Appendix B
Aquifer Descriptions and
Groundwater Availability Analysis
Blaine Aquifer

Location
The Blaine Aquifer, a minor aquifer, occurs in the extreme western part of Brazos G and east of the High Plains of Texas (Figure B-1).

Geohydrology
The Blaine Formation of the Pease River Group of Permian Age consists of beds of gypsum, anhydrite, halite, dolomite, sandstone, and shale. Not all beds are found throughout the formation, however the individual beds of gypsum and dolomite are laterally continuous. Recharge primarily occurs from precipitation on the outcrop, which is along the eastern edge of the formation. Discharge is to the wells, seepage to streams, or leakage to other formations. Saturated thickness reaches 300 feet in the aquifer, but freshwater saturated thickness averages about 135 feet. Groundwater occurs primarily in solution channels and caverns within the beds of anhydrite and gypsum that contribute to the overall poor quality of the water. Although some wells contain slightly saline water, with total dissolved solids between 1,000 and 3,000 milligrams per liter, most contain moderately saline water, with total dissolved solids between 3,000 and 10,000 milligrams per liter, exceeding secondary drinking water standards for Texas. The aquifer is under water table conditions in the eastern part of the aquifer and under confined conditions to the west.

Development and Use
While the upper part of the Blaine provides irrigation supplies from solutioning of gypsum and dolomite beds in adjacent planning areas, Ogilbee (1962) reports that similar conditions are not present in Knox County. They probably do not exist in Fisher, Nolan and Stonewall Counties either. The TWDB data base shows only a few livestock and household wells in the Blaine Aquifer in the four counties. These data show inventoried Blaine wells be less than 200 ft deep. Water quality is highly variable. The TWDB estimated 2012 pumpage from Blaine Aquifer to total 478 acft/yr, of which 11 acft/yr is for municipal use.

Availability
The Blaine Aquifer in Brazos G is in GMA-6. In a letter dated December 2011, the TWDB referenced a report titled GAM Run 10-056 MAG, which presents the MAG for the Blaine Aquifer in GMA-6. The MAG determination utilized the Desired Future Conditions (DFC’s provided by the GMA-6 representative) and version 1.01 groundwater model of the Seymour and Blaine aquifers. Using the approach outlined by the TWDB, the MAG is calculated for each county. The results are presented in the following table.
**Blaine Aquifer**

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>2020</th>
<th>2030</th>
<th>2030</th>
<th>2050</th>
<th>2060</th>
<th>2070</th>
</tr>
</thead>
<tbody>
<tr>
<td>FISHER</td>
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<td>5,062</td>
<td>5,062</td>
<td>5,062</td>
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<td>KNOX</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>NOLAN</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<td>100</td>
</tr>
<tr>
<td>STONEWALL</td>
<td>8,700</td>
<td>8,700</td>
<td>8,700</td>
<td>8,700</td>
<td>8,700</td>
<td>8,700</td>
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<tr>
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<td>14,562</td>
<td>14,562</td>
<td>14,562</td>
<td>14,562</td>
<td>14,562</td>
</tr>
</tbody>
</table>

**Well Yields and Water Quality**

Any extensive development of this aquifer is unlikely because of the frequent occurrence of poor quality water and low well yields.

**Resource Considerations**

Counties in groundwater districts include: Knox (Rolling Plains Groundwater Conservation District (GCD)), Fisher (Clear Fork GCD), and Nolan (Wes-Tex GCD).

**References**


Figure B-1. Location of Blaine Aquifer in Brazos G
Brazos River Alluvium Aquifer

Location
The Brazos River Alluvium Aquifer is a minor aquifer and occurs along the floodplain and terrace deposits of the Brazos River downstream of Hill and Bosque Counties. The width of the aquifer ranges from less than one to almost seven miles. The Brazos River Alluvium Aquifer in Brazos G occurs in parts of Hill, Bosque, McLennan, Falls, Milam, Robertson, Burleson, Brazos, Washington and Grimes Counties. It is limited to the valley area along the Brazos River (Figure B-2).

Geohydrology
The river alluvium forms a floodplain and a series of terraces. The floodplain is of primary significance as a source of groundwater locally, however, groundwater also may occur in the terrace deposits that are outside the floodplain. The alluvium consists of layers of clay, silt, sand and various mixtures. The coarsest and best water-bearing zones are in the lower part of the aquifer. Water in the floodplain alluvium usually exists under water table conditions, although leaky artesian conditions may occur locally where there are extensive lenses of clay. The maximum saturated thickness of the alluvium is about 85 feet. The primary source of recharge is precipitation on the floodplain. Lesser amounts of recharge are losses of runoff in streams crossing the floodplain, groundwater discharge from adjacent aquifers and return flow from irrigation water. Discharge is mostly by seepage to the Brazos River, evapotranspiration, and wells.

Development and Use
The year 2012 Brazos G groundwater use for the Brazos River Alluvium Aquifer was estimated to be 128,528 acft with approximately 99 percent for irrigation.

Availability
The Brazos River Alluvium Aquifer in Brazos G is in GMA-12. In a letter dated July 2012, the TWDB referenced a report titled STA Aquifer Assessment 10-20 MAG, which presents the MAG. The MAG was determination by utilization of analytical groundwater budget equations with allowances for Desired Future Conditions provided by the GMA-12 representative Using the approach outlined by the TWDB, the MAG is calculated for each county. The results are presented in the following table
### Brazos River Alluvium Aquifer

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
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<td>830</td>
<td>830</td>
<td>830</td>
<td>830</td>
<td>830</td>
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<tr>
<td>BRAZOS</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
</tr>
<tr>
<td>BURLESON</td>
<td>22,056</td>
<td>22,056</td>
<td>22,056</td>
<td>22,056</td>
<td>22,056</td>
</tr>
<tr>
<td>FALLS</td>
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<td>16,684</td>
<td>16,684</td>
<td>16,684</td>
<td>16,684</td>
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<tr>
<td>GRIMES</td>
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<td>5,112</td>
<td>5,112</td>
<td>5,112</td>
<td>5,112</td>
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<tr>
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<td>632</td>
<td>632</td>
<td>632</td>
<td>632</td>
<td>632</td>
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<tr>
<td>MCLENNAN</td>
<td>15,023</td>
<td>15,023</td>
<td>15,023</td>
<td>15,023</td>
<td>15,023</td>
</tr>
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<td>MILAM</td>
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<td>3,082</td>
<td>3,082</td>
<td>3,082</td>
<td>3,082</td>
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<td>ROBERTSON</td>
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<td>6,300</td>
<td>6,300</td>
<td>6,300</td>
</tr>
<tr>
<td>WASHINGTON</td>
<td>5,770</td>
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<td>5,770</td>
<td>5,770</td>
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<td>87,989</td>
<td>87,989</td>
<td>87,989</td>
<td>87,989</td>
</tr>
</tbody>
</table>

**Well Yields**
Yields from large supply wells are typically between 250 and 500 gallons per minute (gpm). Well yields are considerably less at the edges of the alluvium, and where there is minimal sand thickness or a considerable amount of silt and/or clay is present.

**Water Quality**
Water quality from the Brazos River Alluvium Aquifer varies widely, even within short distances. Concentrations of dissolved solids exceed 1,000 milligrams per liter (mg/L) in many areas; but, water is sufficiently fresh to meet drinking water standards in some areas. Data show the aquifer generally having 500 to 3,000 mg/L dissolved solids content. Areas with dissolved solids concentrations less than 500 mg/L or greater than 3,000 mg/L are of limited extent. Local groundwater contamination from agriculture chemicals is likely in intensively irrigated areas.

**Resource Considerations**
Any extensive development of this aquifer is likely to cause some reductions of streamflow in the Brazos and Little Brazos Rivers.

Counties with groundwater conservation districts in the Brazos G include: Bosque (Middle Trinity GCD, Grimes (Bluebonnet GCD), Hill (Prairielands GCD), Robertson and Brazos (Brazos Valley GCD), McLennan (McLennan County GCD) and Milam and Burleson (Post Oak Savannah GCD).

**References**

Figure B-2. Location of Brazos River Alluvium Aquifer in Brazos G
Carrizo-Wilcox Aquifer

Location
The Carrizo-Wilcox, a major aquifer within the Brazos G, is of major significance in water planning due to a relatively large supply of undeveloped water. It traverses a southeastern part of the Brazos G in a northeast-southwest-trending band and extends into adjoining planning areas (Figure B-3). It occurs within the Brazos G primarily in parts of Brazos, Burleson, Lee, Limestone, Milam, and Robertson Counties.

Geohydrology
The Carrizo Formation and the underlying Wilcox Group, which is divided into the Calvert Bluff, Simsboro, and Hooper units, form the Carrizo-Wilcox Aquifer. The Simsboro is a major water-bearing unit across the Brazos G and also in neighboring planning areas. Between the Colorado and Trinity Rivers, the Simsboro sands are uniquely productive and are largely separated from overlying and underlying geologic units by clays of low permeability. The sands in the Simsboro and Carrizo are overwhelmingly the two most significant water-bearing zones in the Carrizo-Wilcox. The Calvert Bluff and Hooper are generally tapped only by shallow wells. The Carrizo-Wilcox consists of a thick sequence of ancient river and delta deposits, consisting mostly of sand, silt, and clay. Total thickness is typically between 2,000 and 3,000 feet, and net sand thickness can exceed 50 percent of the total thickness. Some important coal (lignite) deposits occur primarily within the Calvert Bluff. From surface outcrops (recharge areas) the Carrizo-Wilcox zones dip coastward beneath younger strata. Water table conditions occur in recharge areas, and artesian conditions occur in downdip areas. Precipitation is the main source of recharge. A substantial, but unknown, amount of recharge is rejected by evapotranspiration in the outcrop. Freshwater sands occur up to 30 miles south of recharge areas and to depths up to about 3,000 feet in the most permeable sands. Slightly saline water occurs just to the southeast (coastward) of the fresh water. Faulting within the Mexia-Talco Fault Zone occurs in about a 5-mile wide belt across parts of Lee, Burleson, Milam, and Robertson Counties. The faults affect position, continuity, and possibly water quality within the Carrizo-Wilcox zones in variable and mostly unknown ways.

Development and Use
The year 2012 Brazos G groundwater use for the Brazos River Alluvium Aquifer was estimated to be 49,299 acft with approximately 55 percent for municipal purposes. Relatively large amounts of municipal water use is by Bryan, College Station, Texas A&M, Hearne and Rockdale. Most of the irrigation is in Milam and Robertson Counties.

Availability
The Carrizo-Wilcox in Brazos G is in GMA-12 and 14. In letter dated November 2011 to GMA-14, TWDB referenced a report titled GAM Run 10-052 MAG Version 2, which presents the MAG. In letter dated July 2012 to GMA-12, TWDB referenced a report titled GAM Run 10-044 MAG, which presents the MAG. The MAGs was determination by utilization of Version 2.01 of the central Sparta, Queen City, and Carrizo-Wilcox GAM and the specified Desired Future
Conditions provided by the GMA-12 and GMA-14 representatives. The results are presented in the following table.

### Carrizo-Wilcox Aquifer

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
<th>2060</th>
<th>2070</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAZOS</td>
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<td>49,421</td>
<td>53,970</td>
<td>57,169</td>
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</tr>
<tr>
<td>BURLESON</td>
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<td>28,047</td>
<td>32,518</td>
<td>36,492</td>
<td>38,701</td>
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</tr>
<tr>
<td>FALLS</td>
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<td>875</td>
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<td>11,791</td>
<td>11,791</td>
<td>11,791</td>
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<tr>
<td>LEE</td>
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<td>23,402</td>
<td>24,624</td>
<td>26,827</td>
<td>27,380</td>
<td>27,380</td>
</tr>
<tr>
<td>LIMESTONE</td>
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<td>12,604</td>
<td>12,906</td>
<td>12,906</td>
<td>12,906</td>
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<tr>
<td>MILAM</td>
<td>23,923</td>
<td>20,206</td>
<td>19,112</td>
<td>21,359</td>
<td>22,319</td>
<td>22,319</td>
</tr>
<tr>
<td>ROBERTSON</td>
<td>45,435</td>
<td>45,814</td>
<td>46,238</td>
<td>46,582</td>
<td>46,583</td>
<td>46,583</td>
</tr>
<tr>
<td>WILLIAMSON</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>TOTAL</td>
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<td>187,413</td>
<td>197,199</td>
<td>210,829</td>
<td>217,751</td>
<td>217,751</td>
</tr>
</tbody>
</table>

### Well Yields

Wide variations occur in individual well yields for the four Carrizo-Wilcox hydrogeologic units, mostly depending on well depth and local sand thickness. Estimated ranges for maximum individual well yields are from 500 to 2,000 gpm for the Carrizo, from 100 to 300 gpm for the Calvert Bluff, from 500 to 3,000 gpm for the Simsboro, and from 100 to 300 gpm for the Hooper.

### Water Quality

Water generally meets drinking water standards, but local exceptions occur. Excessive iron concentrations are the most common water quality problem, and some water supplies must be treated. Hydrogen sulfide and methane occurrences are occasionally reported. Water obtained near the outcrops of the water-bearing zones generally is higher in hardness and lower in total dissolved solids content. In downdip areas the water is commonly a sodium-bicarbonate-type water, with total dissolved solids content ranging from about 300 to 800 mg/L and averaging 400 to 500 mg/L. The dissolved solid concentrations tend to be greater at the downdip limit of the aquifer.

### Resource Considerations

Few development problems have occurred to date, and water-level declines have been relatively small or restricted to pumping centers near larger developments. No important pollution problems are evident. One potential impact of a very significant drawdown is causing some wells to fail because they are either too shallow or the casing is too small to lower the pump as deep as needed.
There are four groundwater conservation districts that oversee the development and management of the Carrizo-Wilcox Aquifer within the Brazos G. The counties with a groundwater conservation district include: Lee (Lost Pines GCD), Robertson and Brazos (Brazos Valley GCD), Milam and Burleson (Post Oak Savannah GCD), and Grimes (Bluebonnet GCD).

References


Figure B-3. Location of Carrizo-Wilcox Aquifer in Brazos G
Dockum Aquifer

Location
The Dockum, a minor aquifer, occurs only along in the western parts of Nolan, Fisher, and Kent Counties within the Brazos G (Figure B-4). It’s important to note that there is a discrepancy in the occurrence of the Dockum as shown in Figure B-4 and in the Shamburger, 1967 report. The Shamburger report shows the Dockum extending into the mid-part of Nolan County, while the TWDB delineation is limited to the extreme western edge of the county.

Geohydrology
Water is derived largely from sands and gravels in the Santa Rosa Formation of Permian age or from the Santa Rosa and the overlying Trinity Sands in a western Nolan County. Water table conditions mostly prevail.

Development and Use
The year 2012 groundwater use within the Brazos G totaled 12,959 acft. Almost all the water is used for irrigation in Nolan County.

Availability
The Dockum in Brazos G is in GMA-6 and 7. In letter dated December 2011 to GMA-6, TWDB referenced a report titled GAM Run 10-057 MAG, which presents the MAG. In letter dated July 2012 to GMA-7, TWDB referenced a report titled GAM Run 10-057 MAG Version 2, which presents the MAG. The MAGs was determination by using a modified version of the Dockum GAM, and the specified Desired Future Conditions provided by the GMA-6 and GMA-7 representatives. The results are presented in the following table.

<table>
<thead>
<tr>
<th>Dockum Aquifer</th>
<th>County</th>
<th>Modeled Available Groundwater (acft/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2020</td>
<td>2030</td>
</tr>
<tr>
<td>FISHER</td>
<td>2,880</td>
<td>2,880</td>
</tr>
<tr>
<td>KENT</td>
<td>6,250</td>
<td>6,250</td>
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<tr>
<td>NOLAN</td>
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<td>2,926</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12,056</td>
<td>12,056</td>
</tr>
</tbody>
</table>

Well Yields and Water Quality
Well yields vary widely, ranging from less than 10 gpm to 400 gpm and averaging 200 gpm. Water from the aquifer typically meets drinking water standards and contains 500 to 600 mg/L dissolved solids content. However, in heavily irrigated areas, elevated concentrations of nitrates have been reported.
Resource Considerations

There are three groundwater conservation districts in Brazos G counties where the Dockum Aquifer is present. Groundwater management in Nolan County is by Wes-Tex GCD. There is little pumpage from the Dockum in the Kent County (Salt Fork UWCD) and Fisher County (Clear Fork GCD).

References


Figure B-4. Location of Dockum Aquifer in Brazos G
Edwards (Balcones Fault Zone) Aquifer

Location
The northern segment of the Edwards (Balcones Fault Zone (BFZ) Aquifer is a major aquifer and occurs in the southern part of central Brazos G. This segment of the aquifer also extends into the adjacent planning area to the south (northern Travis County, but only to the Colorado River). The northern segment of the Edwards (BFZ) is hydraulically separate from the Edwards (BFZ) occurring south of the Colorado River (the Barton Springs segment) and the Edwards (BFZ) even further south (San Antonio segment). The northern segment of the Edwards (BFZ) appears to be overdeveloped except during average and wet times, and some supplies are subject to shortages in larger droughts.

The Edwards (BFZ) in the Brazos G occurs in a narrow north-south-trending belt across parts of Williamson and Bell Counties (Figure B-5), essentially extending from Round Rock to Salado.

Geohydrology
The Edwards (BFZ) Aquifer consists of the Edwards and associated limestone, including the Comanche Peak, Kiamichi and Georgetown. However, significant water-bearing zones are normally restricted to the Edwards (BFZ), with associated limestone commonly yielding little to no water according to test drilling records (Harden, 1999). The source of the water is infiltration of rainfall and seepage from streams. The water moves primarily in honeycombed, solution-enlarged voids and other enlarged secondary porosity zones along joints and faults. The formation dips to the east beneath younger strata. Water table conditions occur in recharge areas (mostly west of IH-35), and artesian conditions occur further east. At the eastern boundary of the aquifer the water quality becomes more mineralized and eventually unusable for most purposes. The water moves from recharge areas to natural spring discharge points and to wells. The three largest springs (and their approximate high and low flows) include San Gabriel Springs at Georgetown (zero to 25 cubic feet per second (cfs)), Berry Springs north of Georgetown (zero to 48 cfs) and Salado Springs at Salado (5 to 59 cfs). The Edwards (BFZ) responds more quickly than most other aquifers to drought and wet cycles. With adequate rainfall, the aquifer is able to supply substantial water to current users and sustain substantial springflow at the three main locations. In times of below-average rainfall or drought, discharge exceeds recharge with the result being most springflow decreases greatly or dries up and some wells begin to fail. Over the years more and more wells have been drilled and increasingly diminished springflow has occurred. Introduction of surface water supplies has slowed the trend, but competition for Edwards (BFZ) water in the area is continuing.

Development and Use
The year 2012 groundwater use within the Brazos G totaled 19,358 acft. About 90 percent of the water is used for municipal supply, of which about 85 percent is in Williamson County.
Availability
The Northern Edwards (BFZ) Aquifer in Brazos G is in GMA-8. In letter dated September 2008 to GMA-8, TWDB referenced a report titled GAM Run 08-10 MAG, which presents the MAG. The MAGs was determination by using the Northern Edwards (BFZ) (Northern Segment) Aquifer GAM, and the specified Desired Future Conditions provided by the GMA-8 representative. The results are presented in the following table.

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>2020</th>
<th>2030</th>
<th>2030</th>
<th>2050</th>
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<th>2070</th>
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<td>6,469</td>
<td>6,469</td>
<td>6,469</td>
<td>6,469</td>
<td>6,469</td>
</tr>
<tr>
<td>WILLIAMSON</td>
<td>3,452</td>
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<td>3,452</td>
<td>3,452</td>
<td>3,452</td>
<td>3,452</td>
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<tr>
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<td>9,921</td>
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<td>9,921</td>
</tr>
</tbody>
</table>

Well Yields
Wide variations occur in individual well yields obtainable from the Edwards (BFZ). Well yields depend upon boreholes encountering secondary, solution-enlarged openings in the limestone. Wells used for public supply range from 200 to about 2,000 gpm.

Water Quality
Water, although hard, meets drinking water standards with dissolved solids content mostly less than 500 mg/L in developed areas. Further east, the water becomes more mineralized. The fluoride content is high in some of the downdip eastern areas.

Resource Considerations
Groundwater resources appear to be overdeveloped during record drought conditions. Existing local plans of the larger users have long included conjunctive use plans with surface waters from Lakes Georgetown, Travis, and/or Stillhouse Hollow. Significant groundwater pumpage can reduce springflow, and the aquifer is locally subject to pollution from surface sources. The higher withdrawals by wells can directly affect springflow and downstream surface water supplies.

A groundwater district exists in Bell County (Clearwater UWCD).

References

Harden, R. W., 1999, personal communication.


**Figure B-5. Location of Edwards (BFZ) Aquifer (northern segment) in Brazos G**
Edwards-Trinity (Plateau) Aquifer

Location
The Edwards-Trinity (Plateau) Aquifer is a major aquifer in Texas due to its expansive coverage and available water supplies. In the Brazos G, this aquifer is found only in parts of Nolan and Taylor Counties (Figure B-6). It provides only a very small water supply to the planning region.

Geohydrology
Water from the Edwards-Trinity (Plateau) is derived largely from Cretaceous sands (Trinity) in Nolan County in combination with the underlying Dockum, which exists in some areas. Water-table conditions are typical. Maximum well yields typically are less than 50 gallons per minute. In western Nolan County, much of the water production is associated with the Edwards-Trinity (Plateau) because of the surface geology, but the major water-bearing zone of higher capacity wells is the underlying Dockum.

Availability
The Edwards-Trinity (Plateau) Aquifer in Brazos G is in GMA-7 and 8. In letter dated November 2012 to GMA-8, TWDB referenced a report titled GAM Run 10-043 MAG Version 2, which presents the MAG. The MAGs was determination by using the Edwards-Trinity (Plateau) and Pecos Valley Aquifers GAM, and the specified Desired Future Conditions provided by the GMA-8 representative. The results are presented in the following table.

<table>
<thead>
<tr>
<th>Edwards-Trinity (Plateau) Aquifer</th>
<th>Modeled Available Groundwater (acft/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNTY</td>
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</tr>
<tr>
<td>NOLAN</td>
<td>693</td>
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<tr>
<td>TAYLOR</td>
<td>489</td>
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<tr>
<td>TOTAL</td>
<td>1,182</td>
</tr>
</tbody>
</table>

Well Yields and Water Quality
Potential well yields are generally less than 100 gpm. Typical waters meet drinking water standards and contain 400 to 500 mg/L dissolved solids content.

Resource Consideration
In 2012, the TWDB estimated the total pumpage from the aquifer to be 2,631 acft. Most of the usage was for municipal purposes in Nolan County. Few undeveloped supplies appear available. Existing supplies appear to be susceptible to droughts.

Groundwater in Nolan County is regulated by Wes-Tex GCD.
References


Figure B-6. Location of Edwards-Trinity (Plateau) Aquifer in Brazos G
Ellenburger-San Saba Aquifer

Location
The Ellenburger-San Saba Aquifer, a minor aquifer, occurs in the Brazos G, but only in the southwestern part of Lampasas County (Figure B-7). It primarily occurs in adjacent planning area to the south and west.

Geohydrology
The aquifer consists of limestone and dolomites with secondary solutioning along fractures and faults. The aquifer extends from outcrops and dips to depths of perhaps 2,000 feet. Little is known about conditions in the deeper parts of the aquifer. In some areas the aquifer is believed to be connected to the Marble Falls Aquifer. Faults are believed to function as an important part in controlling groundwater flow and water levels. The aquifer supports numerous springs, is lightly used, and usually has less than 1,000 mg/L dissolved solids.

Development and Use
In 2012, the TWDB estimated pumpage to be about 22 acft.

Availability
The Ellenburger-San Saba Aquifer in Brazos G is in GMA-8 and only occurs in Lampasas County. In letter dated March 2012 to GMA-8, TWDB referenced a report titled GTA Aquifer Assessment 10-15 MAG, which presents the MAG using a water budget approach. The results are 2,953 acft/yr from 2020-2070.

Resource Considerations
Groundwater resources are large in relation to current use and future local demand. The Saratoga Underground Water Conservation District has jurisdiction in Lampasas County.

References


Figure B-7. Location of Ellenburger-San Saba Aquifer in Brazos G

Source: Texas Water Development Board
Gulf Coast Aquifer

Location
The Gulf Coast Aquifer, a major aquifer, occurs in a limited area in the southeastern part of the Brazos G. It occurs in a northeast-southwest-trending band and extends into adjoining planning areas (Figure B-8). In the Brazos G the aquifer is present primarily in Washington and in the southern two-thirds of Grimes Counties. A small part of the aquifer exists in the extreme southernmost part of Brazos County, but is not considered to be sufficiently productive for regional planning purposes.

Geohydrology
The Gulf Coast Aquifer consists primarily of four water-bearing zones, the deepest being the Catahoula. The Catahoula is overlain by the Jasper Aquifer (mostly within the Oakville Sandstone). The Burkeville confining layer separates the Jasper from the overlying Evangeline Aquifer, which is contained within the Fleming and Goliad Sands. The Chicot Aquifer overlies the Evangeline and is the uppermost component of the Gulf Coast Aquifer. The Chicot consists of the Lissie, Willis and younger formations.

The water-bearing zones present consist of a complex sequence of ancient river and delta deposits, consisting mostly of interbedded and interfingering sands, silts and clays which thicken coastward. The strata form a leaky artesian aquifer system of large extent along the Texas Coastal Plain. Total thickness in the Brazos G is up to 1,200 feet, and net sand thickness is about 20 percent of the total thickness. From surface outcrops (recharge areas) the sand zones dip coastward beneath younger strata. Water table conditions occur in recharge areas, and artesian conditions occur in downdip areas. Precipitation is the main source of recharge, and large amounts of recharge are rejected by evapotranspiration in the outcrop. Mostly only freshwater sands occur in the Brazos G, and they extend to depths as great as 1,200 feet. However, some slightly saline water sands occur in the deeper extents of the Catahoula.

Development and Use
The year 2012 groundwater use within the Brazos G totaled 3,246 acft. About 80 percent of the water is used for municipal and industrial supply. About 60 percent of the pumpage is in Washington County.

Availability
The Gulf Coast Aquifer in Brazos G is in GMA-12 and 14. In letter dated November 2011 to GMA-14, TWDB referenced a report titled GAM Run 10-038 MAG, which presents the Modeled Available Groundwater MAG. The MAGs was determination by using the Gulf Coast Aquifer GAM, and the specified Desired Future Conditions provided by the GMA-14 representative. The results are presented in the following table.
Gulf Coast Aquifer

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>2020</th>
<th>2030</th>
<th>2030</th>
<th>2050</th>
<th>2060</th>
<th>2070</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAZOS</td>
<td>1,189</td>
<td>1,189</td>
<td>1,189</td>
<td>1,189</td>
<td>1,189</td>
<td>1,189</td>
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<tr>
<td>GRIMES</td>
<td>13,850</td>
<td>13,309</td>
<td>13,086</td>
<td>13,086</td>
<td>13,086</td>
<td>13,086</td>
</tr>
<tr>
<td>WASHINGTON</td>
<td>13,045</td>
<td>13,045</td>
<td>12,677</td>
<td>12,677</td>
<td>12,677</td>
<td>12,677</td>
</tr>
<tr>
<td>TOTAL</td>
<td>28,084</td>
<td>27,543</td>
<td>26,952</td>
<td>26,952</td>
<td>26,952</td>
<td>26,952</td>
</tr>
</tbody>
</table>

Well Yields
Wide variations occur in individual well yields obtainable from the primary water-bearing sands, depending on area, depth, and local sand thickness. Estimated ranges for maximum individual well yields are 300 to 800 gpm.

Water Quality
Water generally meets drinking water standards, but local exceptions occur. Iron content is occasionally a problem. Waters obtained near the outcrops of the water-bearing zones are generally higher in hardness and lower in total dissolved solids content. In downdip areas the water is commonly a calcium-bicarbonate-type water, with total dissolved solids content ranging up to 1,000 mg/L.

Resource Considerations
Groundwater resources are largely undeveloped, few development problems have occurred to date and water-level declines are minimal to none. Few and limited water pollution problems are apparent. Counties with groundwater conservation districts include: Grimes (Bluebonnet GCD) and Robertson and Brazos (Brazos Valley GCD).

References

Baker, E.T., Jr., 1979, Stratigraphic and hydrogeologic framework of part of the Coastal Plain of Texas: TDWR Report 236.


Sandeen, W.M., 1972, Ground-water resources of Washington County, Texas: TWDB Report 162.
Figure B-8. Location of Gulf Coast Aquifer in Brazos G
Hickory Aquifer
The Hickory Aquifer, a minor aquifer, occurs in the southwest half of Lampasas County and the western tip of Williamson County in the Brazos G. The aquifer primarily occurs in an adjacent planning area to the south and west of Brazos G.

The aquifer consists of sandstones which dip northeast away from the Llano Uplift. No pumpage is listed in Brazos G in TWDB data files for year 2012, and no Hickory wells are known to exist within the Brazos G. Geophysical log data suggest that the aquifer is deeper than 3,500 feet. Water-bearing properties are unknown, and water quality with excessive radiological parameters is likely. For these reasons, it is not considered in planning for the Brazos G. The Saratoga Underground Water Conservation District encompasses Lampasas County.

The Hickory Aquifer in Brazos G is in GMA-8. The MAGs was determination by using water budget calculations, and the specified Desired Future Conditions provided by the GMA-8 representative. The results are presented in the following table.

<table>
<thead>
<tr>
<th>Hickory Aquifer</th>
<th>Modeled Available Groundwater (acft/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COUNTY 2020 2030 2030 2050 2060 2070</td>
</tr>
<tr>
<td>LAMPASAS</td>
<td>113 113 113 113 113 113</td>
</tr>
<tr>
<td>WILLIAMSON</td>
<td>15 15 15 15 15 15</td>
</tr>
<tr>
<td>TOTAL</td>
<td>128 128 128 128 128 128</td>
</tr>
</tbody>
</table>

References


Marble Falls Aquifer

Location
The Marble Falls Aquifer, a minor aquifer, occurs in the Brazos G only in Lampasas County (Figure B-9). It primarily occurs in an adjacent planning area to the south and west.

Geohydrology
The Marble Falls Aquifer occurs in discontinuous outcrops in the southwestern part of Lampasas County. Water occurs in secondary solution fractures, cavities and channels in the Marble Falls Limestone. The aquifer is connected to the Ellenburger-San Saba Aquifer where intervening beds are thin or absent and via faults. The aquifer supports numerous springs. The larger ones include the springs at Lampasas, which average about 9 cfs.

Development and Use
TWDB pumpage estimates for year 2012 total 23 acft, of which 13 acft are for municipal use.

Availability
The Marble Falls Aquifer in Brazos G is in GMA-8. The MAGs was determination by using water budget calculations, and the specified Desired Future Conditions provided by the GMA-8 representative. The results are 2,837 acft/yr for decades from 2020 to 2070.

Well Yields and Water Quality
Aquifer use is limited to shallow, small wells. Water quality is suitable for most purposes near the outcrop area.

Resource Considerations
Groundwater resources are large in relation to current use and future local demand. Regulation is provided by the Saratoga Underground Water Conservation District for Lampasas County.

References


Figure B-9. Location of Marble Falls Aquifer in Brazos G
Queen City Aquifer

Location
The Queen City Aquifer, a minor aquifer, occurs in the southeastern part of the Brazos G and in adjoining planning areas. It forms a northeast-southwest-trending band primarily across parts of Robertson, Brazos, Grimes, Milam, Burleson and Lee Counties (Figure B-10).

Geohydrology
The water-bearing zones consist of sands interbedded with silts and clays. Total sand thickness ranges up to 300 feet. From their surface outcrop (recharge area) the sands dip coastward beneath younger strata. Freshwater occurs to depths up to 2,000 feet or more. Water table conditions occur in recharge areas, and artesian conditions exist in downdip areas. Precipitation and vertical leakage are the main sources of recharge. A large amount of recharge is rejected by evapotranspiration in the outcrop.

Development and Use
The year 2012 groundwater use within the Brazos G totaled 3,376 acft. About 40 percent that use was in Milam County. Total use was about 65 percent irrigation and 25 percent municipal. The relatively small use is partly due to the presence and development of the Sparta Aquifer at shallower depths over most of the area where the Queen City is present.

Availability
The Queen City Aquifer in Brazos G is in GMA-12. In letter dated July 2012 to GMA-12, TWDB referenced a report titled GAM Run 10-044 MAG, which presents the MAG. The MAGs was determination by utilization of Version 2.01 of the Central Sparta, Queen City, and Carrizo-Wilcox GAM and the specified Desired Future Conditions provided by the GMA-12 and GMA-14 representatives. The results are presented in the following table.

Well Yields
Estimated ranges for maximum individual well yields are 200 to 500 gpm. Wide variations can occur in individual well yields obtainable from the Queen City sands, depending on area, depth and local sand thickness.

Water Quality
Water typically meets drinking water standards, except for iron. High iron content is a common, but treatable, problem. Hydrogen sulfide or methane gas is reported occasionally. Waters obtained near the outcrops of the water-bearing zones generally are higher in hardness and lower in total dissolved solids content. In downdip areas the water is commonly a calcium/sodium- or sodium-bicarbonate-type water with total dissolved solids content ranging from 300 mg/L up to 1,000 mg/L or more.
Queen City Aquifer

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>Modeled Available Groundwater (acft/yr)</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>2020</td>
</tr>
<tr>
<td>BRAZOS</td>
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<tr>
<td>BURLESON</td>
<td>415</td>
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<tr>
<td>GRIMES</td>
<td>637</td>
</tr>
<tr>
<td>LEE</td>
<td>120</td>
</tr>
<tr>
<td>MILAM</td>
<td>53</td>
</tr>
<tr>
<td>ROBERTSON</td>
<td>0</td>
</tr>
<tr>
<td>WASHINGTON</td>
<td>1</td>
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<tr>
<td>TOTAL</td>
<td>1,830</td>
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</tbody>
</table>

Resource Considerations
Groundwater resources are partly undeveloped, and few development problems have occurred to date. Water level declines are minimal to none. Few and limited water pollution problems are apparent.

Counties with groundwater districts include: Grimes (Bluebonnet GCD), Robertson and Brazos (Brazos Valley GCD), Lee (Lost Pines GCD), and Milam and Burleson (Post Oak Savannah GCD).

References


Figure B-10. Location of Queen City Aquifer in Brazos G
Seymour Aquifer

Location
The Seymour Aquifer is classified as a major aquifer in Texas and occurs in scattered, isolated areas in the western part of the Brazos G and in three other planning areas to the north. The Seymour is a shallow, alluvial aquifer used almost exclusively for irrigation. The largest area of the Seymour Aquifer is in Haskell and Knox Counties where nearly 90 percent of the Seymour pumpage in Brazos G occurs. Other scattered areas of the aquifer extend over parts of Jones, Fisher, Kent, Stonewall, and Throckmorton Counties (Figure B-11). While the Seymour has a large surficial extent in these four counties, the aquifer generally has a relatively thin saturated thickness, is less productive and does not support widespread irrigation as it does in Knox and Haskell Counties.

Geohydrology
The Seymour consists of isolated areas of alluvium and is composed of gravel, sand and silty clay. The gravels, deposited by eastward flowing streams in geologic times, are mostly in the lower part of the Seymour. Total formation thickness is generally less than 100 feet. Water table conditions predominate. Direct infiltration of precipitation is the main source of recharge and is reasonably high. The historical pumpage in Knox and Haskell Counties is equivalent to capturing about 2.0 inches, or over 8 percent, of the annual precipitation. Recharge amounting of over 20 percent of precipitation has been observed for some seasons near Rochester in Haskell County. Water levels have fluctuated mostly in response to variations in rainfall and irrigation pumpage. Continuing water level declines have not occurred in most areas in Haskell and Knox Counties, and some rises have been noted. In all the other counties most water levels show a level or declining trend; and, few rises have been noted.

Development and Use
Within the Brazos G, the TWDB estimates total groundwater pumpage in 2012 to be 107,909 acft. About 98 percent is used for irrigation. However, this aquifer is an important resource for several municipal water users in the northern part of the region. In Kent County, groundwater from the Seymour accounts for nearly all of the municipal supplies. Haskell and Knox Counties accounted for about 96 percent of the total withdrawals in year 2012.

Availability
The Seymour Aquifer in Brazos G is in GMA-6. In a letter dated December 2011, the TWDB referenced a report titled GAM Run 10-058 MAG, which presents the MAG for the Seymour Aquifer in GMA-6. The MAG determination utilized the Desired Future Conditions (DFC's provided by the GMA-6 representative) and version 1.01 groundwater model of the Seymour and Blaine aquifers. Using the approach outlined by the TWDB, the MAG is calculated for each county. The results are presented in the following table.
## Seymour Aquifer

<table>
<thead>
<tr>
<th>COUNTY</th>
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<th>2030</th>
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<th>2060</th>
<th>2070</th>
</tr>
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<td>2,931</td>
<td>2,920</td>
<td>2,915</td>
<td>2,733</td>
<td>2,733</td>
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<td>HASKELL</td>
<td>46,180</td>
<td>44,575</td>
<td>42,358</td>
<td>42,524</td>
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</tr>
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<td>JONES</td>
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<td>2,918</td>
<td>2,918</td>
<td>2,918</td>
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<td>1,179</td>
<td>1,179</td>
<td>1,179</td>
</tr>
<tr>
<td>KNOX</td>
<td>39,219</td>
<td>35,609</td>
<td>31,501</td>
<td>29,705</td>
<td>32,040</td>
<td>32,040</td>
</tr>
<tr>
<td>STONEWALL</td>
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<td>230</td>
<td>224</td>
<td>215</td>
<td>214</td>
<td>214</td>
</tr>
<tr>
<td>THROCKMORTON</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
</tr>
<tr>
<td>YOUNG</td>
<td>309</td>
<td>258</td>
<td>258</td>
<td>258</td>
<td>258</td>
<td>258</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>93,090</td>
<td>87,816</td>
<td>81,474</td>
<td>79,829</td>
<td>83,074</td>
<td>83,074</td>
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</table>

### Well Yields

Well yields average 270 gpm and are as high as 1,300 gpm. Wide variations occur in individual well yields obtainable from the Seymour, depending on area, depth and local character and thickness of gravels.

### Water Quality

Water quality is variable for many reasons. The dissolved solids content of natural water ranges from 300 to 3,000 mg/L with most values between 400 and 1,000 mg/L. Most water meets drinking water standards, except for nitrate content which typically ranges from 30 to 90 mg/L and commonly exceeds the limit of 45 mg/L for public supplies. Past oil field practices have impacted water quality locally. Many detailed maps of individual water quality parameters for Haskell and Knox Counties are included in the TDWR Report 226 (Harden, 1978).

### Resource Considerations

Groundwater resources, while significant, are essentially fully developed, although some added supplies could be developed in some areas of water level rises or in other areas in average to wet times. Counties with groundwater conservation districts include: Kent (Salt Fork UWCD) and Haskell and Knox (Rolling Plains GCD). There may be additional opportunities for conjunctive use or for recharge and conservation projects in the region, depending on surface water availability and cost effectiveness.

### References


Figure B-11. Location of Seymour Aquifer in Brazos G
Sparta Aquifer

Location
The Sparta Aquifer, a minor aquifer, occurs in the southeastern part of the Brazos G and in adjoining planning areas. It occurs in a northeast-southwest-trending band primarily across parts of Brazos, Burleson, Grimes, Lee, Milam and Robertson Counties (Figure B-12). Its location is a short distance southeast of the Queen City Aquifer. Some users have wells screened across both zones.

Geohydrology
The water-bearing zones consist of sands interbedded with silts and clays. Total sand thickness ranges from about 100 to 200 feet. From their surface outcrop (recharge area) the sands dip coastward beneath younger strata. Freshwater occurs to depths up to 2,000 feet or more. Water table conditions occur in recharge areas, and artesian conditions occur in downdip areas. Precipitation and vertical leakage are the main sources of recharge. A large amount of recharge is rejected by evapotranspiration in the outcrop.

Development and Use
The year 2012 groundwater use within the Brazos G totaled 3,708 acft. About 35 percent that use was for municipal purposes and about 57 percent in Brazos County.

Availability
The Sparta Aquifer in Brazos G is in GMA-12. In letter dated July 2012 to GMA-12, TWDB referenced a report titled GAM Run 10-046 MAG, which presents the MAG. The MAGs was determination by utilization of Version 2.01 of the central Sparta, Queen City, and Carrizo-Wilcox GAM and the specified Desired Future Conditions provided by the GMA-12 and GMA-14 representatives. The results are presented in the following table.

Well Yields
Estimated ranges for maximum individual well yields are 200 to 600 gpm. Wide variations can occur in individual well yields obtainable from the Sparta, depending on area, depth and local sand thickness.

Water Quality
Water typically meets drinking water standards, except for iron. High iron content is a common problem, and hydrogen sulfide gas is reported occasionally. Waters obtained near the outcrops of the water-bearing zones generally are higher in hardness and lower in total dissolved solids content. In downdip areas the water is commonly a calcium/sodium- or sodium-bicarbonate-type water with total dissolved solids content ranging from about 300 up to 1,000 mg/L or more.
**Sparta Aquifer**

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>2020</th>
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<th>2030</th>
<th>2050</th>
<th>2060</th>
<th>2070</th>
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</thead>
<tbody>
<tr>
<td>BRAZOS</td>
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<td>7,307</td>
<td>7,307</td>
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<td>BURLESON</td>
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<td>6,734</td>
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<td>2,571</td>
<td>2,571</td>
<td>2,571</td>
</tr>
<tr>
<td>LEE</td>
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<td>305</td>
<td>294</td>
<td>294</td>
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<tr>
<td>ROBERTSON</td>
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<td>400</td>
<td>500</td>
<td>616</td>
<td>616</td>
<td>616</td>
</tr>
<tr>
<td>WASHINGTON</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11,380</td>
<td>14,631</td>
<td>16,293</td>
<td>17,522</td>
<td>17,522</td>
<td>17,522</td>
</tr>
</tbody>
</table>

**Well Yields**
Estimated ranges for maximum individual well yields are 200 to 600 gpm. Wide variations can occur in individual well yields obtainable from the Sparta, depending on area, depth and local sand thickness.

**Water Quality**
Water typically meets drinking water standards, except for iron. High iron content is a common problem, and hydrogen sulfide gas is reported occasionally. Waters obtained near the outcrops of the water-bearing zones generally are higher in hardness and lower in total dissolved solids content. In downdip areas the water is commonly a calcium/sodium- or sodium-bicarbonate-type water with total dissolved solids content ranging from about 300 up to 1,000 mg/L or more.

**Resource Considerations**
Groundwater resources are largely undeveloped, except in the vicinity of College Station and Texas A&M well fields. Few development problems have occurred to date, and water level declines have been limited except near these well fields and the former Bryan well fields. Few and limited water pollution problems are apparent. Counties with groundwater conservation districts include: Lee (Lost Pines GCD), Robertson and Brazos (Brazos Valley GCD) and Milam and Burleson (Post Oak Savannah GCD)

**References**


**Figure B-12. Location of Sparta Aquifer in Brazos G**
Trinity Aquifer

Location
The Trinity Aquifer, a major aquifer, occurs in a north-south-trending band that extends in Brazos G from Williamson County in the south to Hood and Johnson Counties in the north. The aquifer supplies drinking water to numerous communities, homes and farms in Central Texas and irrigation water to many farms, especially in Comanche and Erath Counties. Considering the trends in water level declines as a reference, the aquifer appears to be overdeveloped in a large part of the confined area.

The outcrop of the Trinity Aquifer in Brazos G occurs mostly in Callahan, Eastland, Erath, Hood, Somervell, Comanche, Hamilton, Coryell and Lampasas Counties. The confined area is mostly in Johnson, Hill, Bosque, McLennan, Coryell, Bell and Williamson Counties (Figure B-13).

Geohydrology
The aquifer is composed of the Paluxy, Glen Rose and Travis Peak Formations. The Travis Peak Formation is subdivided into the Hensell, Pearsall/CowCreek/Hamett, and Hosston/Sligo members. Updip where the Glen Rose thins or is missing, the Paluxy and Travis Peak Formations coalesce to form the Antlers Formation. The uppermost water-bearing zone is the Paluxy Formation. The lower water-bearing zone consists of Travis Peak Formation and is divided into the Hensell and Hosston Members in much of the eastern part of Brazos G. Groundwater is much more abundant in the lower zones than the upper zone.

The water-bearing zones consist of a sand and limestone and are often interbedded with clay and shale. The aquifer outcrops in the western part of the north-south-trending band and is confined in the eastern part. The rocks dip east-southeast at a rate of about 15 feet per mile in the northwest part of Brazos G, gradually increase in dip to 40 feet per mile in the central part, and then rapidly increase in dip to 80 to 100 feet per mile east of the Luling-Mexia-Talco Fault Zone. Water table conditions occur in outcrop (recharge) areas, and confined (artesian) conditions occur in downdip areas. The aquifer is naturally recharged by precipitation in the outcrop area where soils have layers of sand and sandy loam. In the downdip area, some recharge to the heavily pumped water-bearing zones probably includes a very modest amount of leakage from over- and underlying formations. Discharge is mostly to wells, springs, seeps and evapotranspiration in the outcrop area, and to wells in the confined zone.

Development and Use
The year 2012 Brazos G groundwater use totaled 85,833 acft, of which 42 percent was municipal use and 52 percent irrigation. Erath County accounts for 15 percent of the total pumping. Municipal pumping in McLennan County accounts for about 11 percent.
Availability
The Trinity Aquifer in Brazos G is in GMA-8. In letter dated March 2012 to GMA-8, TWDB referenced a report titled GAM Run 10-063 MAG, which presents the MAG. The MAGs was determination by using the Northern Trinity and Woodbine Aquifers GAM, and the specified Desired Future Conditions provided by the GMA-8 representative. The results are presented in the following table.

Well Yields
Well yields have a wide variation in the Trinity Aquifer. In general, yields for large supply wells in the western part of the aquifer where the outcrop occurs are between 50 and 250 gpm. In the confined part, large wells usually produce between 200 and 700 gpm. Well yields are mostly related to the cumulative thickness of sand layers and water level in the water-bearing zone at the well. Potential well yields have declined substantially in areas with large declines in water levels from a combination of increased lift and the inability to create a cone of depression around the well.

Water Quality
Water quality from the Trinity Aquifer is acceptable for most municipal and industrial purposes; however, excess concentrations of certain constituents in some areas exceed drinking water standards. One concern is relatively high concentrations of bacteria and nutrients that have been found in some wells in Callahan, Eastland, Erath and Comanche Counties. Another concern is contamination from brines associated with oil and gas operations. Finally, limited areas are impacted by leakage of poor quality water from overlying formations.

Resource Considerations
Groundwater resources are considered to be within or less than development limits in the outcrop area and generally overdeveloped in the confined areas. The Trinity Aquifer in Brazos G is overseen by seven groundwater conservation districts, but these districts do not cover the entire aquifer area within the Brazos G. Counties with groundwater conservation districts include: Lampasas (Saratoga UWCD), Bell (Clearwater UWCD), Bosque, Comanche and Erath (Middle Trinity GCD), McLennan (McLennan County GCD), and Coryell (Tablerock GCD), Somerville, Johnson and Hill (Prairielands GCD) and Hood (Upper Trinity GCD).
### Trinity Aquifer

The following table shows the modeled available groundwater (acft/yr) for the Trinity Aquifer across various counties in the region.

<table>
<thead>
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<th>COUNTY</th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
<th>2060</th>
<th>2070</th>
</tr>
</thead>
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### References


Klemt, W.B., Perkins, R.D., and Alvarez, H.J., 17975, Ground-water resources in part of Central Texas, with emphasis on the Antlers and Travis Peak Formations: TWDB Report 195.


Sandeen, W.M., 1972, Ground-water resources of Washington County, Texas: TWDB Rept. 162.


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**Figure B-13. Location of Trinity Aquifer in Brazos G**
Woodbine Aquifer

Location
The Woodbine Aquifer, a minor aquifer, is in the north-central part of the Brazos G and in adjacent planning areas to the north. It occurs in a north-south-trending belt primarily across parts of Johnson and Hill Counties (Figure B-14).

Geohydrology
The Woodbine consists of water-bearing sandstone interbedded with shale. The sandstone tends to be thicker in the lower part of the formation. The upper part of the Woodbine has distinctly poorer water quality. Total formation thickness ranges up to slightly over 200 feet and sand thickness up to 100 feet. From their surface outcrop (recharge area) the water-bearing sands dip eastward beneath younger strata. Water table conditions occur in recharge areas, and artesian conditions occur in downdip areas. Precipitation is the main source of recharge. Maximum estimated transmissivities for the best yielding zones in the lower Woodbine are about 250 to 500 square ft per day.

Development and Use
Development is mostly limited to local use for household and livestock purposes. The TWDB estimates the total pumpage to be 1,001 acft in 2012. About 75 percent of the pumpage was for municipal purposes.

Availability
The Woodbine Aquifer in Brazos G is in GMA-8. In letter dated July 2012 to GMA-8, TWDB referenced a report titled GAM Run 10-064 MAG, which presents the Modeled Available Groundwater. The MAGs was determination by using the Northern Trinity and Woodbine Aquifers GAM, and the specified Desired Future Conditions provided by the GMA-8 representative. The results are presented in the following table.

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<th>Woodbine Aquifer</th>
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Well Yields
Estimated ranges for maximum individual well yields are 50 to 150 gpm. Wide variations occur in individual well yields obtainable from Woodbine sands, depending on area, depth, and local sand thickness.

Water Quality
Water typically meets drinking water standards. Waters obtained near the outcrop of the water-bearing zones generally are higher in hardness and lower in total dissolved solids content. In confined areas the water is commonly a sodium-bicarbonate-type water with total dissolved solids content ranging from 500 to over 1,000 mg/L. The higher mineralized waters contain appreciably higher sulfate content. High iron concentrations are common in the outcrop areas.

Resource Considerations
The Woodbine is a relatively weak aquifer, supports little development and has minimal potential within the Brazos G. Few development problems have occurred to date, but large water level declines can be expected from any significant added development. Care must be taken in well construction to seal off the higher mineralized water in the upper part of the formation and to screen the best water-bearing zones in the lower part. No existing local plans are known. The groundwater conservation districts regulating the Woodbine in the Brazos G are McLennan County GCD and Prairielands GCD (Hill, Johnson Counties).

References


Klemt, W.B., Perkins, R.D., and Alvarez, H.J., 1975, Ground-water resources of part of Central Texas, with emphasis on the Antlers and Travis Peak Formations: TWDB Report 195.


Thompson, Gerald L., 1969, Ground water resources of Johnson County, Texas: TWDB Report 94.


Ward, J.K., Managed available groundwater estimates for the Woodbine Aquifer in Groundwater Management Area 8: TWDB letter dated Nov 10, 2008 with GAM Run 08-14mag attachment
Figure B-14. Location of Woodbine Aquifer in Brazos G
Yegua-Jackson Aquifer

Location
The Yegua-Jackson Aquifer occurs in the southeastern part of the Brazos G and in adjoining planning areas. It occurs in a northeast-southwest-trending band that is 15-20 miles wide and primarily cuts across parts of Brazos, Burleson, Grimes, Lee, and Washington Counties (Figure B-15). Its location is a short distance downdip of the Sparta Aquifer and is covered by younger sediments in much of the area.

Geohydrology
The Yegua Formation consists of fine to medium sand that is interbedded with indurated fine-grained sandstone and clay. It has a maximum thickness in Grimes County of nearly 1,200 ft. The Jackson Group consists of fine to medium sand, clay, and siltstone. Its maximum thickness is about 1,600 ft. From their surface outcrop (recharge area) the sands dip coastward beneath younger strata. Water table conditions occur in recharge areas, and artesian conditions occur in downdip areas. Precipitation is the main source of recharge. A large amount of recharge is rejected by evapotranspiration in the outcrop.

Development and Use
Development is mostly limited to local use for household and livestock purposes. The TWDB estimates the total pumpage to be 3,481 acft in 2012. About two-thirds of the pumpage occurred in Brazos County. Most of this pumpage was for irrigation purposes.

Availability
The Trinity Aquifer in Brazos G is in GMA-12 and 14. The TWDB referenced a report titled GAM Run 10-060 MAG for GMA-12 and GAM Run 10-055 MAG, Version 2 report for GMA-14 to describe the calculation of the MAG. The MAGs was determination by using the Yegua-Jackson Aquifer GAM, and the specified Desired Future Conditions provided by the GMA-12 and 14 representatives. The results are presented in the following table.

Well Yields
Estimated maximum individual well yields are about 500 gpm. Wide variations can occur in individual well yields, depending on area, depth and local sand thickness.

Water Quality
Relatively shallow wells yield water that typically meets drinking water standards. Waters obtained near the outcrops of the water-bearing zones generally are higher in hardness and lower in total dissolved solids content. In downdip areas, water with total dissolved solids content ranges from about 300 up to 1,000 mg/L or more.

Resource Considerations
Counties with groundwater conservation districts include: Lee (Lost Pines GCD), Robertson and Brazos (Brazos Valley GCD), and Grimes (Bluebonnet GCD).
Yegua-Jackson Aquifer

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References


Figure B-15. Location of Yegua-Jackson Aquifer in Brazos G