2D and 3D Edwards Aquifer Structural Visualization Using ArcGIS

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General Terms and Methodology
Note: This model is a property of the Edwards Aquifer Authority
2D Model Visualization
Base Edwards Aquifer Elevation in Unconfined Zone

World Reference Overlay
Inferred Faults in Unconfined Zone

Base Edwards Aquifer Elevation in Unconfined Zone

Feet above m.s.l.
High: 1751
Low: 134

Authors: Ned Trochanov, Sarah Eason
Edwards Aquifer Thickness in Confined Zone

Feet

High: 1093
Low: 365

Authors: Ned Troshanov, Sarah Eason
Basalt Base Truncated Elevation in Uvalde and Kinney Counties

World Reference Overlay
Basalt Base Truncated Elevation

Feet above m.s.l.
High: -1712
Low: -2712

Authors: Ned Troshinov, Sarah Eason

Sources: Ed U.S.GS, NOAA

Miles
0  2.5  5  10  15  20
Raster TIN Datasets
Land Surface TIN Elevation in Confined Zone

World Reference Overlay

Authors: Ned Troshinov, Sarah Eason

Edge type

Feet above m.s.l.

1085 - 1230
503 - 649
1521 - 1667
930 - 1085
358 - 503
1376 - 1521
794 - 939
1230 - 1376
649 - 794
3D Model Visualization
3D TIN Land Surface Raster Dataset in Confined Zone
3D TIN Land Surface Raster Dataset in Confined Zone with Control Points
3D TIN Land Surface and Top Edwards Aquifer Raster Datasets with Control Points
3D TIN Land Surface, Top and Base of Edwards Aquifer Raster Datasets with Control Points
3D TIN Land Surface, Top, Base of Edwards Aquifer, Base of Upper Glen Rose Raster Datasets with Control Points
3D TIN Land Surface, Top, Base of Edwards Aquifer, Base of Upper Glen Rose Raster Datasets with Control Points and Extruded Basalts
Extruded Inferred Faults (Structural Framework)
3D TIN Raster Datasets with Extruded Basalts, Overburden, Inferred Faults, and Control Points
3D TIN Raster Datasets with Extruded Basalts, Overburden, Edwards Aquifer, Inferred Faults, and Control Points
3D TIN Raster Datasets with Extruded Basalts, Overburden, Edwards Aquifer, Inferred Faults, Upper Glen Rose Fm and Control Points
3D Extruded Edwards Aquifer, Upper Glen Rose Fm, and Inferred Faults, and Control Points
3D Extruded Edwards Aquifer, Upper Glen Rose Fm, and Inferred Faults
Structural Model Limitations

“All models are wrong; some models are useful.” – George E. P. Box (1919-2013)

- The Edwards Aquifer Structure Model delineates faults based on the analysis of sudden changes in formation slope. When structural control points (wells) have a higher density, the delineated inferred faults have a higher probability to be at their correct location and vice versa – when the control points are sparse (e.g., in saline subzone and in fresh subzone in Kinney County), the accuracy of inferred fault location estimation is low. Therefore, it is necessary to **check the structural control point density in any particular estimation**.

- Modeled layer elevations close to inferred faults delineated or in **zones with low control point density should be considered with precaution**. Seismic surveys could be a cheaper alternative to drilling boreholes in areas where potential fault locations are most uncertain.

- This **Edwards Aquifer Structure Model will be updated periodically as new data points become available**.
Project Achievements and Application

1. The Edwards Aquifer 2D ArcGIS structural model has been updated with new data.
2. A project geoprocessing workflow using ModelBuilder visual language has been created, allowing reduction of the time required for future structural model updates.
3. A new method for cross-section drawing has been developed based on the structural model data.
4. The first version of a regional Edwards Aquifer 3D ArcGIS geologic structural model has been developed.

The 2D and 3D ArcGIS structural models can be applied in:
- groundwater-flow conceptual analysis;
- groundwater-flow model construction;
- preliminary information for drilling contractors;
- well exemption status evaluation and educational purposes.
Potential Future Steps
in Edwards Aquifer ArcGIS Modeling

1. Increase control point density in the entire saline subzone and fresh subzone in Kinney County with additional logging information (TxRRC, TWDB).

2. Identify potential zones where faults juxtapose the Edwards Aquifer and Lower Glen Rose Formation.

3. Saturated groundwater flow analysis on:
   a. *Saturated groundwater flow thickness* in the unconfined (recharge) zone at different hydrologic conditions;
   b. Evaluation of *hydraulic restriction zones* based analysis on hydraulic gradients and water-chemistry, and
   c. Attempt to *quantify subsurface flows* based on formation geometry and hydraulic conductivity estimates.
QUESTIONS?