and drilling properties. Driller-log data were included in this database where descriptions appeared to accurately reflect known geology, particularly in areas where geophysical logs and other geologic data were absent. These data were used to develop geologic cross sections, and structure contour and isopach maps.

### *Core Samples*

Detailed descriptions of core samples are an excellent source of data, especially when coupled with geophysical logs. Data from the Hamilton Pool Shell core and several cores from wells in neighboring Hays County were included in this study and provided information about geologic units and aquifer properties. Core samples from Hays County were the product of studies conducted by HTGCD (Broun and Watson, 2017 and 2018). UTBEG is the repository for these core samples and historical core such as those described by Stricklin et al. (1971).

### *Geologic Outcrops*

Surface geologic contacts and contacts from measured sections were included in this database where available. These are sites interpreted by geologists in the field or using high-resolution aerial imagery. In areas lacking other geologic control, contacts were added from the detailed geologic maps discussed below. These contacts were field verified whenever possible by geologists authoring this report.

### *Geologic Maps*

Geologic maps show the surficial distribution and geometries of rock units and other features that are essential to understanding natural resources and making sound public policy (Bernknopf et al., 1993). The study area has a long history of detailed geologic mapping that began with USGS efforts in the early 1900's (Hill and Vaughan, 1902) and continues today. Geologic map resources for the study area are primarily from UTBEG (Proctor et al., 1974; Garner et al., 1976; Barnes, 1981; Woodruff and Collins, 2016 and 2018; Collins, 2017).

An index map showing the 1:24,000-scale geologic maps used in this study is provided in **Figure 3**. These maps provide detailed surface and structural (subsurface) information for the study area, but because of their discontinuous nature, the Geographic Information Systems (GIS) version (Pearson, 2007) of the Geologic Atlas of Texas (Proctor et al., 1974; 1:500,000-scale) was used as the seamless geologic basemap throughout the Atlas. However, the more-detailed 1:24,000-scale geologic maps were critical to site-specific hydrogeologic investigations and to geologic cross section construction.

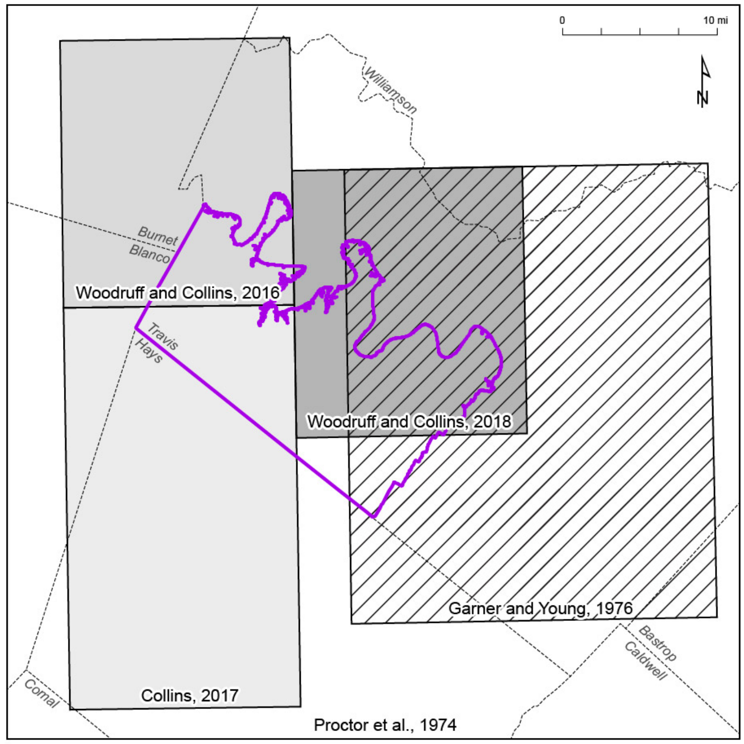


***Figure 3. Spatial Bibliography of Published Geologic Maps.*** *Study area outlined in purple. From Hunt et al., 2020.*

### *Other Published Sources*

Additional sources of geologic data include publications by Brune and Duffin (1983) and Wierman et al. (2010).

## Hydrogeologic Data

Examples of hydrogeologic data compiled for this study include well information, water-level measurements, water-quality and isotope analyses, aquifer property information from pump test data, streamflow measurements, and spring locations. The authors leveraged existing data, much of which are publicly available, whenever possible, and collected new data to fill data gaps in SWTC. Sources for each data type are described below, along with examples of how the data were used in this study.

### *Well Data*

Multiple well databases were accessed to develop an inventory of existing wells in SWTC, to assign aquifer completions for known wells, and to estimate annual pumping volumes for aquifers in SWTC. Those databases include: the TWDB GWDB, which provides detailed well, aquifer, and other information for a limited number of wells and springs in the study area (TWDB, 2019a); the TWDB SDR Database, which houses data submitted by well drillers since 2003 (TWDB, 2019b); and the TCEQ Public Water Systems (PWS) Wells database, which tracks public water supply wells and the population served (TCEQ, 2019b). Wells in the SDR Database with water-level, yield, and specific-capacity data were processed to assign aquifer designations using the procedures described in the Methods section of this report and in Section 10 of the Atlas. In addition, BSEACD staff inventoried wells and springs while collecting water-level, water-quality, and geologic information.

***Water-Level Data***

Recent (2018) potentiometric-surface maps of the Lower and Middle Trinity Aquifers were created as part of this study using water-level data from the following sources: manual measurements made by the authors of the Atlas using a calibrated electric tape (e-line) or, less commonly, with a sonic meter (manual e-line measurements are generally accurate to within ±0.01 feet, while sonic measurements are less accurate with an error of about 2 feet); a recently published Middle Trinity potentiometric-surface map (Hunt et al., 2019); water-level data from January 2017 to July 2019 from the TWDB GWDB and TWDB automated recorder wells (TWDB, 2019a and 2019d); selected water-level data from January 2017 to July 2019 from the TWDB SDR Database (TWDB, 2019b); and water-level data from resistivity logs (see Cockrell et al., 2018). Recent potentiometric-surface maps were compared to historical potentiometric-surface maps published by Brune and Duffin (1983) to estimate water-level changes for the Lower and Middle Trinity Aquifers.

Groundwater hydrographs were presented for sites with continuous monitor well data and sites with historical water-level data. Data from the continuous monitor sites were primarily sourced from the TWDB GWDB and TWDB automated recorder wells (TWDB, 2019a and 2019d). Other data sources include previously unpublished water-level data collected by the HTGCD (HTGCD, 2019) and the BSEACD (BSEACD, 2019).

***Groundwater Geochemistry and Water Quality Data***

The water-chemistry data presented in the Atlas are primarily derived from the TWDB GWDB (2019a). Field work and additional sampling were conducted for this study to help fill data gaps in the study area. Most of the isotope data from the study area were collected by the BSEACD on behalf of the TWDB; these data are stored in the TWDB GWDB (2019a).

***Aquifer Properties Data***

Yield and specific-capacity data used to evaluate aquifer properties were compiled from a previous publication by Hunt et al. (2010), the TWDB GWDB and TWDB SDR Database (TWDB, 2019a and 2019b), field investigations and measurements, and other unpublished data sources (Joe Vickers, personal communication, June 2019).

Water-level data from sources described above were used in combination with geologic data to estimate the saturated thickness of the Lower and Middle Trinity Aquifers in SWTC.

***Streamflow Measurements***

About 24 quantitative streamflow measurements were made along Barton Creek over the course of two consecutive days for this study. Each site was measured at least two times, and measurements were made using acoustic Doppler velocimeters (ADV) (FlowTracker ADV manufactured by SonTek/YSI). All measurements were made by BSEACD and City of Austin staff. The ADV is mounted on a standard wading rod and measures currents in 2 dimensions and provides discrete data on depth and velocity. Techniques and standards for making discharge measurements at streamflow gaging stations are described by Turnipseed and Sauer (2010) and Nolan et al. (2007) and were generally followed in this study. Continuous streamflow values were obtained for USGS sites (USGS, 2019a-d).

## Other Data

Additional datasets used in data analyses and/or featured in Atlas maps include: the map extent used throughout the Atlas, the boundary of SWTCGCD, which was generated using edge-matched boundaries of neighboring GCDs (TWDB, 2019e); and channel elevations for Lake Travis and Lake Austin, which were compiled from lake survey data published by the TWDB (2009 and 2010).

# METHODS AND PROCEDURES

All data were compiled in a Microsoft Access Personal Geodatabase created using ESRI ArcCatalog. Datasets were converted to Personal Geodatabase Feature Classes and organized topically into Personal Geodatabase Feature Datasets within the database. Database structure is shown in **Appendix A** with descriptions of each Feature Class. Feature Class fields are described in the database where applicable. Unless otherwise noted, all geographic coordinates in the database represent locations in NAD83 coordinate system. Methods and procedures used to develop key datasets (Feature Classes) are outlined below.

## Structure and Isopach Contours (Located in “Geology_Structure” and “Geology_Isopach” Datasets)

Structure contour maps were created for each of the major Trinity Group lithostratigraphic units and the Paleozoic basement in the study area. Contours representing these geologic surfaces are included in the geodatabase as separate Feature Classes in the “Geology_Structure” Feature Dataset. Isopach maps were created for each of the major Trinity Group lithostratigraphic units in the study area and for the hydrogeologic units that compose the Middle Trinity and Lower Trinity Aquifers. Contours representing the thicknesses of each unit and aquifer are included in the geodatabase as separate Feature Classes in the “Geology_Isopach” Feature Dataset.

Structure and isopach maps were constructed using data from geologic maps, geophysical logs, driller’s logs, cuttings descriptions, and geologic outcrops (Cockrell et al., 2018; Wierman et al., 2010). These data were used to establish the top elevation or thicknesses of geologic units at discrete points throughout the study area. After compiling available elevation and thickness data for each geologic unit, data were gridded using a kriging interpolation algorithm in Golden Software’s Surfer® software, and contours were created from each grid. Contours were then reviewed manually to ensure accuracy, and anomalous data were corrected whenever possible or removed from the dataset. After review, the data were re-gridded and new contours were created for final review and map layout in ESRI ArcMap. Contours were manually revised to reflect qualitative geologic, boundary, and structural information. Locations of data used to generate contours (“geologic control points”) are shown on each map in addition to surface geologic units equivalent to or older than the mapped surface (Proctor et al., 1974; Pearson, 2007).

In some cases, the formation-top elevations were estimated based on known thicknesses and other geologic control. For example, drillers commonly reach the Hammett Shale when drilling Middle Trinity wells but do not fully penetrate the unit. Because the Hammett has a relatively uniform thickness throughout much of the study area, the top of the underlying Lower Trinity units (Sligo or Hosston) could be estimated in wells that reached the Hammett Formation. Control points based on this type of estimation are noted in the digital datasets accompanying this report.

## Estimating Aquifer Completions for Wells (Applied to Wells in Each Feature Class in “WellData” Dataset)

For this study, aquifer completion estimates were calculated for wells compiled from all sources. Assigning aquifer completions to wells in the SDR Database, which often lack aquifer designations, facilitated evaluation of driller-reported water-level, yield, and specific-capacity data that would have otherwise been excluded from data analyses. Aquifer designations were assigned using the procedures described below.

Using Golden Software’s Surfer® software, surface elevations were assigned to each well using the USGS 1/3-Arc Second National Elevation Dataset (USGS, 2009). Data were then exported to Microsoft Excel®, where surface elevations were converted to feet above mean sea level, and bottom borehole elevations were calculated using reported borehole depth values. Data were exported back into Surfer®, and the difference (residual) between the bottom borehole elevation at a given well and elevation of the top of the Hammett at that location (based on the Hammett structure contour grid) were calculated. Aquifer estimates were assigned for each well using Microsoft Access® according to the residual value. Aquifer assignments correspond to residual ranges established according to average unit thicknesses in the study area (**Table 1**). Aquifer estimates were reviewed and compared to geologic maps using ESRI ArcMap, and aquifer assignments were revised accordingly.

***Table 1. Summary of Aquifer Estimate Residuals****. Source-aquifer estimates were made for wells by calculating the offset (residual) between the bottom borehole elevation and the top of the Hammett Shale, the confining unit dividing the Middle and Lower Trinity Aquifers. Aquifer completion estimates were then assigned using residual ranges shown below, which are based on average unit thickness values for the study area.*

| **Offset from Hammett Surface** *Residual in feet* | **Estimated Aquifer** |
|---|---|
| Greater than 1050 | Upper Cretaceous |
| 700 to 1050 | Edwards |
| 300 to 700 | Upper Trinity |
| 75 to 300 | Middle Trinity (Kgrl) |
| -50 to 75 | Middle Trinity (Kcc) |
| -500 to -50 | Lower Trinity |
| Less than -500 | Paleozoic |

### Potentiometric-Surface Contours (Located in "GroundwaterLevels" Dataset)

The methods used to construct the 2018 potentiometric-surface maps followed techniques described by Hunt et al. (2007). In summary, to construct recent Middle and Lower Trinity potentiometric-surface maps, water-level data were compiled and organized in Microsoft Excel®. Each data point was assigned an aquifer and surface elevation using the methods described above. Water-level elevations were then calculated for all data points in Excel® using surface elevations and depth-to-water measurements. All water-level data were reviewed, and those wells suspected of questionable completions, significant influence from pumping, or other anomalous or non-representative conditions were omitted from the compilation. Water-level data were then gridded using a kriging interpolation algorithm in Surfer®, and potentiometric contours were created from each grid. These contours were reviewed and manually edited in ESRI ArcMap to account for qualitative data and information such as hydrogeologic boundaries, published reports, and experience of the authors.

Brune and Duffin (1983) published potentiometric-surface maps for the Middle and Lower Trinity Aquifers in Travis County using data collected during the Spring of 1978. These historical maps were digitized and georeferenced using ESRI ArcMap. Grids were generated from the digitized historical contours using Golden Software's Surfer® software, and the difference between historical (1978) and recent (2018) water-level elevations was calculated using Surfer's® residuals function. The resulting contours are limited by the geographic extent of the 1978 potentiometric contours.

### Saturated Thickness Contours (Located in "AquiferProperties" Dataset)

Saturated thickness maps were constructed for the Lower and Middle Trinity Aquifers within SWTC. In areas where potentiometric levels are below the top of an aquifer (semiconfined or unconfined conditions), contours representing saturated thickness were developed by calculating the difference between 2018 potentiometric levels and structure contours representing the bottom of the respective aquifer. For areas where potentiometric levels are above the top of an aquifer (fully-saturated or artesian conditions), contours representing the water level (head) above the top of the aquifer were developed by calculating the difference between 2018 potentiometric levels and structure contours representing the top of the respective aquifer.

## ACKNOWLEDGEMENTS

The Atlas and accompanying data compilation are the products of a collaborative groundwater study between the Travis County Transportation and Natural Resources Division (Travis County) and the BSEACD. Data presented in the Atlas and accompanying geodatabase are the result of contributions by many individuals and agencies over many decades, who are too numerous to cite here. The reader is referred to the acknowledgements and references within Hunt et al., 2020 and Wierman et al, 2010 for some of those sources.

The authors would like to thank Travis County and the many participating organizations, agencies, and landowners who contributed to the success of this project. This geodatabase builds upon the works of the TWDB, EAA, HTGCD, BPGCD, and previous works by the BSEACD. Dennis Trombatore and Colleen Lyon of the University of Texas Libraries helped upload the Atlas and accompanying data to the Texas ScholarWorks and Texas Data Repositories.

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# APPENDICES

## Appendix A: Geodatabase Structure – Feature Datasets, Feature Classes and Descriptions

| Feature Dataset | Feature Class | Description |
|---|---|---|
| **AquiferProperties** | AquiferTestSummary | compilation of regional aquifer-test data (shown in Figure 15.2); includes data source for each aquifer test |
| | ControlPoints_SaturatedThickness_ LT | control points used to develop saturated thickness contours for the Lower Trinity Aquifer (shown in Figure 15.8) |
| | ControlPoints_SaturatedThickness_ MT | control points used to develop saturated thickness contours for the Middle Trinity Aquifer (shown in Figure 15.9) |
| | SC_Compilation_SWTCGCD | compilation of specific-capacity data for wells in SWTCGCD (shown in Figure 15.3); data sources: TWDB SDR Database (2019b), TWDB GWDB (2019a), BSEACD field measurements and other previously unpublished data |
| | Yield_Compilation_AtlasExtent | compilation of yield and drawdown data for wells located in the map extent used throughout the Atlas (shown in Figures 15.5 and 15.6); data sources: TWDB SDR Database (2019b), TWDB GWDB (2019a), TCEQ (2019a and 2019b), and BSEACD field measurements |
| **Basedata** | Atlas_MapExtent | map extent used throughout Atlas |
| | SWTCGCD | boundary of SWTCGCD used throughout the Atlas |
| **CrossSections** | CrossSection_ControlPoints | geologic data used to construct cross sections in Section 7 (includes well coordinates, depth, surface elevation, and formation-top depths); data source: BSEACD Regional Geologic Database (described in Cockrell et al., 2018) |
| | CrossSection_A_DipPrimary | cross section A-A' transect (shown in Figure 7.3) |
| | CrossSection_B_DipSecondary | cross section B-B' transect (shown in Figure 7.4) |
| | CrossSection_C_StrikePrimary | cross section C-C' transect (shown in Figure 7.5) |
| | CrossSection_D_StrikeSecondary | cross section D-D' transect (shown in Figure 7.6) |
| **Geochemistry** | Contours_TDS_LowerTrinity | contours indicating fresh to moderately saline areas of the Lower Trinity Aquifer, based on available TDS data (shown in Figure 14.4); TDS data source: TWDB GWDB (2019a) |
| | Contours_TDS_MiddleTrinity | contours indicating fresh to moderately saline areas of the Middle Trinity Aquifer, based on available TDS data (shown in Figure 14.5); TDS data source: TWDB GWDB (2019a) |
| | PMC_Edwards | available carbon-14 data (as fraction modern carbon) for Edwards Aquifer in study area (shown in Figure 14.9); data source: TWDB GWDB (2019a) |
| | PMC_UpperTrinity | available carbon-14 data (as fraction modern carbon) for Upper Trinity Aquifer in study area (shown in Figure 14.9); data source: TWDB GWDB (2019a) |
| | PMC_MiddleTrinity | available carbon-14 data (as fraction modern carbon) for Middle Trinity Aquifer in study area (shown in Figure 14.8); data source: TWDB GWDB (2019a) |
| | PMC_LowerTrinity | available carbon-14 data (as fraction modern carbon) for Lower Trinity Aquifer in study area (shown in Figure 14.7); data source: TWDB GWDB (2019a) |
| | TDS_Edwards | available total dissolved solids data (TDS; in mg/L) for Edwards Aquifer in study area (shown in Figure 14.6); data source: TWDB GWDB (2019a) |
| | TDS_UpperTrinity | available total dissolved solids data (TDS; in mg/L) for Upper Trinity Aquifer in study area (shown in Figure 14.6); data source: TWDB GWDB ( 2019a) |

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| | TDS_MiddleTrinity | available total dissolved solids data (TDS; in mg/L) for Middle Trinity Aquifer in study area (shown in Figure 14.5); data source: TWDB GWDB (2019a) |
| | TDS_LowerTrinity | available total dissolved solids data (TDS; in mg/L) for Lower Trinity Aquifer in study area (shown in Figure 14.4); data source: TWDB GWDB (2019a) |
| | Tritium_Edwards | available tritium data (in tritium units or TU) for Edwards Aquifer in study area (shown in Figure 14.9); data source: TWDB GWDB (2019a) |
| | Tritium_UpperTrinity | available tritium data (in tritium units or TU) for Upper Trinity Aquifer in study area (shown in Figure 14.9); data source: TWDB GWDB (2019a) |
| | Tritium_MiddleTrinity | available tritium data (in tritium units or TU) for Middle Trinity Aquifer in study area (shown in Figure 14.8); data source: TWDB GWDB (2019a) |
| | Tritium_LowerTrinity | available tritium data (in tritium units or TU) for Lower Trinity Aquifer in study area (shown in Figure 14.7); data source: TWDB GWDB (2019a) |
| **GeologicMaps** | GAT | GIS version (Pearson, 2007) of the *Geologic Atlas of Texas* (Proctor et al., 1974); shown in Figure 5.3 and in maps throughout the Atlas where surface geology is displayed |
| ***GeologicMaps_Georeferenced** | **Collins_2017 | *Geologic Map of the Shingle Hills-Dripping Springs- Driftwood-Rough Hollow-Henly-Hammetts Crossing Area, Central Texas* (Collins, 2017); extent shown in Figure 5.2 |
| | **Woodruff_Collins_2016 | *Geologic Map of Upper Lake Travis Area, Texas* (Woodruff and Collins, 2016); extent shown in Figure 5.2 |
| | **Woodruff_Collins_2018 | *Geologic Map of Mansfield Dam, Jollyville, Austin West, and Bee Cave Quadrangles, Central Texas (Lower Lake Travis and Lake Austin Vicinity)* (Woodruff and Collins, 2018); extent shown in Figure 5.2 |
| **Geology_Isopach** | Contours_Isopach_Kgru | contours representing the thickness (in feet; 50-foot contour interval) of the Upper Glen Rose (shown in Figure 8.18) |
| | Contours_Isopach_Kgrl | contours representing the thickness (in feet; 50-foot contour interval) of the Lower Glen Rose (shown in Figure 8.16) |
| | Contours_Isopach_Khe | contours representing the thickness (in feet; 25-foot contour interval) of the Hensel (shown in Figure 8.14) |
| | Contours_Isopach_Kcc | contours representing the thickness (in feet; 25-foot contour interval) of the Cow Creek (shown in Figure 8.12) |
| | Contours_Isopach_MiddleTrinity | contours representing the thickness (in feet; 50-foot contour interval) of the Middle Trinity Aquifer (undifferentiated) (shown in Figure 8.10) |
| | Contours_Isopach_Kha | contours representing the thickness (in feet; 10-foot contour interval) of the Hammett (shown in Figure 8.8) |
| | Contours_Isopach_LowerTrinity | contours representing the thickness (in feet; 50-foot contour interval) of the Lower Trinity Aquifer (undifferentiated) (shown in Figure 8.6) |
| | ControlPoints_Isopach_Kgru | control points used to develop isopach contours for the Upper Glen Rose (shown in Figure 8.18) |
| | ControlPoints_Isopach_Kgrl | control points used to develop isopach contours for the Lower Glen Rose (shown in Figure 8.16) |
| | ControlPoints_Isopach_Khe | control points used to develop isopach contours for the Hensel (shown in Figure 8.14) |
| | ControlPoints_Isopach_Kcc | control points used to develop isopach contours for the Cow Creek (shown in Figure 8.12) |
| | ControlPoints_Isopach_MiddleTrinity | control points used to develop isopach contours for the Middle Trinity Aquifer (undifferentiated) (shown in Figure 8.10) |
| | ControlPoints_Isopach_Kha | control points used to develop isopach contours for the Hammett (shown in Figure 8.8) |
| | ControlPoints_Isopach_LowerTrinity | control points used to develop isopach contours for the Lower Trinity Aquifer (undifferentiated) (shown in Figure 8.6) |

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| **Geology_Structure** | Contours_Structure_Kgru | contours representing the elevation (in feet above mean sea level; 50-foot contour interval) of the top of the Upper Glen Rose (shown in Figure 8.17) |
| | Contours_Structure_Kgrl | contours representing the elevation (in feet above mean sea level; 50-foot contour interval) of the top of the Lower Glen Rose (shown in Figure 8.15); equivalent to the top of the Middle Trinity Aquifer |
| | Contours_Structure_Khe | contours representing the elevation (in feet above mean sea level; 50-foot contour interval) of the top of the Hensel (shown in Figure 8.13) |
| | Contours_Structure_Kcc | contours representing the elevation (in feet above mean sea level; 50-foot contour interval) of the top of the Cow Creek (shown in Figure 8.11) |
| | Contours_Structure_Kha | contours representing the elevation (in feet above mean sea level; 50-foot contour interval) of the top of the Hammett (shown in Figure 8.7) |
| | Contours_Structure_LowerTrinity | contours representing the elevation (in feet above mean sea level; 50-foot contour interval) of the top of the Lower Trinity Aquifer (undifferentiated) (shown in Figure 8.5) |
| | Contours_Structure_Paleozoic | contours representing the elevation (in feet above mean sea level; 500-foot contour interval) of the top of the Paleozoic basement (undifferentiated) (shown in Figure 8.4) |
| | ControlPoints_Structure_Kgru | control points used to develop structure contours for the Upper Glen Rose (shown in Figure 8.17) |
| | ControlPoints_Structure_Kgrl | control points used to develop structure contours for the Lower Glen Rose (shown in Figure 8.15) |
| | ControlPoints_Structure_Khe | control points used to develop structure contours for the Hensel (shown in Figure 8.13) |
| | ControlPoints_Structure_Kcc | control points used to develop structure contours for the Cow Creek (shown in Figure 8.11) |
| | ControlPoints_Structure_Kha | control points used to develop structure contours for the Hammett (shown in Figure 8.7) |
| | ControlPoints_Structure_LowerTrinity | control points used to develop structure contours for the Lower Trinity Aquifer (undifferentiated) (shown in Figure 8.5) |
| | ControlPoints_Structure_Paleozoic | control points used to develop structure contours for the Paleozoic basement (undifferentiated) (shown in Figure 8.4) |
| **GroundwaterLevels** | Contours_Potentiometric_MiddleTrinity_1978 | Spring-1978 potentiometric contours for the Middle Trinity Aquifer, digitized from Brune and Duffin, 1983 (shown in Figure 11.3) |
| | Contours_Potentiometric_MiddleTrinity_2018 | 2018 potentiometric-surface contours for the Middle Trinity Aquifer; data sources: water-level data from TWDB SDR Database (2019b), TWDB GWDB (2019a), and BSEACD field measurements (shown in Figure 11.4) |
| | Contours_Drawdown_MiddleTrinity | calculated water-level change between Spring-1978 and 2018 potentiometric levels for the Middle Trinity Aquifer (shown in Figures ES-1 and 11.5) |
| | Contours_Potentiometric_LowerTrinity_1978 | Spring-1978 potentiometric contours for the Lower Trinity Aquifer, digitized from Brune and Duffin, 1983 (shown in Figure 11.6) |
| | Contours_Potentiometric_LowerTrinity_2018 | 2018 potentiometric-surface contours for the Lower Trinity Aquifer; data sources: water-level data from TWDB SDR Database (2019b), TWDB GWDB (2019a), and BSEACD field measurements (shown in Figure 11.7) |
| | Contours_Drawdown_LowerTrinity | calculated water-level change between Spring-1978 and 2018 potentiometric levels for the Lower Trinity Aquifer (shown in Figure 11.8) |
| | ControlPoints_Potentiometric_MT_2018 | control points used to develop 2018 potentiometric contours for the Middle Trinity Aquifer (shown in Figure 11.4) |
| | ControlPoints_Potentiometric_LT_2018 | control points used to develop 2018 potentiometric contours for the Lower Trinity Aquifer (shown in Figure 11.7) |
| | GroundwaterHydrograph_Sites | sites with historical and/or continuous monitor level data; source TWDB, 2019a (shown in Figure 12.2) |
| **Misc** | ColoradoRiverChannelElevation | point elevation data (in feet above mean sea level) for the Colorado River channel (Lake Travis and Lake Austin); data sources: TWDB, 2009 and 2010 (shown in Figures, 11.3, 11.4, 11.6, 11.7) |

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| | HydrogeologicAreas | boundaries of four hydrogeologic areas defined in Section 16 of the Atlas, based on generalized hydrogeolgic characteristics (shown in Figures 16.1 and 16.2) |
| **Surface_and_Groundwater_Interactions** | BartonCreekFlow_July2019 | locations of flow measurements made along Barton Creek on 7/10/2019 and 7/11/2019; flow data are included for each site (shown in Figures 13.6 and 13.7, Table 13.2) |
| | BartonCreekTributaryFlow_July2019 | locations of flow measurements made along Barton Creek tributaries on 7/10/2019 and 7/11/2019; flow data are included for each site (shown in Figures 13.6 and 13.7, Table 13.2) |
| | Springs | locations of documented springs in the study area; spring names, elevations, and aquifer assignments are included. data sources: TWDB GWDB (2019a), and BSEACD field investigation (shown in Figure 13.3) |
| **WellData** | SDR_July2019_Supplemented | includes data from *WellData* and related TWDB SDR Database tables (2019b) for wells in Travis, Hays, Burnet, Blanco, and Williamson Counties, with supplemental fields added to facilitate data analyses; database field descriptions are primarily from *SDRDownloadColumnDescriptions* excel sheet accompanying the SDR download |
| | GWDB_July2019_Supplemented | data from *GWDB Well Location Shapefile* (TWDB, 2019a) for wells located within the map extent used throughout the Atlas, with supplemental fields added to facilitate data analyses; database field descriptions are primarily from *GWDBDownloadColumnDescriptions* excel sheet accompanying the GWDB download |
| | TCEQ_PSW_Supplemented | data for public supply wells in Travis County, with supplemental fields added to facilitate data analyses (shown in Figure 10.7); data sources: TCEQ Public Water Systems (PWS) wells database (2019b) and public information request (2019a) |

*denotes Personal Geodatabase Raster Catalog
**denotes Personal Geodatabase Raster Dataset