WELGE-LION MOUNTAIN AQUIFER: REVISITING A MINOR AQUIFER OF THE LLANO UPLIFT AQUIFER SYSTEM, CENTRAL TEXAS

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ABSTRACT

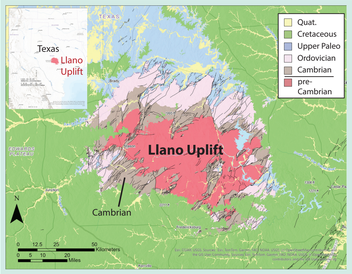
The Welge-Lion Mountain (WGLM) aquifer is an important component of the Paleozoic aquifer system in central Texas; but is not officially recognized as a minor aquifer by the state. This study highlights its significance, particularly in the context of growing water demands and climate variability.

The WGLM aquifer was originally described in Bluntzer (1992) and comprises the Cambrian Welge and Lion Mountain members (also called mid-Cambrian aquifer). The Welge is a well-sorted homogeneous quartz arenite, while the Lion Mountain is a fine- to medium-grained, glauconitic green sandstone. The units represent a high-energy near-shore, shallow marine tidal flat, and possibly locally fluvial depositional environments. The units have a combined thickness of up to 90 feet within the Llano Uplift and radiate away from the uplift into the subsurface. They are faulted and segmented, similar to other Paleozoic aquifers. The WGLM is above the Cambrian Hickory Sandstone aquifer and below the Cambro-Orodovician Ellenburger-San Saba aquifer.

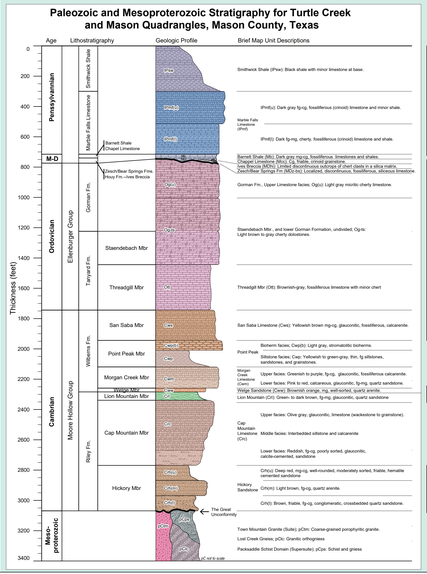
A query of the Texas Water Development Board (TWDB) well database, combined with data from the Hill Country Underground Water Conservation District, provided data for 260 wells completed in the WGLM for livestock, domestic, and public water supply. Data show WGLM wells producing across nine counties of the Llano Uplift region, with well depths ranging from 105 to 1207 feet, and yields ranging from 1.5 to 150 gallons per minute (gpm)--with an average yield of 41 gpm. The WGLM aquifer exhibits excellent water quality, with total dissolved solids (TDS) between 300 and 600 mg/L.

The WGLM aquifer satisfies the TWDB's definition of a minor aquifer because it supplies "relatively small quantities of water in large areas of the State." Recognizing its importance as a minor aquifer among the Paleozoic aquifers of the Llano Uplift will facilitate improved water resource planning, conservation, and management strategies.

Setting



Location map and simplified geologic map of central Texas. The WGLM aquifer is within the Cambrian (brown) exposures around the Llano Uplift. Source data: Geologic Atlas of Texas.



Minor Aquifers of Texas

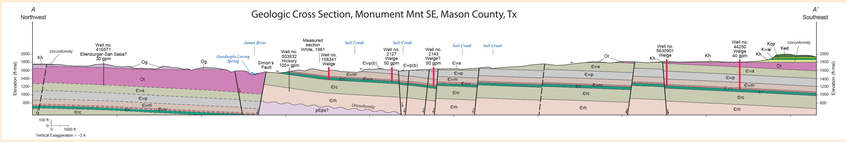
- Marble Falls
- Ellenburger-San Saba
- Welge-Lion Mnt
- Hickory

Stratigraphic and hydrostratigraphic column of the Llano Uplift region. Officially recognized aquifers include the Marble Falls, Ellenburger-San Saba, and the Hickory.

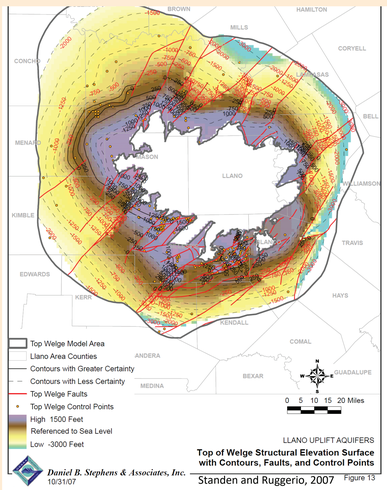
Geology

(Above) Exposure of the WGLM aquifer within a roadcut along FM 1431, Hoover Point Lookout, Burnet County, Texas, USA.

(Left) Welge sandstone outcrop with cross bed structures suggesting fluvial setting.
(Right) Lion Mountain sandstone with herringbone crossbeds suggesting tidal setting.

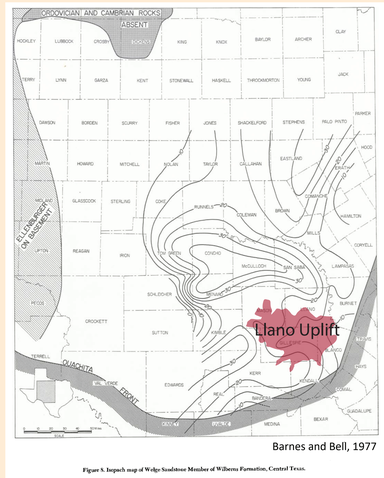


Geologic cross section from the Monument Mountain SE quadrangle in Mason County, Texas. Figure from Hunt (2023). Detailed mapping and well data illustrates that many domestic and agricultural wells are completed within the WGLM aquifer, with most completed solely in the Welge member.



Standen and Ruggerio, 2007

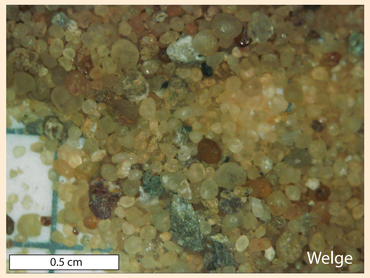
The WGLM aquifer radiates away from the center of the Llano Uplift. Paleozoic-age faults segment and compartmentalize the aquifer.



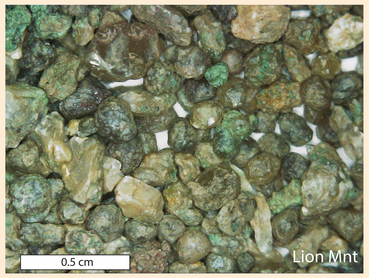
Barnes and Bell, 1977

The Welge member is the most-productive unit of the WGLM aquifer and has a thickness of 10-30 ft in the subsurface, similar to outcrop thickness.

Hydrogeology



Cuttings from the Welge Member within well 476428 at a depth of 290 ft.

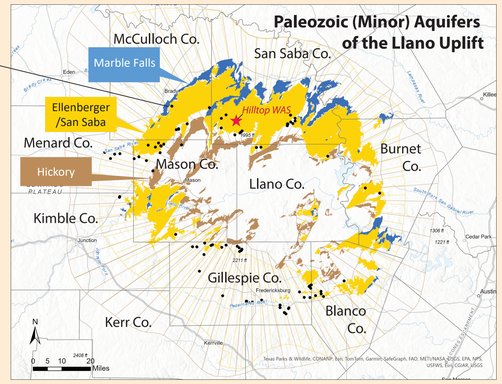


Cuttings from Lion Mountain Member within well 114382 at a depth of 220 ft.

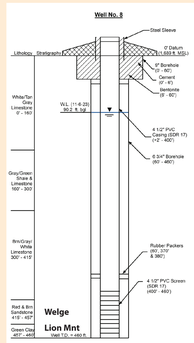
91 WGLM wells in the TWDB database across 9 counties.

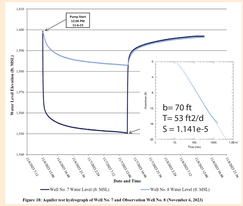
Additional 169 wells not on map in Gillespie County. Total of 260 WGLM wells in study compilation:

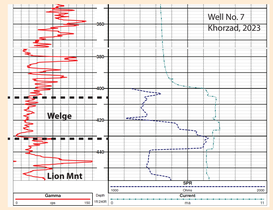
- Use: livestock, domestic, and public water supply.
- Depths: 105 to 1207 feet
- Yield: 1.5 to 150 gallons per minute (gpm); average of 41 gpm.
- Total dissolved solids (TDS): 300 and 600 mg/L.



Example Ground Water Availability Study







Example results from groundwater availability study for the WGLM aquifer in San Saba County (Hilltop study indicated on map above). Data and evaluation from Khorzad, 2023. Aquifer testing of five well pairs within a 900-acre proposed subdivision resulted in fresh water with average pumping of 13.5 gpm, specific capacity of 0.2 to 4.0 gpm/ft and transmissivity range of 46 to 311 ft²/d (avg 80 ft²/d).

Conclusions

The WLM aquifer satisfies the State's definition of a minor aquifer and is clearly a high-quality and important groundwater resource. Recognizing its importance as a minor aquifer among the Paleozoic aquifers of the Llano Uplift will facilitate improved water resource planning, conservation, and management strategies.

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