Groundwater Concerns

C. GROUNDWATER AVAILABILITY MODELS (GAM) -- Adequately quantify groundwater-surface water relationship

It appears that there is adequate science and technology available to use the historical and developing data on the groundwater – surface water relationship of the Colorado River and the Carrizo-Wilcox aquifer to merit quantitative inclusion in the desired future conditions for the Lost Pines GCD. As demonstrated in the information following, the Carrizo-Wilcox GAM has been developed and calibrated to base-flow data on the Colorado River and several streams within the region. The LSWP model and the monitoring program demonstrate that the science and technology are available and in use on the Colorado River to model and monitor the groundwater – surface water interactions. **This same science and technology should be employed to protect the Carrizo-Wilcox Aquifer and the Colorado and Brazos rivers from over-pumping in our region.**

Carrizo-Wilcox GAM 2003 (Appendix C). Based on the data reviewed in developing the Central Carrizo-Wilcox GAM the model was calibrated and verified to the historical period of 1980-2000. Table B-4 in the study shows the calibration targets of the Colorado River, Middle Yegual Creek, and the East Yegual Creek; gives the layer, row and column of the target cells for the river and creeks; and gives the estimated base-flow increase across the outcrop. The Colorado River base flow increase was adjusted from 32,400 ac-ft/year to 26,100 ac-ft/year to correspond to the 1918 USGS study cited above.

Table 6 gives calibration targets for the Colorado River, Big Sandy Creek, Middle Yegua Creek, and East Yegua Creek; all found within Bastrop and Lee Counties. It is clear that the GAM for the central part of the Carrizo-Wilcox has been calibrated to include base flows for the Colorado River and three tributaries in Bastrop and Lee counties. It is expected that GAM analysis of various pumping regimes in these counties would have corresponding impacts on the values of the cells that represent these surface water features and therefore could be used to predict the impact of these regimes on these surface water features.

LCRA-SAWS LSWP Groundwater Model

Though most groundwater availability models (GAM) are weak in representing the groundwater – surface water relationships, the LCRA SAWS Water Project (LSWP) Groundwater Flow Model for the Chicot and Evangeline Aquifers in Colorado, Wharton, and Matagorda Counties was developed to simulate the groundwater – surface water interaction of the these aquifers with the Colorado River. The study included the task to “develop and calibrate a groundwater model capable of simulating the impacts of the LSWP's pumping activities on drawdown, land subsidence, groundwater availability estimates, and changes in surface water-groundwater interactions”.

The following paragraph from the report describes the conceptual context of the model: “All of the interaction between groundwater and the rest of the hydrological cycle occurs in the shallow groundwater system. These interactions include recharge, evapotranspiration, and exchange of water between surface water and groundwater. Many regional groundwater models for the Texas Gulf Coast such as the Groundwater Availability Models (GAMs) (Kasmarek and Robinson, 2004; Chowdhury and others, 2002) do not have sufficient vertical discretization to model a shallow aquifer system. **Based on the groundwater system described by Young and Kelley (2006), a groundwater model should explicitly represent a shallow flow system to provide a reasonable representation of the vertical hydraulic gradients and the interaction between groundwater and surface water.**”

The LSWP model developed used six calibration targets to represent the base flows for the Colorado, West Lavaca, East Lavaca, Brazos-Colorado East, and Colorado Lavaca river basins. All of the calibration targets were estimated by base flow separation of river gauge data for the years cited, except for the Colorado which was obtained from the LCRA study (Saunders, 2006) performed from 2005 to 200. The authors of the model reported that “the model provides excellent matches to the field data.”

The model has been used to predict changes in the groundwater contribution to base-flow in the Colorado River from projected pumping rates over the 80 year life of the LCRA-SAWS project.

A monitoring program has been set up in four locations along the Colorado River at Eagle Lake, Wharton, Bay City and Wadsworth. Shallow wells (<100 ft) have been located near river gages in these locations to provide additional data to demonstrate Colorado is a gaining stream and to demonstrate large differences in hydraulic head in shallow and deep aquifer.