Title of Proposal: Impacts of Texas Interbasin Water Transfers on the Water Dependent Economy and the Environment

Statement of Critical Regional Water Problems:

Water scarcity is becoming a pervasive and persistent problem in Texas particularly in the drier regions containing cities like San Antonio, Austin, Corpus Christi but growth is causing emerging problems in Dallas Fort Worth and Houston. A number of options are being considered including with a prominent one being interbasin water transfers shifting water from surplus to deficit regions. In fact the Senate bill 1 planning documents contained more than 200 proposed transfers in the 50 year plans. Potential water transfers can have unforeseen or negative impacts on basin of origin regional economies and or on the environment including water quality. The Texas water Code mandates that water transfers should consider economic, environmental and water quality impacts (in section 11.085, (K), (F)) demanding projections of impacts on water quality, aquatic and riparian habitat in all affected basins. While there are approximately 216 proposed Texas interbasin water transfers there is no comprehensive evaluation or evaluation methodology for these transfers. This proposal will allow the author to build on an existing state wide modeling project to develop such a procedure namely one that evaluates the total effects of Texas interbasin water transfers on the affected basin economics, and environmental attributes including water quality. Research into such issues only addresses part of the issue. Wurbs investigated the quantity issues in water transfers but ignored economic impact and water quality issues. Gillig et al and Watkins et al focused on economic considerations on South Central Texas Region and Edwards Aquifer region but ignored water quality. Srinivasan examined water quality but did not examine economic issues. All of the research has been localized looking at only single or a couple of basins without looking at broader statewide issues.

Nature, Scope, and Objectives of the Research:

While water transfers help to address water scarcity problems, the movement of water from one area to another has important implications for municipal, industrial, and agricultural users in both the basin of origin and the basin of destination (plus any others affected by the transfer in between) as well as the environmental /water quality characteristics in those basins. Such characteristics need to be evaluated when an interbasin transfer is to be considered with the evaluation made available to policy makers and stakeholders. Such information could be generated by a modeling system that simulated economic impact along with hydrological and water quality attributes of basins. This proposed research would develop a method to integrate the economic, hydrologic, and environmental / water quality evaluation and then would apply on a case study basis to select proposed Texas water transfers.

The research will be supported by modeling efforts from an ATP project and would build upon four models.

- The Water Rights Analysis Package (WRAP) model of Wurbs, that has been used in the Texas regional planning water investigations. That model will be used to provide data for the hydrologic component of the overall research. Currently, this part is done under the ATP project.

- The Edwards Aquifer Groundwater and River System Simulation Model (EDSIMR) of Gillig et al. addressing flow and economics in Nueces, Frio and Guadalupe-Blanco basins.
- The Soil and Water Assessment Tool that simulates the effects of management including water transfer, water diversions and land management changes on water, sediment, and agricultural chemical yields in large complex and ungauged watersheds.
- The TEXRIVERSIM economic and water quantity model that simulates water use, regional economics and hydrologic flows as developed under the ATP project. TEXRIVERSIM integrates stochastic flow balance, instream and estuary flow, reservoir storage, climate effects on agricultural and non-agricultural water demand, agricultural crop dryland / irrigation system choice, twenty-four riverbasins across Texas, aquifer water levels, costs and capacity of proposed water transfer projects etc. TEXRIVERSIM models uncertainty using several flow states of nature.

This project will unify TEXRIVERSIM and SWAT to provide a comprehensive transfer evaluation system. Then TEXRIVERSIM model will be passed on to SWAT for estimation of water quality impacts in terms of indicators such as sediment, nutrient and pesticide loads.

Results Expected from this Project:

This project will develop and apply a water transfer evaluation system that integrates the effects of the proposed water transfer on the economic, hydrologic, environment and water quality in Texas. This system will yield information on economic implications for municipal, industrial and agricultural water users by basin. The hydrological components of the model will evaluate such issues as instream use, streamflows, bay and estuary flows due to inter and intrabasin water transfer. The result will provide information to support effective public water policy making for state agencies, water management authorities and regional water planning groups. It can help them to devise appropriate compensation rules for environmental damage, economic losses to the areas of origin and loss of instream uses.

References

Atwood, J.D., B.A. McCarl, C.C. Chen, B.R. Eddleman, B. Nayda, and R. Srinivasan. "Assessing Regional Impacts of Change: Linking Economic and Environmental Models." Draft of paper in Agricultural Systems (63)3, 147-159, 2000

Gillig, D., B A. McCarl, and F.O. Boadu. "An Economic, Hydrologic, and Environmental Assessment of Water Management Alternative Plans for the South Central Texas Region." *Journal of Agricultural and Applied Economics*, 33, 59-78, 2001

Gillig, D., B.A. McCarl, L.L. Jones, and F.O. Boadu. "Economic Efficiency and Cost Implications of Habitat Conservation: An Example in the Context of the Edwards Aquifer Region." *Water Resources Research 40,* W04102,2004

McCarl, B.A., K.O. Keplinger, C. Dillon, and R.L. Williams. “Limiting Pumping from the Edwards Acquifer: An Economic Investigation of Proposals, Water Markets and Springflow Guarantees.” *Water Resources Research* 35, 1257-68, 1999

Smith, R.A., R.B. Alexander, and K.J. Lanfear. “Stream Water Quality in the Conterminous United States: Status and Trends of Selected Indicators During the 1980’s.” *National Water Summary* 1990-91: *Stream Water Quality*, US Geological Survey Water-Supply Paper 2400, 1993

Watkins Jr, D.W., D.C. McKinney, L.S. Lasdon, S.S. Nielsen, and Q.W. Martin. “A Scenario-based Stochastic Programming Model for Water Supplies from the Highland Lakes.” *International Transactions in Operational Research* 7 (3), 211-230, May 20.