Cooperators/funding sources: Sweetwater Authority, City of San Diego, Otay Water District, State Water Bond and federal funds

Mapping the San Diego Underground

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Abstract

A three-dimensional (3D) geologic map of the San Diego/Tijuana area was created to help define the local groundwater resources. Creating the map, the first of its kind for this area, involved use of pre-existing GIS (geographic information systems) datasets including a DEM (digital elevation model), surface geologic maps, drilling and geophysical logs, and literature describing oil wells, water wells, and outcrops. A variety of software was used to process the data. A total of 88 wells, which showed stratigraphy older than Quaternary age, helped provide depth information. Direct examination of data from multiple-depth wells, installed since 2001 by the U.S. Geological Survey, provided the most reliable "ground-truth" for geologic layers. The 3D map will be used to help local water purveyors and their consultants understand the spatial extent, volume, and arrangement of local geologic layers for potential seasonal storage and extraction of groundwater. Updates on the San Diego Hydrogeology project can be found at http://ca.water.usgs.gov/sandiego/.

Parts for building 3D Geology model:

- Surface geology/outcrops
- Surface elevation (DEM)
- Gravity depth to basement
- USGS multi-depth wells
- Other wells drilled for water
- Exploration oil wells
- Simplified faults
- Software to build model: Excel®, ArcGIS®, RockWare®, and EarthVision®

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Why build a model?

Assembles a lot of data in a manageable way.

Predicts what will be at a location.

Solves problems, answers questions.

Allows us to bring correct equipment and people to job site, saving time and money, and increasing safety.

Surface Geology data sources:

- Kennedy and Tan, 2005: Pt. Loma & La Jolla quad (1:100,000)
- Todd, 2004: El Cajon quad (1:100,000)
- CESAR, 2004: Tijuana River Watershed (1:250,000)
- Tijuana Municipal IMPlan, 2008 (1:100,000)
- UABC - INEGI: Playas de Rosarito (1:250,000)
- Minch, 1967 (paper map)
- Gastil, et al., 1975. (paper map)

San Diego/Tijuana model locator

Model includes mountains, mesas, basin, and offshore

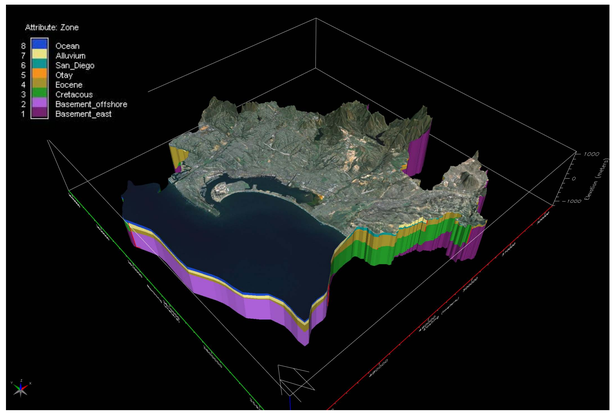
Blue geologic framework model boundary is based on hydrographic boundaries and bathymetry

Explanation

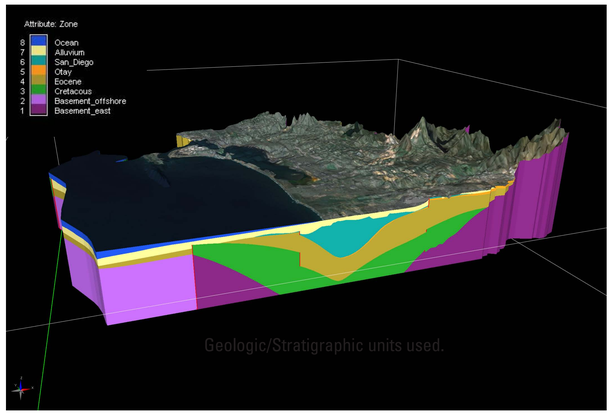
coastline_Clip_hfm

hydro_framework_model_area

Geologic Framework model with imagery, in Earth Vision®.

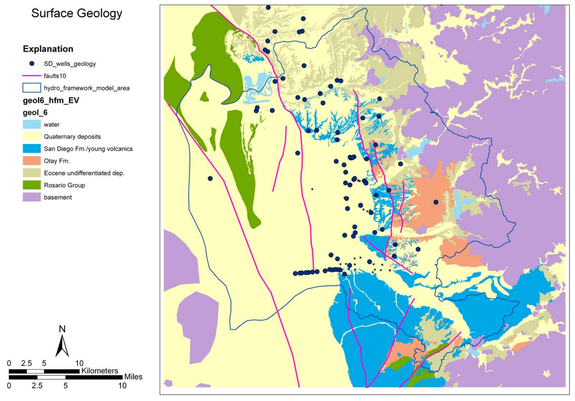


Model cut to show deepest part of San Diego Embayment: model is truncated at -1200m, vertical exaggeration is 5X.

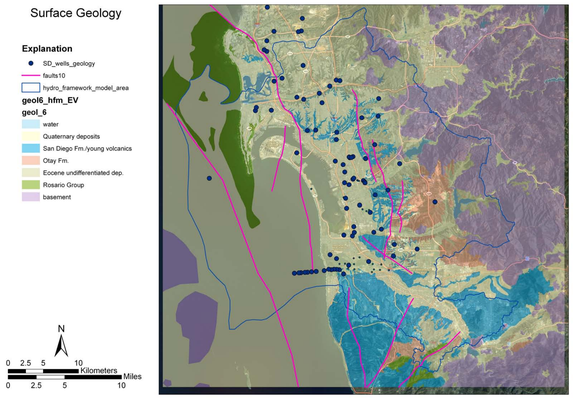


2D surface geology

Surface geology and location of wells (depth data)

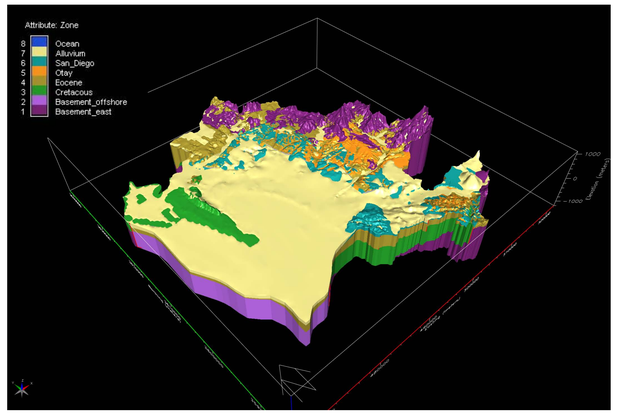


Surface geology overlying imagery, showing well locations

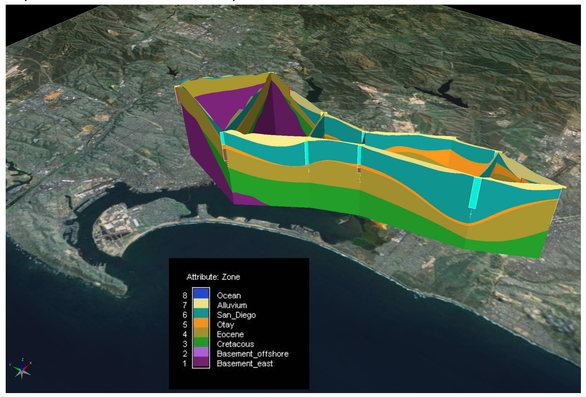


3D geology

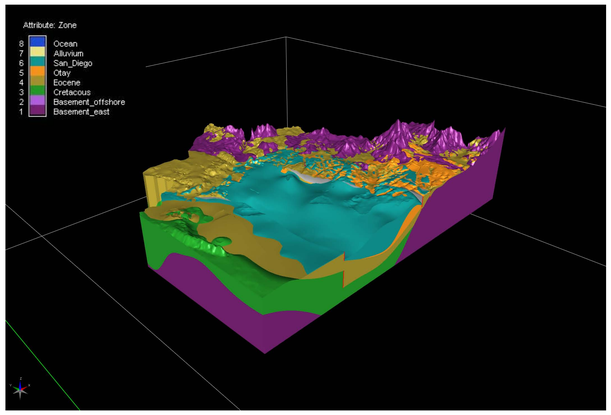
Surface geology of model area.



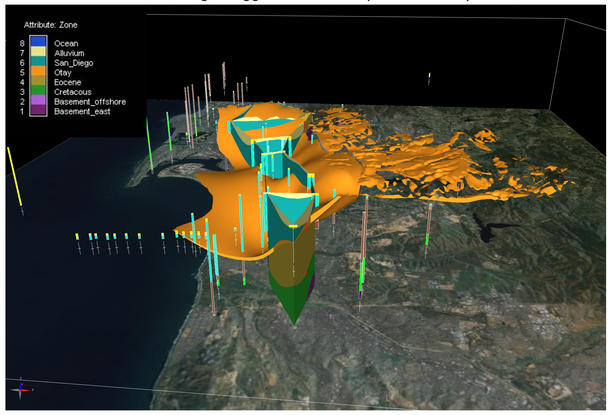
Fence diagram shows basement dropping under San Diego Bay, thick Quaternary deposits along stream channels, and thick San Diego Formation (Pliocene) deposits south of the current bay.



Model cut back to reveal Pliocene San Diego Formation, a potential resource for groundwater recharge during the wet season and extraction during the dry season.



Oligocene Otay Formation (orange) acts as a marker bed composed of non-marine sediment plus ash and bentonite. The deposit is delta or colluvial-fan shaped. Near the U.S./Mexico border, drug smugglers use this deposit for sturdy tunnels.



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