A Preliminary Groundwater Conceptual Model for the South Texas Sand Sheet

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ABSTRACT

A conceptual model is the foundation for conjunctive management of groundwater and surface water. It is especially important in arid and semi-arid areas such as Lower Rio Grande Valley (LRGV) in South Texas where freshwater sources are scarce and vital. Groundwater Availability Models (GAM) was developed for agricultural and urban development and planning for many regions including the LRGV. The recharge rate in GAMs for the northern and southern Gulf Coast aquifers (LRGV) varies from 0.09 to 0.43 in/yr while literatures indicated between 0.06 to 6 in/yr (0.3–50% of annual precipitation).   The South Texas Sand Sheet (STSS) covers six South Texas counties and occupies more than 780,000 ha. STSS consists predominantly of loose sandy soils and relict sand dunes. Its thickness varies between a few inches to 40 ft. The volume of STSS is estimated to be more than 12.6 million ac-ft with assumption of average thickness of about 6 ft. In addition, the eastern portion of STSS is adjacent to Laguna Madre, one of the important lagoon ecosystem on the Texas shoreline. The interactions of fresh/brackish water in STSS with coastal marine ecosystems in Laguna Madre require further studies. Assuming a 15% porosity, the water storage capacity of STSS can be around 1.9 million ac-ft. The recharge rate in such well-sorted medium-sand area with an estimated hydraulic conductivity of 1250 in/yr can be high. Preliminary conceptual model implies that STSS is a significant hydrologic component for water resource management in South Texas. The freshwater held in STSS should be taken into account when managing regional water sources, e.g., groundwater recharge and freshwater storage, flood control, and inflows to coastal areas. Geographic information systems (GIS) analysis and modeling are in progress while additional field data are needed.