REGARDING PETITION TO APPEAL DESIRED FUTURE CONDITIONS ADOPTED BY GMA 9 ON OR ABOUT JULY 26, 2010

AFFIDAVIT OF RENE BARKER, P.G.

BEFORE ME, the undersigned authority, on this day personally appeared Rene Barker, P.G., being duly sworn on his oath, says and deposes as follows:

1. My name is Rene Barker. I am over eighteen years of age and am competent to make this affidavit. The facts stated in this affidavit are within my personal knowledge and are true and correct.

2. I am [~~a~~] licensed as a professional geoscientist by the Texas Board of Professional Geoscientists. I have a Bachelor's degree in Geology from Fresno State University and a Masters degree in Hydrology from Stanford University. While employed by the U.S. Geological Survey (USGS) during 1987-2000, I worked primarily on the hydrogeology of Edwards-Trinity aquifer system in west-central Texas. During 1987-1996, as Project Geologist on the Edwards-Trinity Regional Aquifer System Analysis (RASA), I authored USGS Professional Paper 1421-B, entitled "Hydrogeologic framework of the Edwards-Trinity aquifer system, west-central Texas." Since retiring from the USGS, I have worked on karstic- and structurally altered groundwater-flow conditions in central Texas as a staff Hydrogeologist with Edwards Aquifer Research & Data Center, Texas State University. I am currently an active member of the Edwards Aquifer Area Expert Science Subcommittee under the Edwards Aquifer Recovery Implementation Program. My particular expertise is hydrogeology and groundwater-flow modeling.

3. As a hydrogeologist with experience in karst hydrology and groundwater modeling, I am concerned that the regionally formulated desired future conditions (DFC) allowing for an additional 30 feet of regionally averaged (regionalized) water-level decline will significantly impact the production and reliability of individual groundwater wells in addition to causing local springflow and baseflow rates to drop permanently below long-term-average historical conditions. It is highly likely that this DFC (allowing an additional 19 feet of regionalized water-level decline across Hays Country) will result in untold numbers of dry wells and significant periods of zero springflow from, not only relatively large springs such as Jacob's Well, but also a multitude of backyard springs and shallow seeps. The fact that it is impossible to predict with any degree of certainty the actual number, location, and longevity of these dried up wells and springs makes the DFC inconsistent with sound water-resource management policy, given the sheer number of environmental and economic unknowns it creates.

4. Because the Hill Country (Trinity Aquifer) GAM was calibrated on the basis of one square-mile grid cells and average-annual rates of recharge and discharge, the simulated conditions used to formulate the DFC are inconsistent with respect to desired local and short-term (monthly or even seasonal) conditions. Because the model was calibrated to simulate regional, average-annual conditions, it is incapable of projecting water-level, springflow, and water-budget conditions on a local, short-term basis. Without the necessary local and short-term resolution, there is no assurance that the simulated DFC provides desirable supplies of groundwater for existing wells or desirable rates of daily mean spring discharge and streamflow at locally relevant watercourses.

5. Considering the Hill Country GAM's USGS-based (Harbaugh et al., 1996) origins and the expertise and integrity of TWDB's modeling team (Mace et al., 2000; Jones et al., 2009; Hutchison, 2010), the model itself is unsurpassed in terms of its ability to perform in accord with its regional design and calibration based on best-available hydrogeologic data. The model's limitations with respect to its spatial and temporal resolution result from a "scale of application" commensurate with regional [~~or~~] and "lumped" parameter distributions and average-annual rates of recharge and discharge.

6. In order for the GAM to represent the real groundwater-flow system, it simulates the average or net effect of all modeled conditions and stresses that are accounted for within areas represented by a single model cell. As a consequence, the regional-scale GAM typically underestimates the amplitude of actual water-level fluctuations that result from pumping individual wells in the real aquifer. Although the difference between simulated water-level decline (applicable to one square-mile areas) and actual decline depends on several factors, it is not uncommon in heavily pumped areas for individual wells, stream reaches, or springs to go dry or cease flowing at levels far deeper than the simulated counterparts that represent average or net conditions across entire cell areas. In other words, the regional-scale design of the GAM limits its capacity to simulate a worst-case or conservative perspective relative to site-specific conditions associated with single wells, specific stream reaches, and backyard springs and seeps.

7. Although the limitations associated with the GAM's (one square-mile) scale of application, are thoroughly explained in the model's documentation (Jones et al., 2009), the implications were evidently overlooked by those in favor of adopting the DFC allowing for an additional 30 feet of water-level decline, as averaged or regionalized across the entire area of GMA 9 jurisdiction. Without the intervention of human expertise, the model results alone might be interpreted as conservative, worst-case information when they are, in fact, overly optimistic from the standpoint of underestimating the extent of water-level declines in individual wells, decreases in baseflow to tributary streams, and local reductions in springflow.

8. One of the earliest indications of unsustainable development is groundwater mining, as evidenced by long-term water-level decline. Available water-level data for the Trinity Aquifer indicate that the effects of historical and current pumping have already tapped the threshold of what most hydrologists consider groundwater mining or unsustainable development. The combination of water-level declines in the Hill Country that in places exceed 50 feet and observations (Brune, 1981) that during the mid-1800's flowing wells could be developed "nearly everywhere" are indications that the Trinity Aquifer's limits for sustainable pumping were reached prior to DFC adoption.

9. GAM results substantiate the concerns of informed citizens that the DFC will only exacerbate existing problems. In addition to the expense of deepening wells and pumping from greater depths, such problems include wells, springs, and baseflow to streams that dry up—such as observed during recent droughts, events far less severe than several droughts documented to have occurred in the past. Based on the imminence of drought and an appreciation of the need for prudent water-management practice, Cleaveland (2006) concluded, "It would appear unwise for civil authorities to assume that the 1950s drought represents the worst-case scenario to be used for planning purposes in water resources management in the South Central and Edwards Plateau climate divisions of Texas."

10. Despite the wisdom and widespread acceptance of Cleaveland's assesment, the rates of pumping that the DFC appears to justify are based on statistical analyzes of observed and deduced long-term precipitation and associated recharge distributions. In other words, the simulated conditions ostensibly allowing for an additional 30 feet of regionalized water-level decline were simulated apparently without sustaining the full impact of any specifically known or potential drought, much less anything resembling the 1947-56 drought-of-record. Instead, the projected declines appear to assume that the simulated aquifer receives a more-or-less continuous, unwavering

stream of recharge, dictated by various "wet and dry" periods of average-annual rainfall.

11. Given the GAM's limitations with respect to its regional, long-term perspective versus the reality of local details and specific climatic events, it seems problematic to use this model's output in any context that would affect the fate of individual wells, springs, or stream reaches. To use such output to unequivocally justify pumping increases enabling an additional 30 feet of regionalized water-level decline is inconsistent with sustainable groundwater development, particularly when the likelihood and potentially devastating effect of future droughts are considered. For this reason, I strongly support the appeal of the desired future conditions adopted by GMA9 on or about July 26, 2010

FURTHER AFFIANT SAYETH NOT.

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Rene Barker, Prof. Geoscientist

SWORN AND SUBSCRIBED to before me on this the ___ day of March, 2011.

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Notary Public for and in the State of Texas

My Commission Expires: _____

List of Cited References

(Rene Barker's Affidavit)

Brune, G., 1981, Springs of Texas, v. 1: Fort Worth, Texas, Branch-Smith Inc., 566 p.

Cleaveland, Malcolm K., 2006. Extended Chronology of Drought in the San Antonio Area. Report to the Guadalupe-Blanco River Authority, 29 p.

Harbaugh, A.W. and McDonald, M.G., 1996, User's documentation for the U.S. Geological Survey modular finite-difference ground-water flow model: U.S. Geological Survey Open-File Report 96-485

Hutchison, William R., 2010. Draft GAM Task 10-005. Texas Water Development Board unpublished report.

Jones, I.C., Anaya, R. and Wade, S., 2009, Groundwater Availability Model for the Hill Country portion of the Trinity Aquifer System, Texas, Texas Water Development Board unpublished report,193 p.

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