BRACKISH GROUNDWATER IN THE SOUTHERN PORTION OF THE TRINITY AQUIFER (HILL COUNTRY TRINITY)

TWDB Report 388 Snapshot | October 2023

BACKGROUND on BRACKISH GROUNDWATER STUDIES

The Texas Water Development Board (TWDB) Brackish Resources Aquifer Characterization System (BRACS) Program was established in 2009 to map and characterize the brackish portions of Texas aquifers to provide useful information and data to regional water planning groups and other entities interested in using brackish groundwater as a water supply. Both Texas industry and public water supply planners are looking at brackish groundwater to supplement stressed freshwater resources. Brackish groundwater is a significant water supply component that can be used to meet future water demands. Groundwater desalination strategies in the 2022 State Water Plan (TWDB, 2023) represent additional new groundwater supply for nine of the regional planning groups. Desalination of brackish groundwater has been recommended as an additional supply volume of approximately 19,000 acre-feet per year in 2020, with an additional 157,000 acre-feet per year of brackish groundwater recommended to be in service by 2070.

What is brackish groundwater?

Brackish groundwater contains dissolved minerals with a concentration between 1,000 and 35,000 milligrams per liter, though 10,000 milligrams per liter total dissolved solids is often considered the limit for economical brackish groundwater treatment

SOUTHERN PORTION OF THE TRINITY AQUIFER STUDY AREA

TWDB Report 388 characterizes the southern portion of the Trinity located south of the Colorado River (Figure 1). The study area includes all or part of 24 counties in south-central Texas encompassing portions of regional water planning areas J, K, L, and M, and groundwater management areas 7, 8, 9, 10, 12, and 13. There are 22 groundwater conservation districts located within the study area, including the Barton Springs/Edwards Aquifer Conservation District and the Edwards Aquifer Authority.

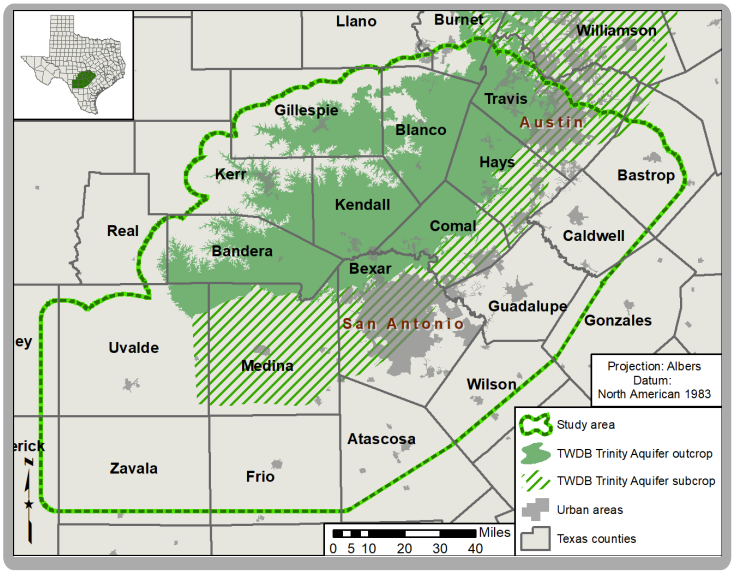

Figure 1. Study area for the southern portion of the Trinity Aquifer brackish groundwater study.

There are 400 public water supply systems in the study area, of which 90 have over 1,000 connections each. The largest of these are the cities of San Antonio and Austin with a combined 2020 population of more than 2.3 million people.

The Trinity Aquifer is a thick sedimentary wedge of calcareous sandstone, shale, limestone, dolomite, and evaporites deposited on an eroded shelf of Paleozoic rocks. This sedimentary wedge thickens to over 5,000 feet thick to the southeast, and is heavily faulted in the study area by the Balcones Fault Zone and the Luling Fault Zone, which tend to restrict the downdip flow of groundwater, but may also result in the cross-formational flow of groundwater.

BRACKISH GROUNDWATER VOLUMES in the SOUTHERN PORTION OF THE TRINITY AQUIFER

SLIGHTLY SALINE **201.5** million acre-feet

MODERATELY SALINE **243.1** million acre-feet

VERY SALINE **442.7** million acre-feet

Total aquifer storage volumes of brackish ground-water was calculated for each of the water-bearing hydrostratigraphic units according to salinity class. We define salinity classes as ranges of total dissolved solids content measured in milligrams-per-liter, with slightly saline as 1,000 to 3,000, moderately saline as 3,000 to 10,000, and very saline as 10,000 to 35,000. The calculations of total aquifer storage volumes of brackish groundwater for the southern portion of the Trinity Aquifer study area are shown in Table 1. Not all brackish groundwater can be produced or economically developed. These volumes do not consider the effects of land subsidence, degradation of water quality, or any changes to surface water-groundwater interaction that may result from extracting groundwater from the aquifer.

The volumes calculated in this study are estimates to be used to provide an insight into the magnitude and distribution of this important resource. We recommend that site-specific studies be conducted to support projects and efforts that will incorporate brackish groundwater resources into water resources planning. It is also important to note that these estimates are not the same as the TWDB calculated total estimated recoverable storge (TERS) volumes for the defined major and minor aquifers of Texas, which are confined to the aquifer boundaries used by the TWDB GAM models. Furthermore, this study utilized specific yield values that were determined by a recent core study (Standen, 2021) and they are significantly different than those used in previous TERS reports (Jones and Bradley, 2013; Jones and others, 2013). These volumes should not be used for joint groundwater planning or evaluation of achieving adopted desired future conditions in the same way total estimated recoverable storage and modeled available groundwater are used according to the joint planning process described in Texas Water Code § 36.108.

Table 1. Brackish groundwater storage volumes divided by hydrostratigraphic units of the Trinity Group. Values are in millions of acre-feet. Slightly saline is 1,000 to 3,000 milligrams per liter, moderately saline is 3,000 to 10,000 milligrams per liter, and very saline is 10,000 to 35,000 milligrams per liter total dissolved solids.

Hydrostratigraphic unit	Slightly saline	Moderately saline	Very saline	Total
Upper Glen Rose limestone	22.3	53.2	49.4	124.9
Lower Glen Rose limestone	35.6	61.7	67.3	164.6
Hensell sandstone	12.9	23.3	15.8	52.0
Cow Creek limestone	12.9	10.3	18.6	41.8
Sligo limestone	30.8	17.0	74.6	122.4
Hosston sandstone	87.0	77.6	217.0	381.6
Total	201.5	243.1	442.7	887.3

SALINITY SPATIAL DISTRIBUTIONS

Maps of the salinity distributions by hydrostratigraphic unit are shown in Figure 2. In general, fresh and slightly saline groundwater is present in the shallower updip northern portions of the study area. The average depths to brackish groundwater for each salinity class in the Upper Glen Rose limestone and Hosston Sandstone (the shallowest and deepest units, respectively) are shown in Table 2.

TWDB Report 388 and all data used for the study is available to the public and downloadable from the TWDB website: https://www.twdb.texas.gov/groundwater/bracs/studies/HillCountry_Trinity/index.asp.

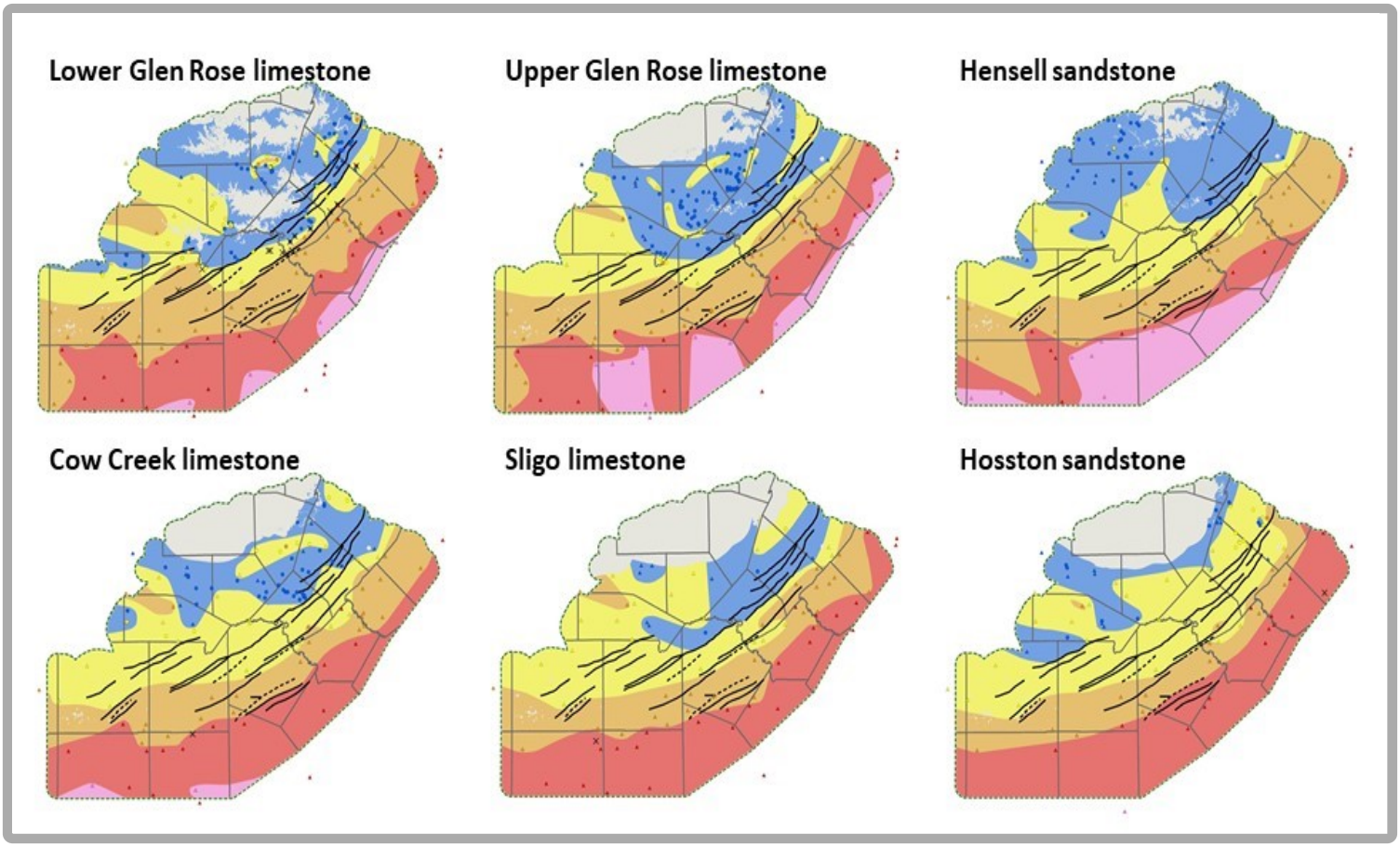

Figure 2. Southern portion of the Trinity aquifer salinity zones. Blue = fresh, yellow = slightly saline, orange = moderately saline, red = very saline, and pink = brine.

Table 2. Average minimum and maximum depths to brackish groundwater by salinity class.

Salinity class	Minimum average depth in the Upper Glen Rose limestone (feet below ground surface)	Maximum average depth in the Hosston sandstone (feet below ground surface)
Slightly saline	297	1,419
Moderately saline	2,257	3,897
Very saline	5,732	7,643

GEOLOGICAL CROSS SECTION

Figure 3 shows a dip-oriented cross section through the central study area, from Gillespie County to Wilson County. The cross section illustrates the way that differing hydrostratigraphic units can be laterally adjacent as a consequence of faulting, providing a means for cross-formational flow. A vertical-to-horizontal exaggeration of approximately 40x is used to visualize some of the thinner correlated units.

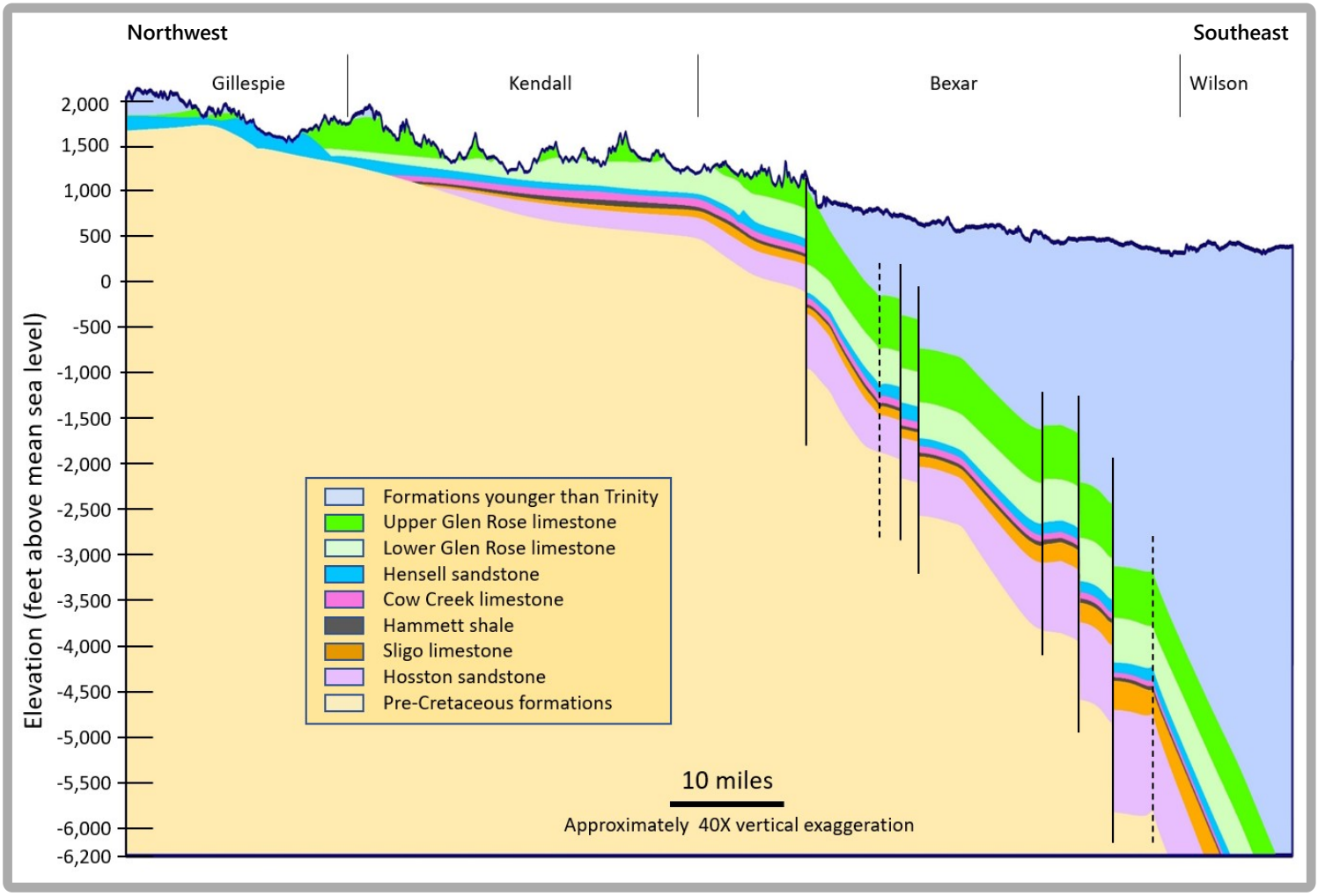

Figure 3. Geological dip-oriented cross section through the central study area.

REFERENCES

Jones, I.C., and Bradley, R., 2013, GAM Task 13-032: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 9: Texas Water Development Board, 24 p.

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