Exhibit C

2011 SOUTH CENTRAL TEXAS REGIONAL WATER PLAN
REGION L
SCOPE OF WORK

ADMINISTRATIVE AND PUBLIC PARTICIPATION ACTIVITIES FUNDING BASE
Total Cost 80,950

TASK 1) General Group Meetings and General Communications Materials and Information

a) Provide planning, attendance and follow-up for the regularly scheduled meetings of (South Central Texas Regional Water Planning Group) SCTRWPG. Tasks include preparing for and responding to the public participation process, including organizing and categorizing public comment in the electronic data base (33,000).

b) Produce Logo/Letterhead (1,500).

TASK 2) Website Improvements: Maintain a useful, up to date, interactive website to accomplish Region L's public participation goals. The SCTRWPG will use its website to specifically accomplish Public Participation by making all important information publicly available and maintaining useful and up-to-date content; and interacting with the Public by providing an online means of one- and two-way communication between the Group and the public. The website will be updated and several features will be updated or newly implemented. The work includes:

a) Ongoing Maintenance:

- Posting minutes of SCTRWPG meetings. Citizens who could not attend meetings would be able to read the minutes to ensure that all citizens have the opportunity to stay up to date on any meeting held by the Group, especially a meeting which affected their area.
- Posting region specific technical documents, such as study findings, in an easily accessible area of the website. By placing these documents online, all citizens could have access to important data.
- Maintaining an up to date calendar of events. This would give all citizens knowledge of the movements of the planning group. The public could stay up to date on workshops and meetings of interest thereby increasing the public's participation in the entire process.
- Updating Group member biographies and contact information.

b) Changing the URL: The current URL, www.watershedexperience.com, is difficult to remember for the Group and for the public. By changing the URL to something more memorable the Group hopes to increase website traffic.

c) Streamlining website navigation: In order to make the website more user-friendly, to increase use by the public, and to prevent frustration, a web designer would update the navigation and style of the website. This would also include:

- Tracking traffic. Knowing how many people visit the website, what areas are most popular, and which documents are accessed most frequently will help the Group know which issues are most important to the public.
- Developing a Style Guide. By making the site's graphics, layout, content, and navigation consistent and by providing helpful information such as file size and dates, users will have a more productive visit to the website. This information would be documented so that all future additions to the website would follow the same guidelines.

(All base website tasks 9,100)

TASK 3) Facilitation: Meet individually (in person or by telephone) with each member of the SCTRWPG to assess interests, positions, concerns, and information needs. (12,750)

a) Determine particular needs of new members and what members who have joined the SCTRWPG since the first planning period wish they had had in terms of orientation.
b) Field questions and provide answers or resources as required in order to facilitate integration into the group and to strengthen group cohesion.
c) Analyze issues raised.
d) Develop process for addressing questions and concerns.
e) Meet with all members as soon as possible. Depending upon the need, follow-up sessions may be scheduled with some members during the biennium. (One hour per member + travel, assessment, and response: 30 @425).
f) Summarize the interviews conducted in a report.

TASK 4) Facilitate nine SCTRWPG quarterly meetings in San Antonio. (11,200)
Assist in preparing agenda for each of the nine quarterly meetings, including outcomes, next steps, and supporting reports or documentation as necessary.

TASK 5) Development of Scope of Work **13,400**

Technical Consultant	8,154
Public Participation Consultant	3,577
Facilitation Consultant	1,669
Subtotal	13,400

STUDY 1: Lower Guadalupe Water Supply Project (LGWSP) for GBRA Needs Total Cost 109,857

Update the technical evaluation of the Lower Guadalupe Water Supply Project for Guadalupe Blanco River Authority (GBRA) Needs. Refine the design and operation of this water management strategy to minimize adverse impacts on the environment and local economic conditions. Update cost and describe how it will be funded.

TASK (1) Refine composition of potential water sources, including: GBRA / Union Carbide Corporation (UCC) water rights, new surface water appropriations, groundwater from the Carrizo/Simsboro Aquifer, and/or water from Canyon Reservoir. Up to three (3) scenarios of source composition and facilities will be evaluated using the Guadalupe – San Antonio River Basin Water Availability Model (GSA WAM), hydrologic assumptions, and operational procedures consistent with those approved by the TWDB for use during the second round of Region L planning[1] (11,440).

TASK (2) Refine facility components and configurations including: pump station(s), off-channel storage, transmission pipeline alignment, and delivery point(s). Up to three (3) scenarios of source composition and facilities will be evaluated using the Guadalupe – San Antonio River Basin Water Availability Model (GSA WAM), hydrologic assumptions, and operational procedures consistent with those approved by the TWDB for use during the second round of Region L planning (8,964).

TASK (3) Evaluate changes in instream flows and/or freshwater inflows to the Guadalupe Estuary using the Guadalupe – San Antonio River Basin Water Availability Model (GSA WAM), hydrologic assumptions, and operational procedures consistent with those approved by the TWDB for use during the second round of Region L planning. Such changes will be evaluated and presented in the study report in a manner similar to that in Section 4C.32 of the 2006 South Central Texas Regional Water Plan (8,210).

TASK (4) Update environmental issues assessment in accordance with TWDB guidance and including discussion of instream flows, freshwater inflows to bays and estuaries, wildlife habitat, wetlands, threatened and endangered species, and cultural resources (13,477).

TASK (5) Update project cost estimates and describe potential means of funding project implementation (11,652).

TASK (6) Evaluate potential local economic impacts of the project in the source and terminus areas using data developed by the TWDB[2] and giving due consideration to relevant information from other sources[3] For example, the economic impacts of not meeting the needs at the terminus area will be

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[1] Information regarding the GSA WAM, hydrologic assumptions, and operational procedures is provided in Section 3.2 of the 2006 South Central Texas Regional Water Plan. Hydrologic assumptions most closely approximate those for TCEQ Run 1, including current treated effluent volumes and reuse commitments. The GSA WAM includes modifications and improvements to the standard TCEQ model version for more accurate simulation of specific water rights and application of Consensus Criteria for Environmental Flow Needs (CCEFN).

[2] TWDB, "Socioeconomic Impacts of Unmet Water Needs in the South Central Water Planning Area," April 2006.

[3] R.W. Beck, "Socioeconomic Analysis of Selected Interbasin Transfers in Texas," DRAFT, Texas Water Development Board, November 2006.

expressed in two parts as follows: 1) direct economic values that would be lost as a result of projected shortages (unmet needs); and 2) economy-wide indirect economic values foregone through failure to meet the projected needs of the direct beneficiaries at the terminus area. Computations will be based upon the direct and indirect economic multipliers, as reported by the TWDB input-output model of the region. These economic impacts at the terminus areas are assumed to be independent of scenario of source composition and facilities. However, some attention will be given to assessment of economic impacts at the source areas for each of the scenarios of source composition and facilities (e.g., the local economic impacts of project construction, using economic multipliers developed by the TWDB, as expressed via the construction and associated sectors of the economy). (10,295).

TASK (7) Update documentation of technical evaluation of project (14,075).

TASK (8) Preparation for, active participation in, and follow-up to up to meetings of the SCTRWPG and meetings of the Workgroup by the Technical Consultant (study share of total cost of attending nine SCTRWPG and nine associated Staff Workgroup meetings 19,689).

TASK (9) Monitor this newly redesigned project to discover residual concerns, problems, or side-effects and address them individually or in small groups with SCTRWPG members and, if appropriate, with stakeholders. Any negative regional impacts should be resolved as early as possible in the planning cycle. The Facilitation Consultant will work with the SCTRWPG to ensure that concerns expressed by individuals, as well as potential solutions, are brought to the group for resolution and action, as needed. (3,500)

TASK (10) Meet with individual SCTRWPG members to manage or avoid situations in which conflict may arise. Track and document concerns and potential solutions for SCTRWPG (6,375).

TASK (11) Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report. Report to include documentation from all Tasks including documentation of technical evaluations of up to three configurations of the LGWSP for GBRA Needs. The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Region L Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules (2,180).

Funding Sources
Texas Water Development Board 109,857

STUDY 2: Brackish Groundwater Supply Evaluation
Total Cost 59,961

Identify brackish groundwater sources and evaluate desalination as a water management strategy to meet projected needs.

TASK (1) Identify proximate water user groups with needs and target areas for development of brackish groundwater supplies from the Edwards and Gulf Coast Aquifers (4,646).

TASK (2) Research information regarding water quality, describe and evaluate potential treatment processes, and prepare cost estimates for up to three (3) projects for representative water user groups potentially including (San Antonio Water System) SAWS, Woodsboro, and Seadrift (23,998). To maximize effectiveness with limited funds HDR will coordinate closely with SAWS to supplement SAWS research to explore use of Edward's brackish water as a regional water source.

TASK (3) Review and refine technical information regarding one brackish groundwater supply project from the Wilcox Aquifer which is being evaluated by SAWS under separate contract for consistency with TWDB guidelines for regional water planning (2,500).

TASK (4) Prepare documentation of technical evaluations of up to four potential projects (20,169).

TASK (5) Preparation for, active participation in, and follow-up to meetings of the SCTRWPG and meetings of the Staff Workgroup by the Technical Consultant (study share of total cost of attending nine SCTRWPG and nine associated Staff Workgroup meetings 6,468).

TASK (6) Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Report to include documentation from all Tasks. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report. The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Region L Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules (2,180).

Funding Sources

San Antonio Water System	25,657
Texas Water Development Board	34,304
	59,961

STUDY 3: Enhanced Water Conservation, Drought Management, and Land Stewardship Total Cost 63,906

Review and refine conservation recommendations of the 2006 Regional Water Plan, including consideration of practices such as condensate collection, rainwater harvesting, and drought management as well as land stewardship.

TASK (1) Excerpt information from 2006 Regional Water Plan about the following water conservation practices of the 2006 Plan and assess overlapping elements of conservation and potential drought management practices (4,629):

- Plumbing retrofit with low flow plumbing fixtures;
- Lawn watering water conservation;
- Water reuse;
- Rainwater harvesting;
- Condensate collection (technical and cost information outlined below); and
- Land stewardship (i.e., brush management).

Prepare presentation materials regarding referenced water management strategies in the 2006 Regional Water Plan.

TASK (2) Prepare preliminary cost estimates to install air-conditioning systems with condensate collection facilities and plumbing to deliver the water for use either as landscape irrigation or for other uses, such as toilet flushing and sanitation (8,101).

TASK (3) Quantify and evaluate Drought Management as a water management strategy for Region L (37,999).

a) Excerpt information from 2006 Regional Water Plan regarding Drought Management and drought contingency planning.
b) For a representative municipal water user group (city) in each county of Region L, obtain the Drought Contingency Plan from TCEQ and determine quantities of water expected to be "saved" as a result of implementation of various stages of such plans. Obtain and plot municipal water use data for the past 10 years (or suitable alternative length of time) for comparison to projected drought of record water use, in order to quantify the difference between actual use during "Normal" conditions and during "Drought" conditions.
c) From the results of the action listed immediately above, calculate the quantities of water needed resulting from drought conditions, shift the projected municipal water demand curve downward to eliminate the

quantity of water "saved" by implementation of the Drought Management water management strategy, and adjust other water management strategies accordingly.

d) Describe potential effects of Drought Management strategy upon water management strategies (quantities and time needed) for representative water user groups of the Region L plan.
e) Calculate potential savings or "Benefits" associated with the Drought Management water management strategy (e.g., reduced or delayed costs or impacts for other water management strategies).
f) Calculate economic impacts of not having quantities of water "saved" via the Drought Management water management strategy using data developed by the TWDB[4].

TASK (4) Preparation for, active participation in, and follow-up to meetings of the SCTRWPG and meetings of the Staff Workgroup by the Technical Consultant (study share of total cost of attending nine SCTRWPG and nine associated Staff Workgroup meetings 6,497).

TASK (5) Provide descriptions and explanations of drought management based on information developed under Tasks 1 and 3, as well as a summary of comments received on these topics during the previous planning period. Work with select stakeholders and SCTRWPG members as a part of regularly scheduled SCTRWPG meetings and assist the SCTRWPG in deliberating about whether and/or how drought management should play a role (e.g. as a water management strategy) in the regional water plan. Assist SCTRWPG in crafting associated language if necessary. Work includes preparation for a minimum of two SCTRWPG meetings at which drought management will be deliberated, at least one of which will include input from selected stakeholders regarding drought management. Includes preparation of handout materials, providing a brief summary of activities and outcomes for report, and, as directed by the group, arranging relevant presenters (4,500).

TASK (6) Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report. Report will to include documentation from Tasks 1-5 including preliminary cost estimates for condensate collection facilities, and documentation of technical evaluation of Drought Management as a water management strategy. The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Region L Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules (2,180).

[4] TWDB, "Socioeconomic Impacts of Unmet Water Needs in the South Central Water Planning Area," April 2006.

Funding Sources

San Antonio Water System	31,427
Texas Water Development Board	32,479
	63,906

STUDY 4: Environmental Studies
Total Cost 173,960

Continue environmental studies focused on bays & estuaries, instream flows, bottomland hardwoods, endangered species, and other relevant subjects of interest to the regional water planning group.

TASK (1) Research and refine estimates of historical diversions and effluent discharges affecting flows in the lower Guadalupe River and freshwater inflows to the Guadalupe Estuary prior to 1977. Evaluate potential effects on fisheries harvest equations for selected species of interest (Blue Crabs, White Shrimp, Brown Shrimp, Eastern Oyster, Black Drum, Red Drum, and Spotted Seatrout). More specifically, accounting for actual diversions prior to 1977 will show that reported fisheries harvest for the Guadalupe Estuary prior to 1977 was accomplished with less freshwater inflow than assumed in the derivation of the current fisheries harvest equations. Standard regression techniques comparable to those used by TWDB staff will be used to re-evaluate fisheries harvest equations for selected species of interest. Provide results and technical documentation (25,728).

TASK (2) Perform ecologically-based streamflow assessments (similar to those for the Guadalupe Estuary in Section 7 of the 2006 Regional Plan) for the Guadalupe River at Victoria and the San Antonio River at Falls City. Such assessments will be based on simulated streamflow sets from applications of the GSA WAM representative of natural, present, baseline (full permits), and regional water plan conditions and will likely include criteria associated with the frequency of occurrence of critical high and low flow conditions. Provide documentation of analyses and results (13,212).

TASK (3) Develop and deliver presentation materials and GIS-based graphics to support SCTRWPG and education programs focused on regulatory processes, endangered species habitat ranges, and other factors potentially affecting implementation of planned strategies (7,747).

TASK (4) Provide limited technical support to ongoing research by Texas A&M University by providing relevant freshwater inflow data from simulations including planned water management strategies and/or resulting from work element (1) of this topic (4,972).

TASK (5) Preparation for, active participation in and follow-up to meetings of the SCTRWPG and meetings of the Staff Workgroup by the Technical Consultant (study share of total cost of attending nine SCTRWPG and nine associated Staff Workgroup meetings 13,021).

TASK (6) Prepare a draft and final report, Part I, to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report. Report to include documentation from Tasks 1-6 including results and technical documentation from Tasks 1 and 2 and documentation of historical diversions and effluent discharges, potential effects on fisheries harvest equations, and ecologically-based streamflow assessments. The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Region L Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules (2,180).

TAMU Ecosystem Modeling (Tasks 7 - 12):
The goal of this portion of the study is to produce an ecosystem simulation model that will integrate existing project field data with information from the scientific literature to project possible ecosystem responses to variation in freshwater inflows.

Ecosystem Model Description will be produced as a part of the integration of the five sub-models. This integration of sub-models will also be an integral part of the development of each sub-model. Each sub-model, except the marsh hydroperiod sub-model, includes components from other sub-models. Thus, although some preliminary development and testing of individual sub-models will occur, final phases of model development and testing will be conducted with the overall model. Development of the integrated Ecosystem Model is not a separate activity.

Extensive field data collection activities related to overall model and sub-model development have just completed. No additional field data collection is necessary to develop and test the 5 sub-models and overall Ecosystem Model under this contract. These field data and observations have already been collected and are available for use in the development and calibration of an Ecosystem Model.

The overall Ecosystem Model will consist of several hierarchically-nested sub-models (Figs. 1-5) representing dynamics of the physical environment and the ecological community within the marsh, including a:

(1) marsh hydroperiod sub-model (MHM),
(2) hydrological connectivity sub-model (HCM),
(3) marsh vegetation sub-model (MVM),
(4) crab dynamics sub-model (CDM), and
(5) crane behavior and energetics sub-model (BEM)

Symbols with dotted lines in Figures 1 – 5 indicate the connections among the five sub-models. For example, "WaterLevelMarsh," "SeaSalinity," and "EvapRate," whose dynamics are generated in the marsh hydroperiod sub-model (Fig. 1), also are a part of the hydrological connectivity sub-model (Fig. 2). Likewise, "Veg1," whose dynamics are generated in the marsh vegetation sub-model (Fig. 3), also is a part of the crab dynamics sub-model (Fig. 4).

Currently, the status is that none of these 5 sub-models exist and each will be developed from start to finish under this contract. As part of this contract, each of these 5 sub-models as well as the overall Ecosystem Model will be developed, calibrated, and tested against historical data, at both the sub-model and overall Ecosystem Model levels. Other than testing and calibration activities, final application of the sub-models and overall model, however, will not be part of this contract scope of work.

TASK (7) The marsh hydroperiod sub-model (MHM) will be developed as a stochastic compartment model based on difference equations with a one-half day time-step ($\Delta t = 0.5$ day). The model will be coded using the program STELLA and simulations will be run on a personal computer. STELLA is a commercial software package that facilitates the creation of both simple and complex numerical models. It has a graphical interface that aids in laying out, constructing, and utilizing a model. Models can be configured to run independently with set inputs (either numerically or graphically specified) or in an interactive "flight simulator" mode. Model output can be observed via numerical readouts, tables, and graphs. The STELLA software also provides a variety of tools that facilitate documentation and presentation of the model.

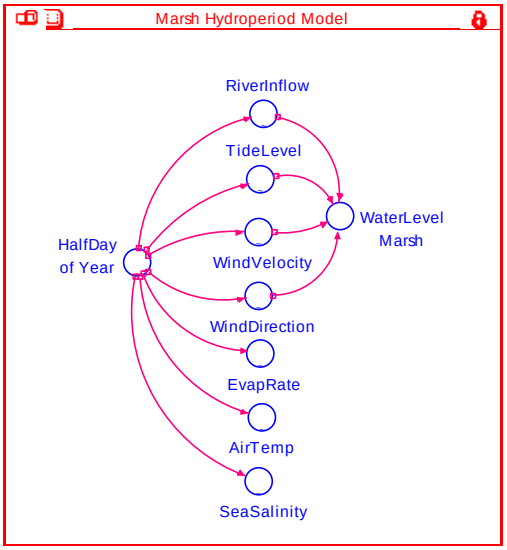
System dynamics will be simulated for a period 10 years. System dynamics will be described in terms of the state variables (the boxes) represented in Figures 1- 5. The Visualizations of spatial-temporal relationships of state variables at the three sites where much of our fieldwork has been focused (boat ramp, pump canal, and Sundown Bay) also will be provided.

The marsh hydroperiod sub-model includes diurnally-varying river inflow, tide level, wind velocity, and wind direction, and the resulting water level within the marsh, as well as evaporation rate, air temperature, and sea salinity (Fig. 1) (22,034).

The marsh hydroperiod sub-model will be developed in order to understand temporal patterns in marsh inundation at Aransas National Wildlife Refuge (ANWR). The MHM will be based, initially, on statistical relationships between the Seadrift tide gage and tidal creek water levels measured at three ANWR sites. These three sites: Boat Ramp (BR), Pump Canal (PC), and Sundown Bay (SB) have been monitored for nearly three years. We also have an extensive record of water level data in a nearby pond at each creek site. Marsh elevation survey data will be related to water level gages and will be used to determine the switching point between marsh inundation and exposure at any given elevation point.

Eventually, under future contracts, simulations of tidal fluctuations, wind, and possibly barge effects on water level fluctuations/marsh inundation at each site are planned.

Figure 1. Diagram of the marsh hydroperiod sub-model (MHM).

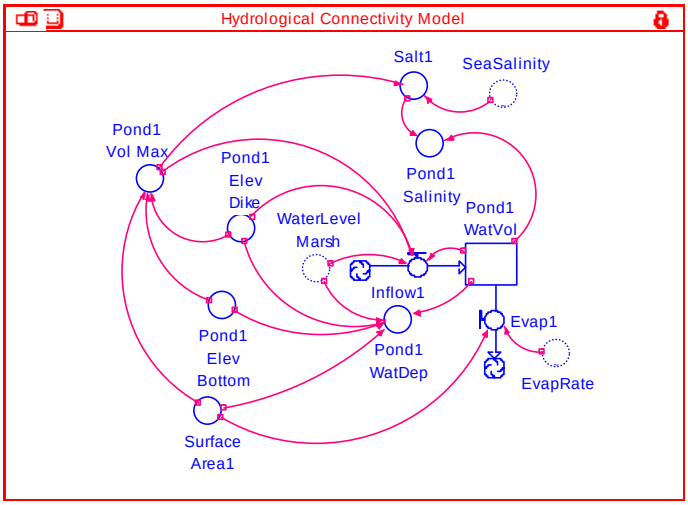


TASK (8) The hydrological connectivity sub-model (HCM) will be developed as a stochastic compartment model based on difference equations with a one-half day time step ($\Delta t = 0.5$ day). The model will be coded using the program STELLA and simulations will be run on a personal computer. System dynamics will be simulated for a period of 10 years. System dynamics will be described in terms of the state variables (the boxes) represented in Figures 1-5. The visualizations of spatial-temporal relationships of state variables at the 3 sites where much of our fieldwork has been focused (boat ramp, pump canal, and Sundown Bay) also will be provided.

The hydrological connectivity sub-model includes water volume, water depth, and salinity of ponds within the marsh, which are a function of the surface area, physical volume, and elevations of the bottom and dike of the pond, as well as the water level within the marsh, which controls the frequency with which the pond is filled with seawater; rate of evaporation also is included (Fig. 2). (22,034)

The hydrologic connectivity sub-model will be a spatially explicit simulation of temporal surface water connectivity patterns across the marsh surface at ANWR—generated from the point-based MHM. Given the intermittent inundation patterns in ANWR marshes, we hypothesize that these connections are important for blue crab (*Callinectes sapidus*) movements into and out of the ponds and for sustaining prey densities for whooping cranes (*Grus americana*) during the winter period. A digital elevation model (DEM) will be generated from intensive existing elevation surveys and benchmarks established around our three ANWR marsh sites. The DEM will be used in GIS to visualize and quantify changes in hydrologic connectivity with changes in water level (tides, wind, etc.) at each site.

Figure 2. Diagram of the hydrological connectivity sub-model (HCM).

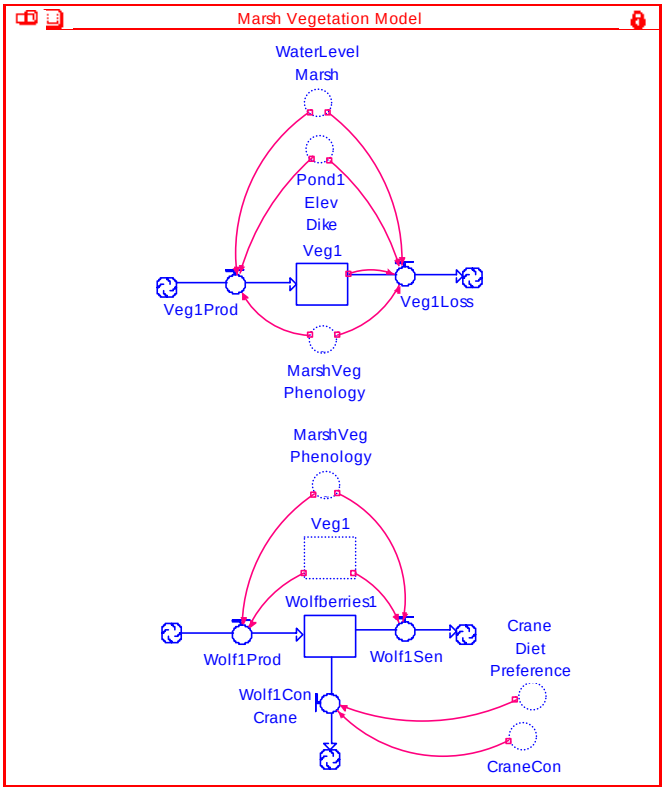


TASK (9) The marsh vegetation sub-model (MVM) will be developed as a stochastic compartment model based on difference equations with a one-half day time step ($\Delta t = 0.5$ day). The model will be coded using the program STELLA and simulations will be run on a personal computer. System dynamics will be simulated for a period of 10 years. System dynamics will be described in terms of the state variables (the boxes) represented in Figures 1- 5. The visualizations of spatial-temporal relationships of state variables at the three sites where much of our fieldwork has been focused (boat ramp, pump canal, and Sundown Bay) also will be provided.

The marsh vegetation sub-model will include the amount of emergent vegetation and the quantity of wolfberry fruits around ponds. Amount of emergent vegetation depends on rates of growth and senescence, both of which depend on the average elevation of the ground around the pond, the general water level within the marsh, and marsh vegetation phenology. Quantity of wolfberry fruits depends on rates of production and senescence, both of which depend on amount of marsh vegetation and marsh vegetation phenology, and on the consumption of wolfberries by cranes, which depends on crane dietary preferences (Fig. 3) (19,409).

The marsh vegetation sub-model will simulate seasonal patterns of wolfberry (*Lycium carolinianum*) biomass and fruit production at each site. It will also calculate wolfberry fruit availability over the simulated period within each of the three territories that straddle our three sampling sites. This sub-model will be parameterized with two years of existing field data on spatial and temporal patterns in wolfberry and a greenhouse experiment to understand the role of inundation and salinity in affecting growth of this halophyte.

Figure 3. Diagram of the marsh vegetation sub-model (MVM).



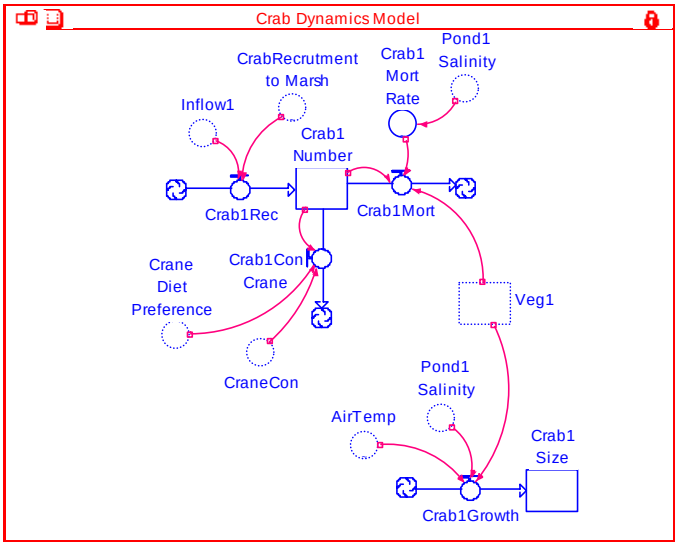
TASK (10) The crab dynamics sub-model (CDM) will be developed as a stochastic compartment model based on difference equations with a one-half day time step ($\Delta t = 0.5$ day). The model will be coded using the program STELLA and simulations will be run on a personal computer. System dynamics will be simulated for a period of 10 years. System dynamics will be described in terms of the state variables (the boxes) represented in Figures 1- 5. The visualizations of spatial-temporal relationships of state variables at the three sites where much of our fieldwork has been focused (boat ramp, pump canal, and Sundown Bay) also will be provided.

The HCM will be used in conjunction with empirical data on crab dynamics and megalopal settlement in ponds and adjacent connected waters (i.e., bays and tidal creeks). The result of this marriage will be a crab dynamics sub-model that will simulate potential crab availability in ponds as a function of temporal patterns in connectivity at each of our three sites. Hydroperiod in each pond will then be simulated as an evaporative function and will result in proportional salinity increases, which may affect crab fitness.

The crab dynamics sub-model will include the number and size of crabs in ponds. Crab number is a function of the seasonality of crab recruitment to the edge of the marsh, the frequency with which the pond is filled with seawater (which brings crabs to the pond), the (non-crane-related) mortality

of crabs, which depends on pond salinity, and the consumption of crabs by cranes, which depends on crane dietary preferences. Crab size is a function of growth rate, which depends on air temperature, pond salinity, and amount of marsh vegetation around the pond (Fig. 4) (22,034).

Figure 4. Diagram of the crab dynamics sub-model (CDM).



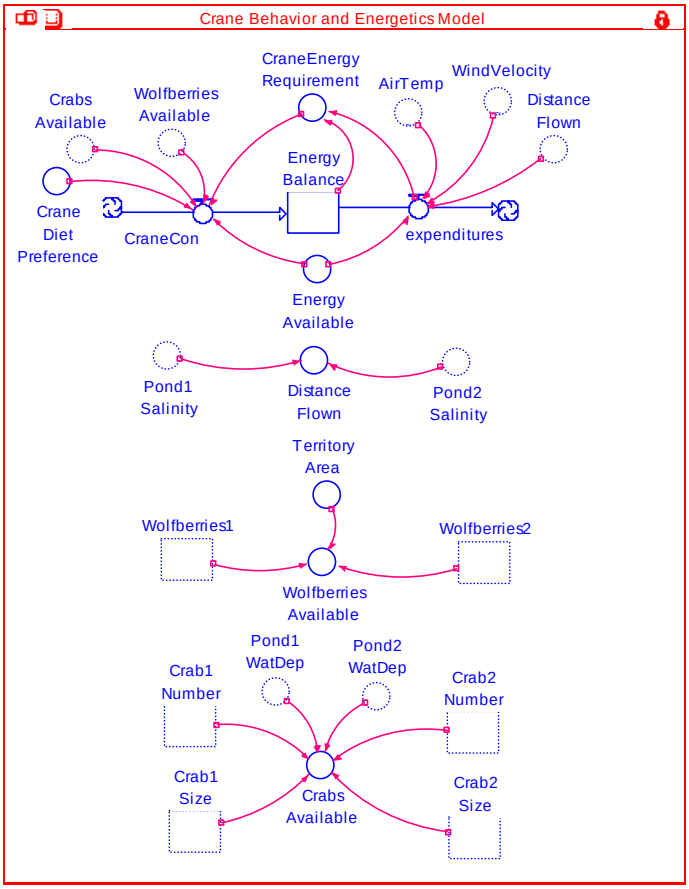
TASK (11) The crane behavior and energetics sub-model (BEM) will be developed as a stochastic compartment model based on difference equations with a one-half day time step ($\Delta t = 0.5$ day). The model will be coded using the program STELLA and simulations will be run on a personal computer. System dynamics will by simulated for a period of 10 years. System dynamics will be described in terms of the state variables (the boxes) represented in Figures 1- 5. The visualizations of spatial-temporal relationships of state variables at the three sites where much of our fieldwork has been focused (boat ramp, pump canal, and Sundown Bay) also will be provided.

The CDM and MVM sub-models will combine to determine food availability for cranes in each of the territories bordering our sampling sites. This food availability will then be fed into a behavior and energetics sub-model that will consider food availability, thermal constraints, and crane behavior patterns that combine to determine the energy balance of this species. This sub-model will also consider the importance of surface water salinity as a potential driver in affecting drinking water availability for whooping cranes.

The crane behavior and energetics sub-model will include the consumption and expenditure of energy. Rate of energy expenditure is a function of air temperature, wind velocity, and distance flown to and from the crane's territory to obtain fresh drinking water, which depends on the salinity of

water in ponds within the territory. Rate of consumption is a function of availability of wolfberries, which depends on density of wolfberries and size of the territory, and of availability of crabs of the appropriate size, which depends on depth of water in ponds within the territory (Fig. 5) (19,409).

Figure 5. Diagram of the crane behavior and energetics sub-model (BEM).



TASK (12) Prepare a separate draft and final report, Part II, associated with the TAMU modeling activities, Tasks 7-12, including relevant information associated with coordination of this work with Tasks 1-6. Report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report. The report will explain the work performed including, for example, the results of sub-model calibrations/verifications and the nature and use of the sub-models and the overall Ecosystem Model. Report submission to include the full working Ecosystem Model consisting of five sub-models that link freshwater inflows and marsh community dynamics in San Antonio Bay to Whooping Crane populations. The report will be submitted per

TWDB requirements and results from this study will be included in the 2011 Region L Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules (2,180).

Funding for Texas A&M Modeling (Tasks 7 – 12):	
San Antonio River Authority	12,500
Guadalupe-Blanco River Authority	12,500
Texas Water Development Board	82,100
Total A&M Funding	107,100

Overall Study Funding Sources (Tasks 1-12)	
San Antonio River Authority	12,500
Guadalupe-Blanco River Authority	12,500
Texas Water Development Board	148,960
	173,960

STUDY 5: Environmental Evaluations of Water Management Strategies
47,137

Improve or expand environmental evaluations of water management strategies. Provide greater focus on endangered species issues and on ensuring consistency with resource agencies.

TASK (1) Prepare and deliver technical presentations and provide technical support through participation in two (2) SCTRWPG subcommittee or task force workshops regarding environmental evaluations in the 2006 Regional Water Plan, compare these evaluations to those performed by other planning regions, and solicit comments regarding potential improvements to be considered for integration into environmental evaluations for the 2011 Regional Water Plan (17,762).

TASK (2) Document potential refinements to methodologies for environmental evaluations and budgetary implications of such refinements in accordance with results of the two workshops and prepare and deliver a presentation to the SCTRWPG (9,868).

TASK (3) Document proposed refinements to environmental evaluations in accordance with SCTRWPG recommendations (5,397).

TASK (4) Preparation for, active participation in, and follow-up to meetings of the SCTRWPG and meetings of the Staff Workgroup by the Technical Consultant (study share of total cost of attending nine SCTRWPG and nine associated Staff Workgroup meetings 8,325).

TASK (5) Review, assess, and compile the comments received on the 2006 plan on this topic for distribution to the planning group. (525)

TASK (6) Convene a workshop with a limited number of interested stakeholders as selected by the SCTRWPG who provided in-depth comments on the previous regional plan and the Technical Consultant to clarify concerns and identify perceived shortcomings in the environmental evaluations performed to date by the SCTRWPG. Compile the responses and prepare a report to the planning group in cooperation with the Technical Consultant. (1,225)

TASK (7) In association with the SCTRWPG, identify and work with member delegates and the Technical Consultant at a second small-group workshop to discuss the needs, gaps, and proposed solutions and report back to the full SCTRWPG. (1,225)

TASK (8) Prepare recommendations for the environmental analysis scope of work for the next biennium in cooperation with the Technical Consultant. (630)

TASK (9) Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report. Report to include documentation from Tasks 1-9 including documentation of potential refinements of environmental evaluations for the 2011 Regional Water Plan. The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Region L Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules (2,180)

Funding Source

Texas Water Development Board 47,137