Galveston Bay Freshwater Inflows Group

Final Report
Houston Advanced Research Contract # 582-7-77804
September 1, 2006 – May 31, 2009
Submitted May 31, 2009
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I. Overview

The Galveston Bay Freshwater Inflows Group (GBFIG) was established in1996 to reach consensus among stakeholders in the development of a scientifically-based management plan and implementation strategies to provide freshwater inflows to the Galveston Bay system. This mission is consistent with, and supportive of, the "Freshwater Inflow and Circulation Action" element of *The Galveston Bay Plan*. GBFIG includes staff from relevant natural resource agencies, representatives from environmental groups, fisheries and agricultural interests, and water district managers.

GBFIG has five objectives:

1. Establish GBFIG.
2. Obtain necessary background information.
3. Conduct analysis required to determine under what hydrological conditions freshwater inflows to Galveston Bay would be inadequate.
4. Assess feasibility of various options for addressing freshwater inflow deficits.
5. Develop freshwater inflow management recommendations.

Objectives 1-3 were completed before the institution of this contract cycle and are addressed in the Final Report for Contract #582-4-65037.

The deliverables as defined in this contract were:

1. *Facilitate 3 meetings by April 30, 2009*
   Two meetings were conducted during the project period. The primary purpose of the first meeting (August 4, 2007) was to nominate candidates for the Basin and Bay Area Stakeholder Committee (BBAS). A secondary purpose was to discuss the future of GBFIG within the new policy context as mandated by HB3/SB3. Regarding the first objective: the list of nominees is attached. Regarding the second objective: GBFIG members decided to take a "wait and see" approach to the BBAS, reserving the right to continue meeting to ensure that its concerns are being addressed by the BBAS. The objectives of the second meeting (April 29, 2009**)** were to review the work of the BBAS to date and to review the Draft Environmental Flows Report of Region H.

   Weeks also attended meetings of Region H and BBAS.

   2. Write Meeting Summaries
   Summaries for both meetings are attached.

   3. Draft a set of management recommendations for submission to Region H Water Planning Group (Objective 5). If the GBFIG is unable to agree on a set of recommendations, the PI shall analyze and discuss the reasons for the inability to come to consensus in the Final Report.
   At the end of the last contract cycle (December 2003-May 2006), GBFIG had completed Objectives 1 through 3 and had begun working on Objective 4. Several meetings during this time were devoted to scenario building and the discussion of options for addressing inflow deficits. In 2007, the Texas Legislature passed HB3/SB-3 which mandated the formation of geographically located stakeholder groups, called Basin and Bay Area Stakeholder Committees (BBAS) and geographically based Basin and Bay Expert Science Teams (BBEST). GBFIG submitted a slate of candidates for consideration to the BBAS and many of these were accepted, including the following GBFIG participants:

   John Bartos

   Glenda Callaway

   Jace Houston

Jim Katchik
Ken Kramer
Paul Nelson
Danny Vance
Pudge Wilcox

The Trinity and San Jacinto River BBAS then nominated the Trinity and San Jacinto River Basin and Bay Expert Science Team, on which the following GBFIG participants serve:
Richard Browning
Woody Frossard
Jim Lester
Bob McFarlane
Woody Woodrow

HB3/SB-3 mandated the creation of the BBAS before GBFIG had completed its last objective, drafting a set of management recommendations. This deliverable, therefore, will be met by the BBAS, not GBFIG, due to circumstances outside of GBFIG's control.

Further in the report, I discuss some of the reasons that GBFIG was unable to draft management recommendations during this contract period.

4. Submit a Draft Final Report
A draft final report was submitted to the Contract Officer by April 30, 2009.

5. Submit a Final Report
A final report was submitted to the Contract Officer by May 31, 2009.

GBFIG's Impact on Inflows Policy.

GBFIG represents one of the earliest attempts to deal with the issue of ensuring freshwater inflows to bays and estuaries and its pioneering efforts are important for three key reasons. First, it brought together diverse interests in a neutral venue to focus on inflows science and policy and this generated a level of trust not present before. Second, it worked exclusively on freshwater inflows and as a result some of the key scientific and management issues being

discussed today were first discussed in GBFIG. These include identifying target frequencies, recognition of the importance of timing and location of flows, the identification of diverse tools to ensure flows, and the use of criteria and scenarios to discuss these tools. Third, its work as a group provided the stimulus for legislative initiatives by keeping the issue of freshwater inflows before the policy community. Additionally its member stakeholder groups actively promoted legislative action on freshwater inflows.

GBFIG recommendations on target frequencies were incorporated into policy through the Region H Plans of 2001 and 2006 and these recommendations are currently used in modeling and to initiate management discussions.

GBFIG as a Collaborative Process

GBFIG provided the first opportunity for the stakeholder groups comprising it to sit down face to face in a neutral venue and have in-depth discussions about freshwater inflows using a collaborative learning model. Stakeholders decided not to break into subcommittees, meaning that each participant heard the same scientific presentations and analysis and stakeholder discussions. This served to foster trust among participants.

Ultimately, GBFIG did not complete all 5 tasks and the following factors contributed to situation:

1. GBFIG could not control its own meeting schedule.
2. No one entity "owned" GBFIG and was responsible for its execution.
3. Stakeholders continued to disagree about the scope and nature of the inflows problem and its framing.
4. While generally high, over the course of GBFIG's 10 years, issues related to trust among the different stakeholder groups periodically arose.
5. Scientific disagreement stalled management discussions and there was not consensus regarding taking an adaptive management approach.

These are discussed in more detail below.

GBFIG Meeting Schedule

GBFIG was dependent on outside scientific information and during the early years meetings were delayed while waiting for the results of modeling or other reports. Additionally, the Texas Legislature has been very active in freshwater inflows management through legislation. Meetings were often delayed while waiting to see the status of particular legislation or reports from legislatively mandated groups. This was the case with SB2 in 2001 which mandated model review; SB 1639 in 2003 that established the Study Commission on Environmental Flows; and SB3 in 2007which established BBAS and BBEST. These last two groups combined mirror GBFIG. BBAS discusses management issues and BBEST focuses on scientific issues. GBFIG consists of both management and scientific members and used a staged approach to review the best available science before turning to the consideration of management strategies as one body.

GBFIG and Ownership

A letter was jointly signed by the heads of TWDB, TNRCC (now TCEQ), TPWD and the TCCC in 1997 supporting the efforts of GBFIG and suggesting that it seek: a) a formal relationship with the Galveston Bay Council (which it now has due to GBEP funding); and b) status as a sub-group within Region H, which did not occur despite Region H's agreement to accept GBFIG recommendations. Additionally, representatives from these agencies attended GBFIG meetings. There was, however, no formal mandate given to GBFIG and although GBFIG did provide advice to Region H, it had no formal mandate from Region H that outlined its responsibilities to the body and provided deadlines for decisions. Therefore, there was no clear, formalized mandate for GBFIG and no formal institutionalized path for the inclusion of GBFIG management recommendations into the decision making process of the relevant agencies. Further, there were no clear deadlines for GBFIG decisions, which allowed the completion of key objectives to be delayed. The key decision that GBFIG did make, the recommendation of Max H, Min Q and Min Q Sal was made in the face of a deadline for inclusion into the 2001 Region H Plan.

This said, the lack of formal reporting requirements allowed GBFIG a great deal of flexibility. When the topic of whether to seek a more formal designation arose, there seemed to be agreement that this flexibility was a key factor in GBFIG's success as a venue where

stakeholders with differing interests in, and conceptualizations of, water could discuss and debate scientific and management issues despite these differences of orientation. Had GBFIG been more formalized, it is possible that some of its flexibility and its role as a safe place for discussion would have been lost. Participation in a formalized group might have impeded some members' ability to participate. Additionally, although GBFIG was constituted in such a manner as to conform with TCEQ advisory council standards, there was concern that formalization would necessitate more formal membership rules.

Problem Definition and Framing of the Freshwater Inflows

GBFIG began as a negotiated settlement after the Galveston Bay Foundation (GBF) opposed funding for expansion of the Wallisville Reservoir. GBF and the City of Houston signed an agreement to consider freshwater inflows in relation to Galveston Bay. GBFIG stakeholders represent conservation organizations, natural resource producer groups, state agencies and water producer groups. An assessment of the ability to come to consensus was conducted in that each participant organization was asked to write a statement indicating their interest in freshwater inflows. Not all of the stakeholders provided these letters, but those that did, agreed that inflows were important to their interests.

An interview based assessment on the potential for agreement on inflows was carried out in 2004 by the University of Texas in preparation for the Tri-Agency Stakeholder group. The purpose of the Tri-Agency group was to work to resolve technical and scientific differences, not to make management recommendations. The interviews, therefore, focused on the use of scientific models and the appropriateness of using a stakeholder group to deal with scientific issues, and did not delve too deeply into the underlying value differences that might make consensus difficult. It is not known if a different type of pre-process assessment would have revealed the differences among stakeholders in problem definition and framing that arose over the course of GBFIG's deliberations and which may have impeded its ability to make management recommendations.

The term 'problem definition' refers to how a social group understands: a) a particular state of being as undesirable; and b) the consequences of that undesirable state. In the GBFIG case, the undesirable state, or problem, would be too little freshwater inflow into the bays. Although all GBFIG stakeholders wanted to ensure that adequate freshwater continue to flow

into the bays, there was not agreement on what constituted adequate flows and what the consequences of decreased inflows would be. This disagreement was manifested in several ways: a)the critique of a direct link between fishery productivity and freshwater inflows; b) the lack of agreement on whether Galveston Bay will face shortages in the future due to return flows, especially when counting imported water; and c) disagreement regarding the desirable state of inflows. This was manifested by the concern expressed by some stakeholders that Max H, Min Q and Min Q Sal were not appropriate inflow targets.

In addition to a lack of consensus on the extent to which freshwater inflows were likely to become a serious problem for Galveston Bay, there were differences among the stakeholder groups about how to frame the issue of risk regarding inflows policy. Frames rely on pre-existing mental models that guide an individual's interpretation of events. "The frame that a decision-maker adopts is controlled partly by the formulation of the problem and partly by the norms, habits, and personal characteristics of the decision-maker" (Tversky and Kahneman 1981:453). For those stakeholders who perceived their primary responsibility as being to the environment, risk was framed in terms of too few inflows, resulting in damage to habitats and wildlife. In this frame, water is conceptualized as part of a greater ecological system. For stakeholders who perceived their primary responsibility being to water users, risk was framed as the inability to provide sufficient water to people, industry, farmers etc. Using this frame, environmental flows should be met after these other needs are met and water is conceptualized as a commodity which is sold as well as an ecological service. These two frames differ in their stress on the relative importance of ecological productivity and economic productivity. Consequently, stakeholders assessed risk differently and used the precautionary principle differently. One group applied the precautionary principle in order to ensure the health of ecological systems and the other applied it to ensure the health of human systems.

The role of new reservoirs provides an example of these different framings. For some stakeholders, they were the option of last resort because they feared the destruction of habitat and ecological processes. For others, they were vital to a growing population and to mitigate drought because they feared the impact of future drought on economies and lifestyles.

Participation, Transparency and Trust

GBFIG consists of a wide array of stakeholders. It was carefully set up to meet TCEQ estuary advisory council requirements regarding membership and facilitated meetings and ground rules were put in place to ensure that everyone was given an opportunity to have their opinions considered. The view was expressed several times that GBFIG was the first venue in which diverse stakeholders could discuss the issue of inflows in a neutral environment and that this was a key factor for building trust among different social groups that did not exist before. Decisions were made by consensus. A consensus option might not represent everyone's preferred option but was an option everyone could live with.

GBFIG goals were both scientific (objectives 2 &3) and managerial (objectives 4 & 5). Therefore, all GBFIG members participated in both scientific and management discussions and debate. This is a different model than that adopted by the Legislature which over the years has created scientific advisory committees that report to managerial stakeholder groups. Although the GBFIG model could at times be cumbersome, it increased the level of mutual understanding of the issues and trust among stakeholders because all processes were transparent and everyone had an opportunity to question the scientific foundations of management.

Despite the trust engendered through the GBFIG process, there were several occurrences over the 13 year period that stressed the forum:

a) After the recommendation to Region H was delivered, some GBFIG members felt that full consensus regarding the recommendation had not been reached. These stakeholders hired outside consultants in 2000 to re-evaluate the science (the 1998 Study) on which the recommendation was based, thus making manifest the lack of consensus that other stakeholders thought had been achieved.

b) Three of the four state agencies that signed the letter of support for GBFIG in 1997 convened a new stakeholder group (commonly called the Tri-agency group) in 2004 to review the science on which the 1998 Study was based (discussed in more detail in the next section). This was viewed by some members as an end-run around GBFIG which, at the time the new stakeholder group was convened, had been working on freshwater inflows for 6 years. There was some feeling that the new stakeholder group would not be able to add substantially to discussions already underway. In the

end, a division of labor occurred in which the Tri-agency group worked to resolve scientific and technical disagreements and GBFIG agreed to focus on management recommendations – a departure from the original GBFIG process which had considered both science and policy. Ultimately, GBFIG was unable to engage in substantive management discussions because some stakeholders were uncomfortable making management recommendations until the scientific issues were resolved.

c) Two water manager members applied for water rights where there was still un-appropriated water in reservoirs and return flows. Several of the conservation stakeholders were concerned that this was a move to appropriate water before the scientific studies were completed.

d) Water managers were concerned that water that cities and others needed would be allocated to inflows during drought conditions to augment inflows despite assurances everyone understood drought as a natural condition that the B&E targets took into consideration.

Scientific Disagreement and Adaptive Management

In 2000, several water providers jointly funded an evaluation of the 1998 Bay and Estuary Study on which GBFIG made its recommendation of 5.2 million acre ft. to Region H. This evaluation concluded that the methodology used represented a first step towards determining inflows but that more work needed to be conducted before proceeding to management recommendations. Specifically, the evaluation cited concerns about statistical methods, the use of commercial harvest data as a proxy for abundance, the application of the model in extreme wet or dry conditions, its treatment of seasonal variation, and the adequacy of peer review. This evaluation of inflow needs to Galveston Bay is continuing and its sponsors hope that this information can assist the BBAS in making inflows recommendations.

The critique of the 1998 Study prompted the formation of a new stakeholder group, the Galveston Bay Stakeholder Group (also called the Tri-Agency group). A series of three meetings in 2004 and 2005 were hosted by TWDB, TPWD, and TCEQ to address concerns about state methodologies. This group included some members of GBFIG in addition to individuals that

were not part of GBFIG. The group appointed a technical subcommittee that subsequently identified 17 scientific/technical issues that should be addressed in order to make management decisions regarding freshwater inflows.

1. Demonstrate validity of TPWD fisheries-independent dataset for developing new productivity-inflow regression equations.
2. Use recent harvest data to redevelop productivity-inflow regression equations for TxEMP analysis, for comparison to 2001 FWI recommendation.
3. If appropriate, use TPWD fisheries-independent data to develop new productivity-inflow regression equations for TxEMP analysis.
4. Validate Texas Rainfall Runoff (TxRR) model and/or suggest suitable alternatives.
5. Explore and develop better statistical relationships between salinity at specific locations and FWIs.
6. Validate TxBLEND and/or suggest suitable alternatives.
7. Investigate alternatives to bi-monthly inflows for use in productivity-inflow regression equations and TxEMP analysis.
8. Investigate significance of key hydrological events upon measures of productivity/abundance – with special attention given to meteorological (e.g., El Niño) and geographic influences (e.g., multiple watershed input) Task 9. Investigate suitability of grouping species (by trophic group, guild, or other) as a measure of biological productivity and FWIs.
10. Investigate use of a different index or measure of estuarine biological productivity.
11. Describe the historical relationship between FWIs and biological productivity for the full range of flows for one or more Texas estuaries.
12. Run TxEMP with modified and/or without the hydrological constraints to get an understanding of the effect of the constraints on the model's output.
13. Run the model with modified biomass constraints to get an understanding of the effect of the constraints on the model's output.
14. Assess availability and/or need for vegetation, primary production, turbidity, substrate, etc. data in order to define bay health in terms of habitat variables.
15. Examine effect of other factors (such as ship channel changes) on the circulation of the bay. Such factors may complicate understanding the impacts of FWI changes.

16. Evaluate alternative measures of ecological health (such as in Task 14).

17. For analysis of nutrient and organic carbon input components of FWIs, assemble data, perform mass budgets, assess kinetics, and compare with measures of productivity/abundance.

To date, work has been conducted on Tasks 1, 2, 3, 4, 5, 6, 7, 8, 9 12, 15.

Senate Bill 3 created a state-wide Science Advisory Committee and a regional expert science team. The mandate of these science advisory groups is to review the best available science, not to engage in new studies. It is anticipated that some of the work described above will be reviewed by the SB3 created science groups.

Adaptive management is a "systematic approach that builds on trial and error utilizing feedback loops to allow us to learn from experience" (American Water Resources Assn. http://www.awra.org/meetings/SnowBird2009/ accessed 4/1/09). It allows practitioners to proceed within the face of scientific uncertainty by treating management options as experiments to test assumptions which are later revised in light of new information, thus reducing uncertainty over time.

Taking an adaptive management approach was discussed several times by GBFIG members but never formally adopted. There was not a consensus to proceed to management considerations in the face of uncertainty. Some stakeholders held the view that science will always progress, never be perfect, and thus action needed to proceed in the face of incomplete knowledge with the understanding that management decisions can be revised later. Others were willing to discuss management scenarios in theory in order to have options to consider when the scientific studies were concluded. Conversely, some stakeholders felt that the current level of scientific understanding was too weak a base from which to launch management discussions.

Policy Landscape

The significance of freshwater inflows on the policy landscape (comprised of the institutions and scientific activity devoted to inflow management) has grown since the introduction of water planning in the late 1950s (See Figure 1). When GBFIG was created in 1996, the primary policy actors concerned with freshwater inflows were state agencies and the legislature. TWDB and TPWD have been collecting bay and estuary data since 1975 and published a report in 1981. Freshwater inflows are addressed in the Galveston Bay Plan (1988)

and the legislatively mandated Bay and Estuary Study (1998) conducted by TPWD and TWDB. The current landscape is much more populated, with NGOs, agencies, multi-agency working groups, scientific advisory groups, the legislature and the governor's office all working on the issue through myriad institutional forms and scientific studies. Public education campaigns have been launched and there have been several stakeholder groups devoted to either the review of the science or the recommendation of policies related to inflows. GBFIG members have played key roles in almost all of the studies/forums that have been created since its inception, which is illustrated by the red shading that touches all other efforts. GBFIG members have participated in: Region H and C Planning Groups; BBAS; BBEST, Tri-Agency Working Group and its Technical Committee; Environmental Flows Advisory Committee; Study Commission on Environmental Flows; Texas Living Waters Program and numerous scientific studies.

GBFIG as a group, and its individual stakeholders, has made important contributions to the management of freshwater inflows. For over 13 years, it has kept freshwater inflows on the policy agenda and has served as an impetus for the formation of the institutions needed to accomplish the goal of ensuring water for human and ecological systems.

References

American Water Resources Assn. http://www.awra.org/meetings/SnowBird2009/ accessed 4/1/09).

Tversky, Amos and Daniel Kahneman. 1981. The Framing of Decisions and the Psychology of Choice. Science 211(4481): 453-458.

Acronyms:

BBAS	Basin and Bay Area Stakeholder Committee
BBEST	Basin and Bay Expert Science Team
GBEP	Galveston Bay Estuary Program
GBFIG	Galveston Bay Freshwater Inflows Group
SAC	Science Advisory Committee
TCCC	Texas Coastal Coordination Council
TCEQ	Texas Commission on Environmental Quality
TNRCC	Texas Natural Resources Conservation Commission