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

Scientific Investigations Map 3303
Pamphlet accompanies map

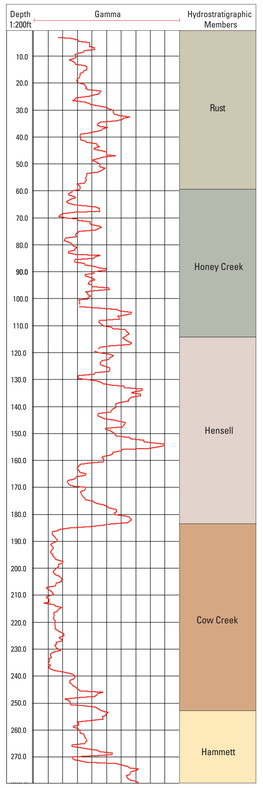


Figure 3. Geophysical log (gamma-ray) of the Springwood groundwater well (DX–68–13–209) located 0.5 mile east of the study area. This log does not include the uppermost Doeppenschmidt hydrostratigraphic unit. On the geophysical log, 1 foot corresponds to 200 feet of borehole.

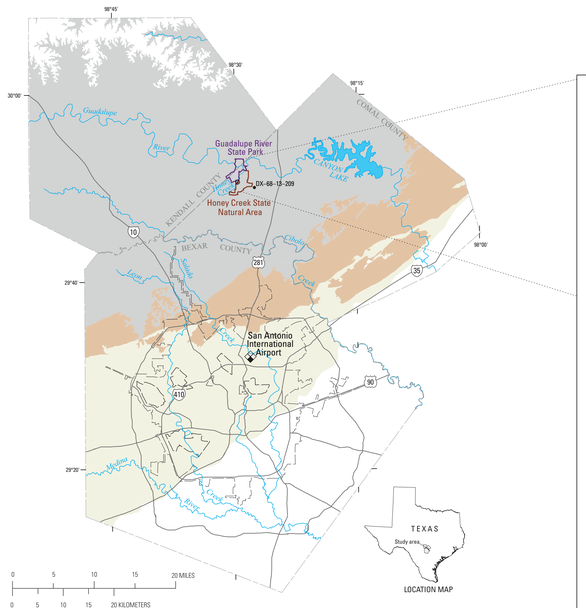
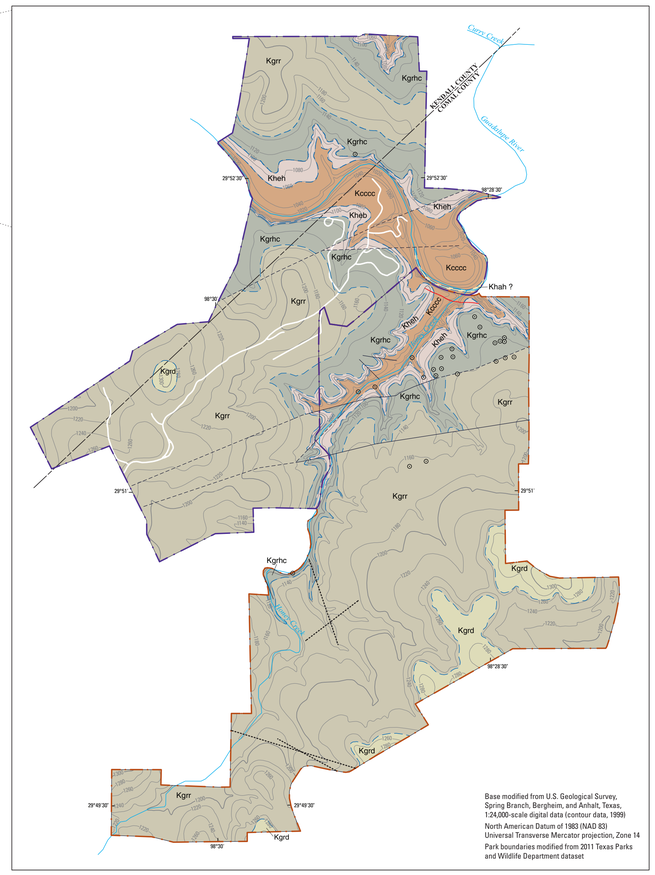


Figure 1. Location of the Guadalupe River State Park and Honey Creek State Natural Area, Bexar, Comal, and Kendall Counties, Texas.

EXPLANATION

- Trinity aquifer outcrop and Edwards aquifer catchment area (Maclay, 1995)
- Edwards aquifer outcrop (Ashworth and Hopkins, 1995)
- Edwards aquifer subcrop (Ashworth and Hopkins, 1995)
- City limit
- Honey Creek cave
- DX–68–13–209 Well and State Well number
- National Weather Service station

Hydrostratigraphic map of the Guadalupe River State Park and Honey Creek State Natural Area, Kendall and Comal Counties, Texas



Base modified from U.S. Geological Survey, Spring Branch, Bergheim, and Anhalt, Texas, 1:24,000-scale digital data (contour data, 1999)
North American Datum of 1983 (NAD 83)
Universal Transverse Mercator projection, Zone 14
Park boundaries modified from 2011 Texas Parks and Wildlife Department dataset

SCALE 1:24 000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

APPROXIMATE MEAN DECLINATION, 2014

Mapping was completed by A.R. Clark, with the help of C.D. Blome and R.R. Morris. D.E. Pedraza prepared the digital compilation and GIS database of the hydrostratigraphic map.

EXPLANATION OF HYDROSTRATIGRAPHIC UNITS

Stratigraphic unit		Informal hydrostratigraphic unit	
Glen Rose Limestone	Lower member	Kgrd	Doeppenschmidt
		Kgrr	Rust
		Kgrhc	Honey Creek
Pearsall Formation	Hensell Sand Member	Kheh	Hensell
	Cow Creek Limestone Member	Kcccc	Cow Creek
	Hammett Shale Member	Khah	Hammett

DESCRIPTION OF MAP UNITS

[Stratigraphic nomenclature of the Cretaceous rocks exposed in and around the study area are from Mancini and Scott (2006) and Barker and Ardis (1996) and the U.S. Geological Survey National Geologic Map Database, GEOLEX (*http://ngmdb.usgs.gov/Geolex/geolex.html*). The rocks exposed in the study area compose a section of the middle Trinity aquifer. The middle Trinity aquifer is composed of the lower member of the Glen Rose Limestone, and Hensell Sand Member and Cow Creek Limestone Member of the Pearsall Formation. The Hammett Shale of the Pearsall Formation acts as a barrier between the middle Trinity aquifer and the lower Trinity aquifer. The middle Trinity aquifer is from 284 to 297 ft thick in the study area. The lithostratigraphy of the study area was mapped and combined with the porosity characteristics using the classification system developed by Choquette and Pray (1970) to determine the hydrostratigraphic units. Detailed descriptions of the Lower Cretaceous rocks exposed in the study area are the compilation of this report and Stricklin and others (1971), Stricklin and Smith (1973), Amsbury (1974), Inden (1974), Perkins (1974), and Weirman and others (2010). The descriptions below include general information about the geologic formation or member, lithologies, thickness, primary fossils present, porosity, type locality, and the derivation of the unit's name. Averages and ranges of unit thicknesses shown below are derived from within the study area.]

Trinity Group (Lower Cretaceous)—Overlies, in the subsurface, Pennsylvanian shale (Imlay, 1940) in the study area. Contains shale, grainstone, sandstone, and fossiliferous limestone, alternating and interfingering with mudstone, wackestone, packstone, and grainstone. Upper part removed by erosion. Thickness of remaining Trinity Group approximately 566–579 ft

Glen Rose Limestone (Lower Cretaceous, lower Albian to upper Aptian)—Alternating beds of yellowish-tan, medium-bedded limestone and argillaceous limestone with minor evaporite layers. Composed of the lower and upper members (informal classification), separated by a regionally extensive, small fossil identified as *Corbula* sp. (Whitney, 1952). Entire upper member, corbula bed and upper part of the lower member, removed by erosion

Lower member of Glen Rose Limestone (Lower Cretaceous, lower Albian to upper Aptian)—Massive, fossiliferous mudstone and marlstone (Clark, 2003). Grainstone and biostromes interbedded with thin mudstone in the lower two-thirds of unit. Mudstone increases in the upper parts. Regionally, unit approximately 260 ft thick; however, upper portion removed by erosion and only about 185 ft preserved. Composed of the following hydrostratigraphic units in descending stratigraphic order: Doeppenschmidt (Kgrd), Rust (Kgrr) and Honey Creek (Kgrhc)

Kgrd **Doeppenschmidt hydrostratigraphic unit**—Aquifer; interparticle, moldic, burrowed, bedding plane, fracture and cave porosity. Thickness 60 ft. Named for the Doeppenschmidt homestead within study area

Kgrr **Rust hydrostratigraphic unit**—Confining unit; interparticle, fracture, and cave porosity. Thickness 70 ft. Named for Rust homestead in Guadalupe River State Park

Kgrhc **Honey Creek hydrostratigraphic unit**—Aquifer; contains interparticle, moldic, burrow, bedding plane, fracture, channel, and cave porosity. Contains corals and rudists. Forms of *Trigonia* sp. common. Thickness averages 55 ft. Named for Honey Creek Cave

Pearsall Formation (Lower Cretaceous)—Defined by Imlay (1945), contains five members the (bottom to top)—Hosston, Sligo, Hammett Shale, Cow Creek Limestone and the Hensell Sand. The Hosston member does not crop out in the study area; it is a dolomitic mudstone to grainstone. The Sligo member does not crop out in the study area, it is evaporite grading upward into mudstones to grainstones often dolomite (Bebout and others, 1981). The Hammett Shale is a burrowed mixture of clay, terrigenous silt, carbonate mud, dolomite, and carbonate particles (Amsbury, 1974). According to Lozo and Smith (1956) the Cow Creek Limestone is a calcarenitic limestone grading upward to a crossbedded beach coquina with poorly sorted quartz grains and scattered chert pebbles. The Hensell Sand is a weakly cemented mixture of clay, quartz and calcareous sand with chert and dolomite pebbles (Lozo and Smith, 1956)

Hensell Sand Member (Lower Cretaceous, upper Aptian)—Limestone and sandstone. Weakly cemented, contains ferruginous clay, quartz, and calcareous sandstone. Glauconitic quartz geodes common. *Exogyra* sp. and oysters present. Thickness from 40 to 70 ft. Contains Hensell hydrostratigraphic unit

Kheh **Hensell hydrostratigraphic unit**—Aquifer; interparticle, moldic, and cave porosity. Thickness from 40–70 ft. Named for Hensell Sand lithostratigraphic unit

Cow Creek Limestone Member (Lower Cretaceous, Aptian)—Predominantly carbonate. Base shaley, transitions into fine- to medium-grained, massive, off-white, partly honeycombed, and fossiliferous limestone up-section. Thickness about 72 ft (Barnes, 1974). Contains Cow Creek hydrostratigraphic unit

Kcccc **Cow Creek hydrostratigraphic unit**—Aquifer; interparticle, moldic, vug, burrow, fracture, bedding plane, channel and cave porosity. Thickness about 72 ft

Hammett Shale Member (Lower Cretaceous, lower Aptian)—Contains siltstone, thin dolomite, and claystone. Lower 15 ft contains siltstone and dolomite. Upper part is claystone with fine-grained sandstone streaks, contains fossiliferous, dolomitic limestone (Lozo and Stricklin, 1956; Weirman and others, 2010). Total thickness 50 ft (Lozo and Stricklin, 1956). Contains Hammett hydrostratigraphic unit

Khah **Hammett hydrostratigraphic unit**—Confining unit, contains little porosity. Thickness 50 ft. Named for the Hammett Shale lithostratigraphic unit

MAP EXPLANATION

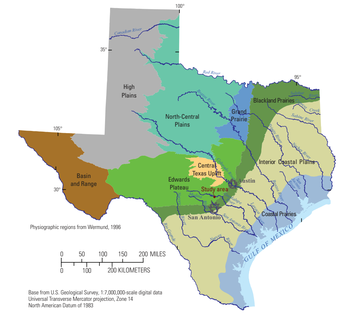
- **Fault, type unspecified**— Dashed where inferred
- **Fracture**
- **Igneous dike**
- **Contact**—Between hydrostratigraphic units
- **Guadalupe River State Park boundary**
- **Honey Creek State Natural Area boundary**
- **Road**
- **Cave or sinkhole**

Table 1. Summary of the geologic framework and hydrostratigraphy of the Trinity Group rock units in Guadalupe River State Park and Honey Creek State Natural Area, Kendall and Comal Counties, Texas.

[Period, group, formation, members, and lithology modified from Stricklin and others (1971), Stricklin and Smith (1973), Amsbury (1974), Inden (1974), Perkins (1974), and Weirman and others (2010); aquifers from Ashworth (1983); thicknesses from outcrop and geophysical logs; hydrogeologic function modified from Weirman and others (2010); porosity types modified from Choquette and Pray (1970) and Lucia (1995); IP, interparticle porosity; MO, moldic porosity; BU, burrowed porosity; BP, bedding plane porosity; FR, fracture porosity; CH, channel porosity; VUG, vug porosity; CV, cave porosity]

Geologic framework						Hydrostratigraphy					
Period	Group	Formation	Member	Approx. thickness (feet)	Lithology	Aquifer	Hydrostratigraphic unit	Thickness of outcrop in study area (feet)	Hydrogeologic function	Porosity type
Early Cretaceous	Trinity Group	Glen Rose Limestone	Lower member	185	*	*	*	*	*	*	*
					Packstone to grainstone with fossil fragments	Middle Trinity aquifer	Doeppenschmidt	60	Aquifer	IP, MO, BU, BP, FR, CV
					Alternating beds of marl and mudstones, miliolid grainstone, grainstone, nodular bioturbated wackestone, and monopluriids		Rust	70	Confining unit	IP, FR,CV
					Thick to massive beds of a *Toucasia* sp. grainstone; contains terrigenous sandstone, pelecypods, and fossil fragments		Honey Creek	55	Aquifer	IP, MO, BU, BP, FR, CH, CV
		Pearsall Formation	Hensell Sand Member	40–70	Reddish claystone and siltstone; contains terrigenous sandstone, pelecypods, and fossil fragments		Hensell	40–70	Aquifer	IP (upper), MO, CV
			Cow Creek Limestone Member	58	Very fine grained to fine-grained carbonate sand with localized bedding, upper part is a white, well sorted, fine- to medium-grained carbonate sand grainstone, locally recrystallized		Cow Creek	72	Aquifer	IP, MO, VUG, BU, FR, BP, CH, CV
				14	Dolomitic oyster mudstone to packstone						
			Hammett Shale Member	50	Upper: claystone, with siltstone lenticles Lower: siltstone and dolomite	Confining unit	Hammett	50	Confining unit	**

* *not present in the study area*
** *not aerially exposed in the study area*



EXPLANATION

Physiographic province
- Basin and Range
- Central Texas Uplift
- Edwards Plateau
- Grand Prairie
- High Plains
- North-Central Plains

Gulf Coastal Plain physiographic subprovince
- Blackland Prairies
- Coastal Prairies
- Interior Coastal Plains

Figure 2. Physiographic provinces in Texas.



Photograph 1. Guadalupe River, looking upstream towards the main river access point in the Guadalupe River State Park. Bedrock in the river is the lower part of the Cow Creek Limestone Member, Cow Creek hydrostratigraphic unit (Kcccc). Photograph by Robert R. Morris, USGS Volunteer for Science, November 10, 2011.

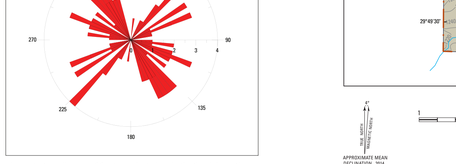


Figure 4. Rose diagram of fracture orientations in the Guadalupe River State Park and Honey Creek Natural Area, Kendall and Comal Counties, Texas.



Photograph 2. Looking downstream along the right bank of the Guadalupe River in the northwestern part of the study area, showing the cutback in the lower part of the Cow Creek Limestone Member. Photograph by Robert R. Morris, USGS Volunteer for Science, February 16, 2012.



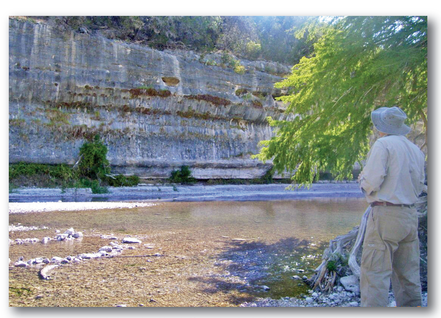
Photograph 3. U.S. Geological Survey geologist noting the contact between the Hensell Sand Member and the lower member of the Glen Rose Limestone near the western boundary of Guadalupe River State Park, Kendall County, Texas. Photograph by Robert R. Morris, USGS Volunteer for Science, November 9, 2011.



Photograph 4. Well-preserved hand specimen showing moldic porosity from the Honey Creek hydrostratigraphic unit (Kgrhc) a few feet above the contact between the Honey Creek unit and the underlying Hensell unit (Kheh). Smallest division on the scale along the lower portion of the image is 0.6 inch. Photograph by Robert R. Morris, USGS Volunteer for Science.



Photograph 5. Example of moldic and channel porosity in the Honey Creek hydrostratigraphic unit (Kgrhc) in Honey Creek State Natural Area, Comal County, Texas. Photograph by Robert R. Morris, USGS Volunteer for Science, November 9, 2011.



Photograph 6. Cow Creek hydrostratigraphic unit (Kcccc; Cow Creek Limestone Member) along the north side of Guadalupe River, Guadalupe River State Park, Kendall County, Texas. Photograph by Allan K. Clark, USGS, February 15, 2012.



Photograph 7. Top of the Cow Creek hydrostratigraphic unit (Kcccc; Cow Creek Limestone Member) along the south side of the Guadalupe River in Guadalupe River State Park, Kendall County, Texas. A part of the river can be seen near the middle of the left side of the photograph. Photograph by Robert R. Morris, USGS Volunteer for Science, February 15, 2012.



Photograph 8. USGS personnel recording details of the igneous dike in the Cow Creek unit (Kcccc) exposed on the north bank of Honey Creek. Photograph by Robert R. Morris, USGS Volunteer for Science, November 9, 2011.



Photograph 9. Igneous rock from dike and quartz geode in Honey Creek State Natural Area, Comal County, Texas. Photograph by Allan K. Clark, USGS, November 9, 2011.

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Geology and Hydrostratigraphy of the Guadalupe River State Park and Honey Creek State Natural Area, Kendall and Comal Counties, Texas

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2014

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