Collaborative Stakeholder-Driven Water-Energy-Food Resource Modeling and Planning

Sandia National Laboratories

Ray Finley, Geoff Klise, Howard Passell, Marissa Reno, Beth Richards, Jesse Roach, Vince Tidwell, Erik Webb

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Resource planning is more complicated and more critical than it has ever been

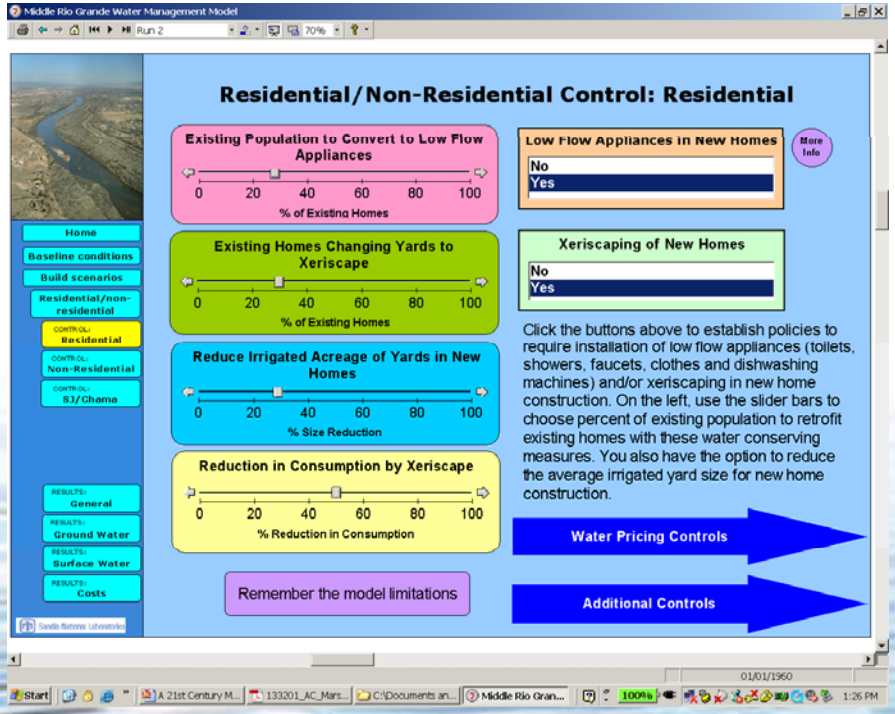
- Increasing population
- Increasing resource consumption
- Decreasing resource availability
- Increasing stakeholder involvement
- Increasing transboundary issues
- Increasing appreciation of the complexity
  - multi sector/discipline
  - many variables, interdependencies, feedbacks, time lags

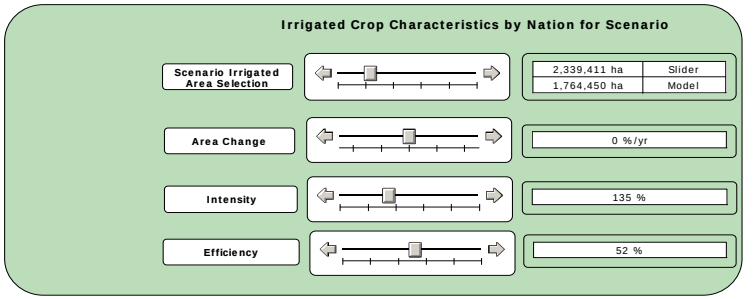
One solution: Collaborative Stakeholder-Driven Modeling, Roadmapping and Planning

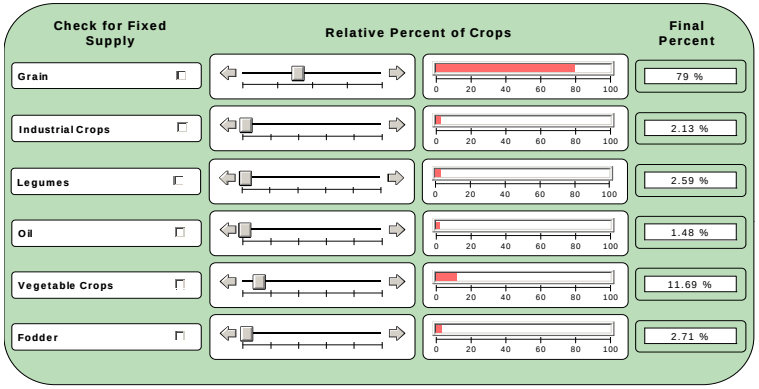
- Engage multi-sector, multi-disciplinary experts
- Collect knowledge, data, information
- Build computer simulation models for
  - evaluating tradeoffs
  - developing consensus
  - educating stakeholders, policy makers & public
  - planning future strategies
- Ongoing efforts: modeling improves management, experience improves the model

INTERACTIVE, USER FRIENDLY MODELS

Allows for real time construction and evaluation of competing development strategies







According to discussion in 2nd workshop:

* Pre 1993 returns back to river of origin. Main Outfall Drain (MOD) constructed in 1993.

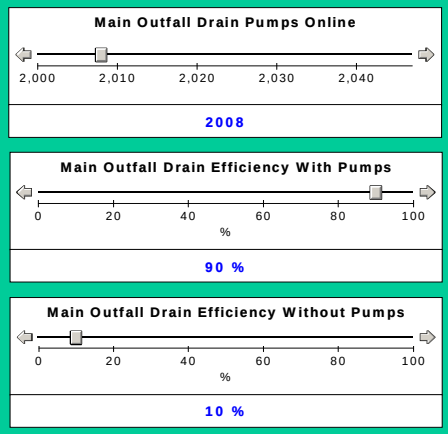
* 1993 - 2003 returns from between rivers below Baghdad and Fallujah go back to the Euphrates via MOD.

* 2003 - 2008 to Central Marsh via MOD (90% to marsh, 10% to gulf via Shatt al Basrah).

* After 2008 to gulf via MOD and pump station to Shatt al Basrah (90% to gulf, 10% to Central Marsh).

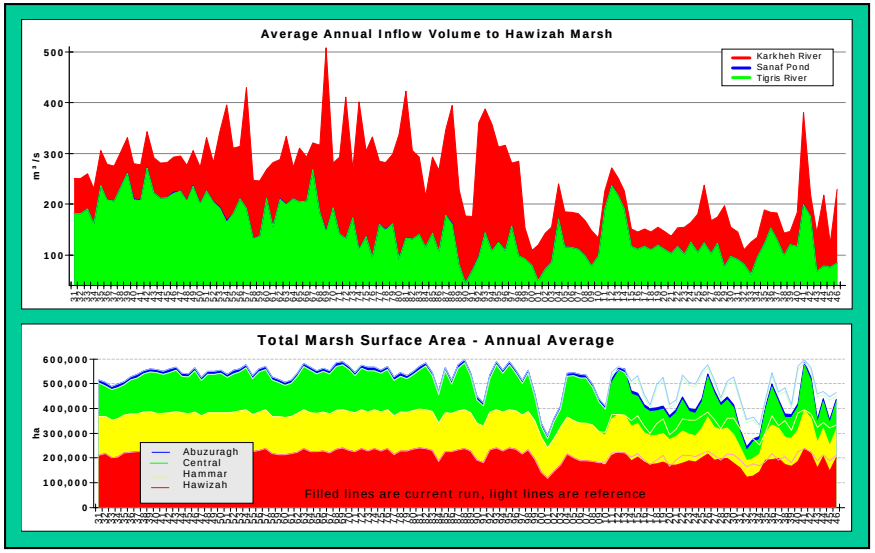
These sliders allow user to adjust the year MOD pumps begin working, and the efficiency of the MOD in terms of how much water is delivered directly to gulf with and without pump station.

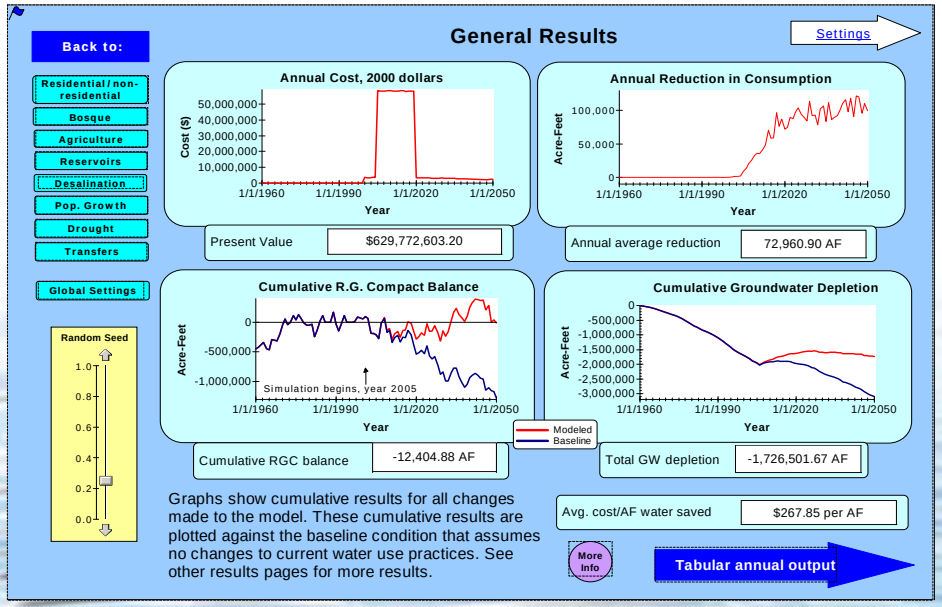
MoWR engineers provided a spreadsheet that somewhat contradicted this in terms of which diversions go to MOD, and discrepancy remains unresolved.

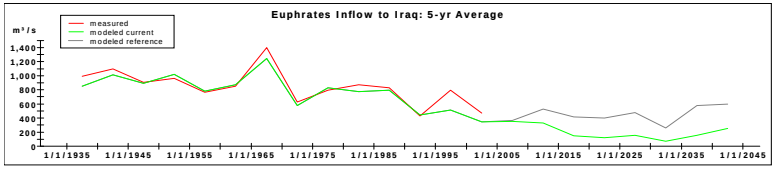


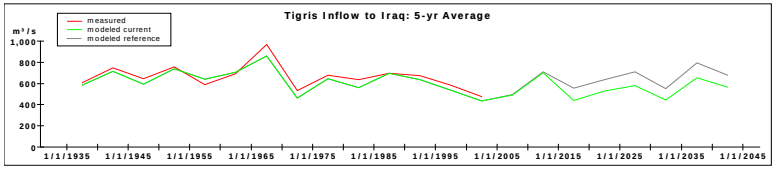
GRAPHICAL OUTPUT

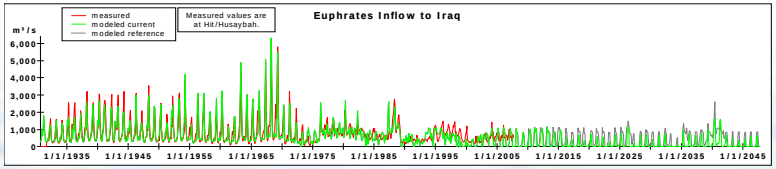
Allows real time comparison of alternatives, education of stakeholders and policy makers, and development of rigorous, quantitative development plans

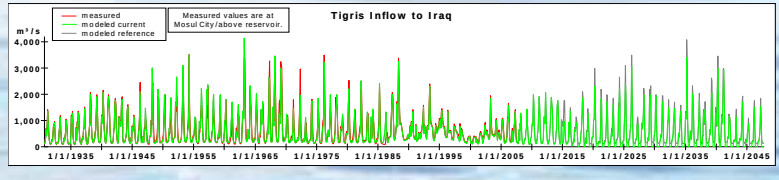












Collaborative Stakeholder Involvement

- Collaborative stakeholder involvement is key
  - Brings together experts from across disciplines and sectors
  - Over months or years they work together to better understand interdependencies among systems
  - Their collaborative experience is captured in a quantitative model
  - Model is clearinghouse for best data and knowledge
- Model *AND* the collaborative process are both important products of the work
  - Both form the structure for ongoing planning, evaluation of consequences, improvement of models, and so on . . .

Overall advantages of the approach

- Reduces guess work associated with large-scale infrastructure planning projects
- Includes climatic variability, demographic patterns, economics
- Provides rigorous and quantitative evaluation of outcomes
- Provides a user-friendly, interactive tool perfect for educating policy makers and the public
- SNL projects include capacity development
  - Modeling and planning skills stay after SNL leaves

Collaborative Modeling & Planning Project Examples

- Aral Sea Basin
- Middle and Lower Rio Grande
- Gila Basin
- Mimbres Basin
- US Water/Energy Interdependencies
- Willamette Basin
- Iraq/Tigris-Euphrates
- Libya Great Man Made River Basin
- Santa Fe Renewables (SNL/Wild Earth Guardians collaboration)
- Atlantic Council 21st Century Marshall Plan for Water, Energy and Agriculture in Developing Nations
- Ecology of National Security/Environmental Security
- Algae Biofuels

Strategy for Land and Water Resources in Iraq (SLWRI) Water Systems Planning Model

A simulation tool for long term water planning developed collaboratively by:

Iraq Ministry of Water Resources,
US DOS Iraq Transition Assistance Office,
UNESCO, and Sandia National Laboratories