Dockum Aquifer
Brackish groundwater study

Stakeholder Meeting
Llano Estacado (Region O) Planning Group
Lubbock, Texas November 15, 2017
The following presentation is based upon professional research and analysis within the scope of the Texas Water Development Board’s statutory responsibilities and priorities but, unless specifically noted, does not necessarily reflect official Board positions or decisions.
Presentation Outline

Introduction to mapping brackish groundwater in the Dockum Aquifer

- What is brackish groundwater?
- House Bill 30 (2015)
- Aquifer overview
- Data collected and data gaps
- Next steps
- Questions, comments, stakeholders input
**Brackish Groundwater**

_Saltier than fresh water, less salty than seawater_

<table>
<thead>
<tr>
<th>Groundwater Salinity Classification</th>
<th>Salinity Zone Code</th>
<th>Total Dissolved Solids Concentration in milligrams per liter (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>FR</td>
<td>0 to 1,000</td>
</tr>
<tr>
<td>Slightly Saline</td>
<td>SS</td>
<td>1,000 to 3,000</td>
</tr>
<tr>
<td>Moderately Saline</td>
<td>MS</td>
<td>3,000 to 10,000</td>
</tr>
<tr>
<td>Very Saline</td>
<td>VS</td>
<td>10,000 to 35,000</td>
</tr>
<tr>
<td>Brine</td>
<td>BR</td>
<td>Greater than 35,000</td>
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</table>

Drinking Water Limit

Major/Minor Texas Aquifers Mapped Limit*

Seawater

Brackish Groundwater Production Zones (BGPZ) 84th Texas Legislature, 2015

Directed TWDB to:

- Define brackish groundwater production zones
- Estimate productivity over 30 & 50 year periods
- Recommend groundwater monitoring
- Work with stakeholders and groundwater conservation districts
- Complete four aquifers December 2016
- Complete all aquifers December 2022

### Criteria designation:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
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<tr>
<td>Must have brackish water</td>
<td>In areas of the state with moderate to high availability and productivity</td>
</tr>
<tr>
<td>Must have hydrogeologic barriers</td>
<td>Sufficient to prevent significant impacts to fresh water availability or quality</td>
</tr>
<tr>
<td>Cannot be within these boundaries</td>
<td>Edwards Aquifer within the Edwards Aquifer Authority, Barton Springs-Edwards Aquifer Conservation District, Harris-Galveston Subsidence District, or Fort Bend Subsidence District</td>
</tr>
<tr>
<td>Cannot be already in use</td>
<td>Brackish water already serving as a significant source of water supply for municipal, domestic, or agricultural</td>
</tr>
<tr>
<td>Cannot be used for wastewater injection</td>
<td>Permitted under Title 2 of Texas Water Code, Chapter 27</td>
</tr>
</tbody>
</table>
Dockum Group extends into four States
• 57 Texas Counties
• 20 Groundwater Conservation Districts
• 5 Groundwater Management Areas
• 4 Regional Water Planning Groups
Previous Study Results

- Dockum is classified as a minor aquifer
- Covers approximately 26,000 square miles of Texas
- 109 million acre-feet of brackish groundwater with total dissolved solids from 0 to 5,000 milligrams per liter.
- 27 million acre-feet of brackish groundwater with total dissolved solids from 5,000 to 10,000 milligrams per liter.
# Stratigraphic Controversy

Table 3.0.1 Summary of Triassic Dockum Group nomenclature (modified from Bradley and Kalaswad, 2003).

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</thead>
<tbody>
<tr>
<td>Region</td>
<td>Southern High Plains Texas &amp; New Mexico</td>
<td>Northern Texas Panhandle</td>
<td>Eastern New Mexico</td>
<td>Southern Texas Panhandle</td>
<td>Southern High Plains Texas &amp; New Mexico</td>
<td>Oklahoma Panhandle</td>
<td>Northeastern New Mexico</td>
<td>Southern High Plains Texas &amp; New Mexico</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dockum strata distinctions vertically</td>
<td>Dockum Beds 3</td>
<td>(thin or absent)</td>
<td>Trujillo sandstone and shale</td>
<td>Upper red clay</td>
<td>Chirle Formation</td>
<td>Chirle Formation</td>
<td>Upper Dockum(2)</td>
<td>Upper Dockum(2)</td>
<td>Redonda Formation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teocova Sandstone</td>
<td>Santa Rosa Sandstone</td>
<td>Santa Rosa Sandstone</td>
<td>Lower Dockum(2)</td>
<td>Lower Dockum(2)</td>
<td>Santa Rosa Sandstone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(generally absent)</td>
<td>(generally absent)</td>
<td>Basal shale</td>
<td>Camp Springs Member</td>
<td>Colorado City Member</td>
<td>Teocova Member</td>
<td></td>
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</tbody>
</table>

(1) in New Mexico only  
(2) not intended as a formal stratigraphic name  
Dockum is considered a group designation by all researchers except Lucas and Anderson.  
Lateral stratigraphic correlation between units depicted on this table is not intended.  
Bradley and Kalaswad (2003) refer to the more prolific parts of the Dockum Aquifer as simply the "Best Sandstone".

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Simplified Lithologic Model

Figure 2.2.4  Schematic cross section of the Dockum Aquifer in New Mexico and Texas (modified from Ewing and others, 2008).
Fig. 2.32. The base of the Dockum Group in gamma-ray well logs: a, McGowan et al.'s (1979, fig. 32) identification of the base of the Dockum Group; b-d gamma-ray well logs in southern Garza County showing interpreted TR-3 unconformity, Santa Rosa Sandstone, and base of Boren Ranch Sandstone/beds; b, America Liberty Oil Company No. 7 T.N. McCrory; c, Bush Exploration No. A-2 Beggs 45; d, Humble Oil and Refining Company No. 1 Irene Rodgers.
• Base of Dockum generally follows trend of Permian Basin structural low
• Thickness of Dockum does not align with Permian Basin structure
• Net sand map of “Upper Dockum”

Figure 4.2.28  Net sand thickness of the upper Dockum Group in feet.

• Net sand map of “Lower Dockum”

• Total dissolved solids from GAM study

Figure 4.8.1  Total dissolved solids concentrations in milligrams per liter in groundwater in the Dockum Aquifer.
• Total dissolved solids from TWDB Groundwater Database
• Transmissivities derived from aquifer tests in the TWDB Groundwater Database
• Yields derived from aquifer tests in the TWDB Groundwater Database
Stakeholder Input

• Additional Dockum Well Data
  – Aquifer Tests
  – Water chemistry

• Injection well data

• Current use
Next Steps:
~1.5-2 year study

• Additional Kickoff stakeholder meeting (Lubbock)
• Map stratigraphy, lithology, measured water quality, calculated water quality, aquifer properties, and existing use
• Calculate the volume of fresh, slightly saline, moderately saline, and very saline groundwater
• Proposed production area (PPA) analysis stakeholder meeting
• PPA impact analysis (modeling)
• Final report(s) and stakeholder comment solicitation
• Board possibly designates brackish groundwater production zones (BGPZ)