



## Honshu, Japan Earthquake of March 11, 2011 9.0 Magnitude recorded in the Edwards Aquifer, San Antonio, Texas

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**Abstract:** *The Edwards Aquifer is a large karst aquifer located in south-central Texas USA. The Index Well J-17, in which water levels in the aquifer are continuously monitored since 1934, detected distinctly the March 11, 2011 Honshu, Japan earthquake (9.0 magnitude). The Edwards Aquifer fluctuated approximately 0.3 meters (1 foot) during the initial response and continued to oscillate for approximately two hours after the event.*

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The Edwards Aquifer is a large karst aquifer located in south-central Texas USA. The Edwards Aquifer is the primary source of water for approximately two million people in the greater San Antonio area and is noted for some of the largest yielding wells in the USA ([www.edwardsaquifer.org](http://www.edwardsaquifer.org)). The Edwards Aquifer extends from the boarder of Mexico at Del Rio, Texas, east beneath San Antonio where it then trends northeast to Austin and Waco, Texas – a distance of approximately 550 kilometers (350 miles). The Edwards Limestone is approximately 140 meters (450 feet) thick and may extend as much as 1,000 meters (3,000 feet) below the land surface and more than 700 meters (2,100 feet) below sea level.

Water levels in Well J-17, located at Ft. Sam Houston in San Antonio, have been monitored continuously since 1934; and J-17 is one of 52 observation wells operated by the Edwards Aquifer Authority. Because of the long continuous record of water level measurements at the well, J-17 is used as an “Index Well” for the aquifer and water levels are used to trigger a Critical Period (drought) program in the greater San Antonio area.

The top of the J-17 well casing is 222.75 meters (730.81 feet) above mean sea level (msl) with the top of the Edwards Limestone at 74.01 meters (242.81 feet) above msl. J-17 is 265.18 meters (870 feet) deep and does not fully penetrate the Edwards Limestone. However, the aquifer is under artesian conditions at J-17 with water levels ranging from a high of

214.37 meters (703.3 feet) msl in 1992 to a low of 186.69 meters (612.5 feet) msl in 1956. In October 1998, San Antonio received 45.90 centimeters (18.07 inches) of rain in two days and water levels in J-17 rose 2.05 meters (6.72 feet) within a 24-hour period.

Artesian wells around the world commonly record earthquakes. There is a long record of earthquakes being detected at J-17 including the December 2004 Sumatra earthquake, the January 2010 Haiti earthquake, and the February 2010 Chile earthquake.

Because of the importance of J-17, there are a number of different water level measuring devices in the well (Fig. 1, left). However, earthquake signals for this well are best exhibited with an analog recorder (Stevens Type A-71 Chart Recorder; Fig. 1, right). During the March 11, 2011 Honshu, Japan earthquake (9.0 magnitude), the chart recorder at J-17 showed the Edwards Aquifer fluctuating approximately 0.3 meters (1 foot) during the initial response and continuing to oscillate for approximately two hours after the event (Fig. 2). The timeline is set to Central Standard Time USA and the elevations are measured in feet msl. Note UTC time in the narrative box for comparison. The earthquake seismic water took approximately 15 minutes to arrive in the San Antonio area.

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Fig. 1. Water level measuring devices in the J-17 well.

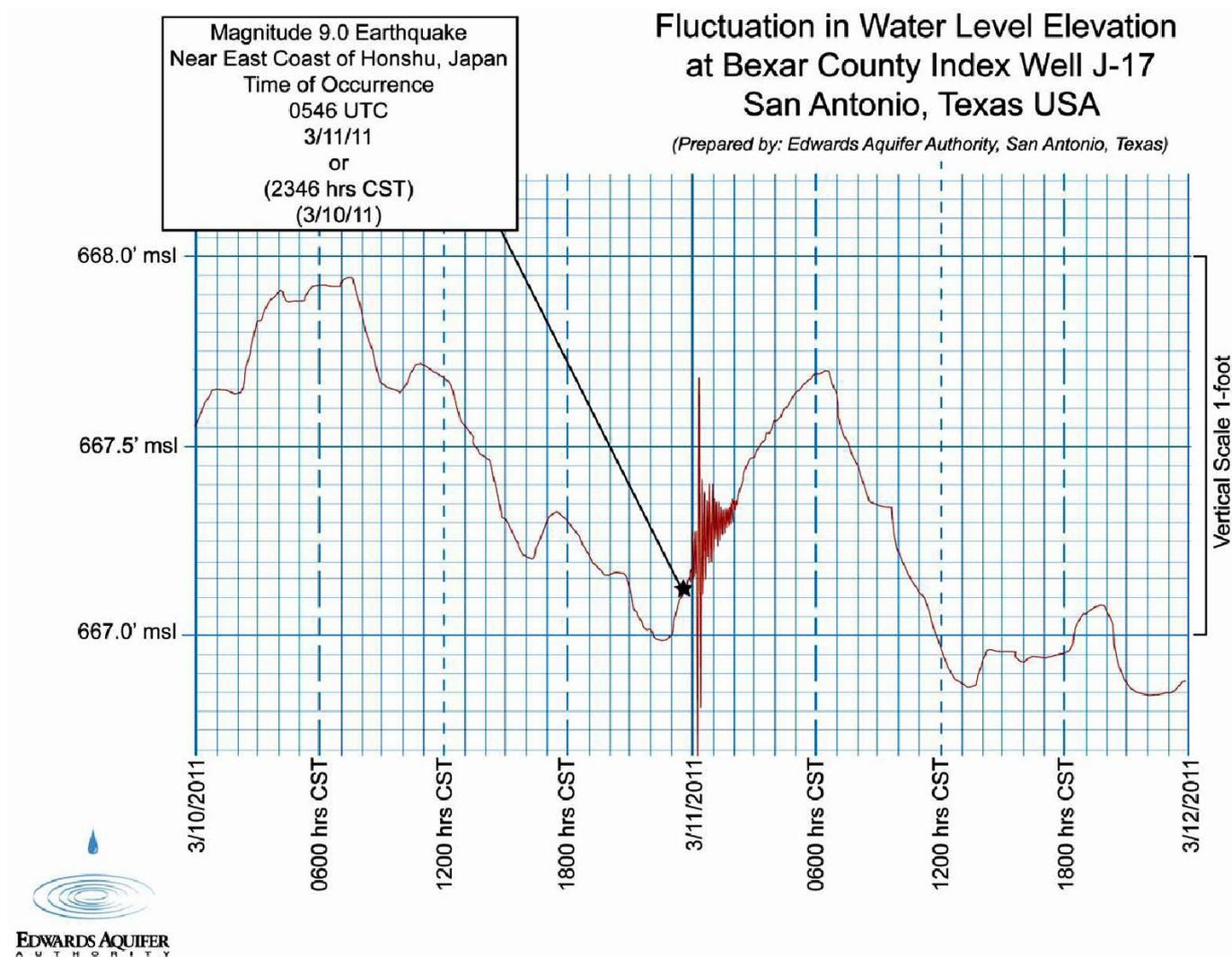


Fig. 2. Fluctuation in water level elevation at well J-17 in response to the March 11, 2011 earthquake in Japan.