

---

## CHAPTER SEVEN

### FRESHWATER INFLOW

---

Estuaries require freshwater inflow to be biologically productive. Galveston Bay, which receives a great amount of freshwater inflow, is an unusually productive estuary. Water rights are entirely under state control. The Texas Water Commission (TWC), the Texas Parks and Wildlife Department (TPWD), and the Texas Water Development Board (TWDB), all play a role in the water rights process. This chapter begins with a brief review of state law, which is necessary to an understanding of the ensuing discussion of freshwater inflow into Galveston Bay; finally, agency practices and resources are evaluated.

#### WATER OWNERSHIP AND RIGHTS

Water can be divided into two types: surface water and groundwater. In Texas, courts have ruled that groundwater "belongs to the owner of the land above it and may be used or sold as private property" (Kaiser, 1986, p.32). Surface water within a defined watercourse belongs to the state, and Texas courts have ruled that the state owns these waters in trust and may allocate the water for the use and benefit of all people in the state (Kaiser, 1986, p. 19).

Water rights in Texas were originally determined according to English common law and the riparian doctrine. At first, the owner of land adjacent to a natural watercourse had private rights over the water flowing by his land. Over time, the doctrine of prior appropriations of water rights was incorporated into Texas water law to suit Texas' more arid climate. Under prior appropriation, the party who first puts a source of surface water to beneficial use obtains a right to use that water. Similarly, disuse ends a party's right to that portion of water. The concept behind this doctrine is best stated in Section 11.027 of Texas' present Water Code: "As between appropriators, the first in time is the first in right." The doctrine requires continued use to maintain a water right, and may be best stated as "use it or lose it" (Lyndon B. Johnson School of Public Affairs, 1991, p. 3.9). Currently, a water right lapses after ten years of non-use.

Prior appropriate applies to "beneficial uses" of water. The 1931 Wagstaff Act established a priority ranking of beneficial uses of surface water (Tx. Water Code S. 11.024):

- |                           |                            |
|---------------------------|----------------------------|
| 1. Domestic and municipal | 5. Hydroelectric           |
| 2. Industrial             | 6. Navigation              |
| 3. Irrigation             | 7. Recreation and Pleasure |
| 4. Mining                 | 8. Other Beneficial Uses   |

In 1985 the Texas Legislature amended the Wagstaff Act, substituting "Bays and Estuaries" in the eighth category in place of "other beneficial uses." The law also requires TWC to assess the effects, if any, of the issuance of the permit on the bays

and estuaries of Texas and, for permits issued within 200 miles of the coast, to take into account conditions necessary to maintaining beneficial inflows to bays and estuaries.

Conflicts that developed between the two systems of water rights in Texas (the riparian system and the prior appropriations system) were settled by the 1967 Texas Water Rights Adjudication Act, which merged the two systems. The act required that any person claiming a riparian water right after 1969 file a claim for the right with TWC. If a permit was granted, it had the effect of consolidating riparian rights under the prior appropriation doctrine. Since 1969, any person who wants to acquire a water right must receive a permit from TWC. The result of the permitting process is a water right that entitles the owner to an amount of water determined by the permit.

In sum, Texas water law vests strong rights in those who were already using the water. The priority of beneficial uses puts virtually all human uses (domestic, agriculture, energy, and pleasure) above maintaining the habitat or protecting the environment. Thus freshwater inflow into Galveston Bay is hostage to the ever-growing populations along the rivers that feed the bay and is protected only to the extent the permitting process takes estuary needs into account.

### **GALVESTON BAY INFLOW TRENDS**

Surface water is the most important source of water for Galveston Bay. Most of the freshwater inflow to Galveston Bay comes from two river basins, the Trinity River Basin and the San Jacinto River Basin. For the years 1941-1976, scientists calculated that the Trinity River Basin supplied more than 70 percent of inflow during the wet months of December through June. The San Jacinto River Basin supplied about 18 percent. The average annual freshwater inflow to Galveston Bay from the Trinity and San Jacinto River Basins, which are gauged, and the San Jacinto-Brazos Coastal Basin, San Jacinto-Trinity Coastal Basin, and the Trinity-Nueces Coastal Basin, from which inflow is calculated, was 11,340,000 acre-feet in the same period (National Oceanographic and Atmospheric Administration [NOAA], March 1988, p. 15). The maximum annual inflow was 23,696,000 acre-feet in 1973 and the minimum annual inflow was 2,913,000 acre-feet (about one-tenth of the maximum) in 1956. When evaporation losses are considered, then these figures change to 22,290,000 and 1,321,000 acre-feet.

The total appropriations of water rights in the two major basins that contribute 88 percent of Galveston Bay's freshwater inflow are shown in Table 7-1. The figure is based on a model which is run using a variety of data including stream flow measured by the USGS, self-reporting data, and water rights already allocated. The results suggest that in 1989, all of the rivers draining into Galveston Bay had sufficient water to allow TWC to issue additional water rights permits for diversion and for surface impoundments.

Table 7-1  
Water Rights Appropriated as of June 1991  
(millions of acre-feet)

River Basin	Total	Use 1 Municipal	Use 2 Industrial	Use 3 Irrigation	Use 4/5 Mining + Hydro*	Use 7 Recreational	Use 8 Other
Trinity	5.10	2.80	1.80	.40	.02/.12	.005	.0002
San Jacin.	0.63	0.29	.32	.02	.006/0	.0009	0.00
Trinity/ San Jacin.	0.05	0.00	.03	.02	0.00	.0001	0.00

\* Mining/Hydro-electric Power

Sum of rows may not exactly equal total due to rounding.

Source: Texas Water Commission

Statewide, Texans use about 14.2 million acre-feet (maf) of water per year, of which about 6.5 maf come from surface water. Of this surface water, more than 44 percent is used for irrigation, about 30 percent for municipalities, and about 20 percent for manufacturing. Steam electricity, livestock, and mining account for the remainder.

At this writing, there are 94 water rights holders in the San Jacinto River Basin and 481 water rights holders in the Trinity River Basin. Appropriations of water rights will continue to affect freshwater inflow to Galveston Bay. Surface impoundments, installed to ensure drinking and irrigation water and reduce flooding, have changed the amount of freshwater inflow to Galveston Bay, mostly by eliminating the peaks in upstream demand and thereby evening the quantity of inflow. However, observers believe that Galveston Bay's problem is less a lack of fresh water than the quality of the inflows, which is compromised by increasing development around the bay and the rivers flowing into it.

Return flows, or water put back into the bay, constitute a second important source of freshwater inflow. Return flows add nutrients to the bay, with higher nutrient loads expected in the future as Houston's population increases. The City of Houston currently discharges about 300 million gallons per day of treated effluent to the Bay, much of it through the Houston Ship Channel. The population forecasts used by the City of Houston predict a 2.5 to 3 percent annual growth rate; in order to meet the growing demand for drinking water, Houston is considering interbasin transfers from the Toledo Bend Reservoir (on the Sabine river near the Louisiana border). This will increase both the return flow and the nutrient load to the Bay.

## Timing and Release

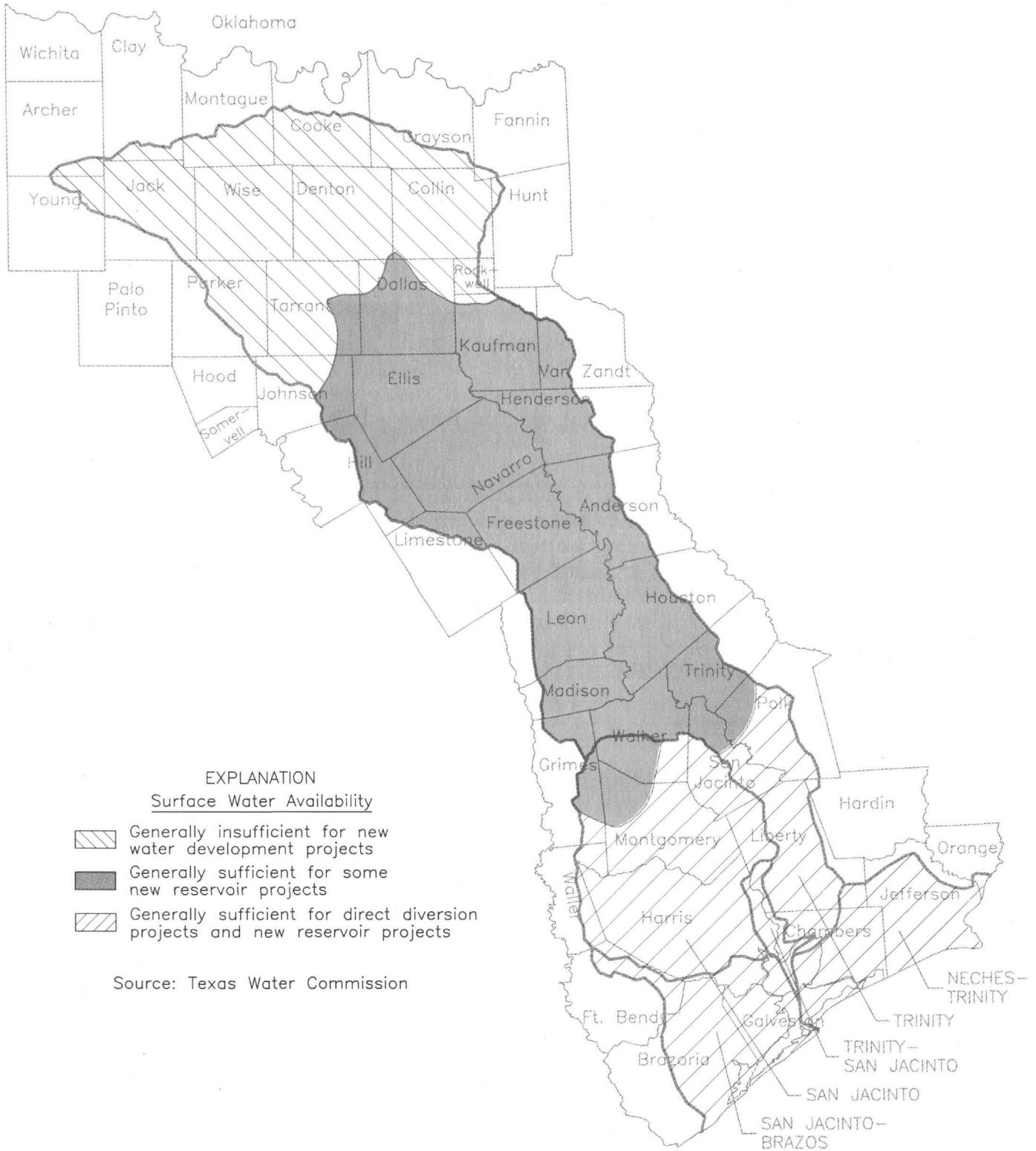
Thus far, our discussion has focused on the quantity of water reaching the bay. The timing of its arrival is also very important, however; surface impoundments or reservoirs on rivers may affect both quantity and timing. Utilization of much of the state's water resources is made possible by impoundment and diversion structures that are federally constructed and/or permitted. The U.S. Army Corps of Engineers (Corps), the Bureau of Reclamation, and the Soil Conservation Service (SCS) build reservoirs and river diversions. The Corps permits impoundments and diversion under the Rivers and Harbors Act and Section 404 of the Clean Water Act. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) provide comments and advice on impounding and diversion of river flows to those agencies under the FWCA and NEPA. Surface impoundments in the watersheds draining into Galveston Bay are owned and maintained by a variety of agencies, including the City of Houston (Lakes Houston, Conroe, and Livingston), the San Jacinto River Authority (Lake Conroe), and the Trinity River Authority (Lake Livingston), in the lower basin. Including the upper basin of the Trinity River basin, there are over 26 reservoirs in the Trinity and San Jacinto river basins (Texas Water Development Board, 1990, pp. 3-32, 3-33), owned and operated by municipalities, river authorities, and water districts.

Reservoirs clip the peaks on river flow during floods and spread floods over a longer time base. They also can contribute to low flow releases during the summer drought. The seasonality of freshwater inflow has an impact when average river flows are unchanged. For example, dams built on the Sabine River contained the natural peak river flows of spring for later release in generating electricity; the unnatural summer floods reduced salinity below a tolerable level and the white shrimp fishery collapsed (NOAA, 1989, p. 46). Estuarine dependent species have adapted to seasonal cycles of the ecosystem, including spring rain and decreased summer precipitation. Alteration in this pattern adversely affects estuary productivity.

One way to ensure that seasonality of freshwater inflows is maintained is for the state to acquire water rights for that purpose. However, there are impediments to implementing this proposal. First, there may not be enough water rights available for this purpose. Second, obtaining these water rights could be costly. Finally, the scientific knowledge is lacking to justify a program for systematically releasing water to Galveston Bay. The multitude of jurisdictions that control some timing compound this lack of knowledge about the precise freshwater needs of the bay.

With the notable exception of the Wallisville Project on the Trinity River, no additional surface impoundments are planned in the basins draining into Galveston Bay. The proposed Tennessee Colony in the Trinity River Basin has not obtained financing nor have the environmental impacts been fully addressed (TWDB, 1990, p. 3-33). The Lake Creek project in the San Jacinto River Basin is currently not planned for development, and was never submitted to Congress for approval, although the final Environmental Impact Statement was submitted to

Figure 7-1  
 Surface Water Availability  
 in Galveston Bay Watershed



the Environmental Protection Agency. The project sponsor, the San Jacinto River Authority, suspended the project for financial reasons and lack of local support. The Bedias Dam and Reservoir project in the Trinity River Basin has also been suspended and is not likely to be constructed.

The Wallisville Project is the only project being developed by the Army Corps of Engineers in the San Jacinto and Trinity River Basins at this time. Project sponsors include the City of Houston, the Trinity River Authority, and the Chambers-Liberty County Navigation District. When constructed, Wallisville will provide water for the City of Houston and also serve as a saltwater intrusion barrier. The Wallisville Project has been the subject of a protracted and lengthy battle, with critics charging that a salt water intrusion barrier could be designed with fewer environmental effects. The National Marine Fisheries Service (NMFS) has testified that construction of the dam would result in reduced freshwater inflow, reduced nutrients crucial to the food web, and reduced sediments to Galveston Bay. NMFS estimates that freshwater inflow from the Trinity River to the bay could be reduced by 4.3 percent during high river flows and 22 percent during drought conditions. Reduced inflows could result in salinities too high to sustain the brackish to fresh marshes and submerged grasses. NMFS claims the proposed work would also adversely impact fishery resources (both economically and environmentally) by isolating marine fishery habitat behind the dam and levees.

Construction on the project began again in 1991, although heavy rains through the winter of 1991-1992 have delayed work on the project. Then, on January 28, 1992, TWC ordered a year-long annual study before reauthorizing Wallisville's water rights, which were granted to the City of Houston and Trinity River Authority (Dawson, "New Wallisville Dam," 1992, p. A-16). Although more legal delays may ensue, the Wallisville Dam is currently under construction.

## **WATER RIGHTS PERMITTING**

### **Texas Water Commission**

As noted, potential water users must obtain a water rights permit. The process for determining water rights is illustrated in Figure 7-2 "Application Procedure for State Water Rights Permits." The Commissioners of TWC vote on each permit, called a Certificate of Adjudication. In 1991, TWC issued about 200 water rights permits, including amendments.

Water Rights Team. The first step in obtaining a permit is to submit an application. Applicants may seek a new water right, an amendment to a water right, an exemption for water from an exempt reservoir, or an extension to an amendment. Applicants must supply information about the source of the proposed water use; the amount and purpose of diversion and use; the rate and method of diversion; the location of the diversion point, reservoir, and dam; how much water will be returned; and a conservation plan. The application is processed by the Water Rights Team in the Division of Watershed Management, Office of Water Resource Management of TWC.

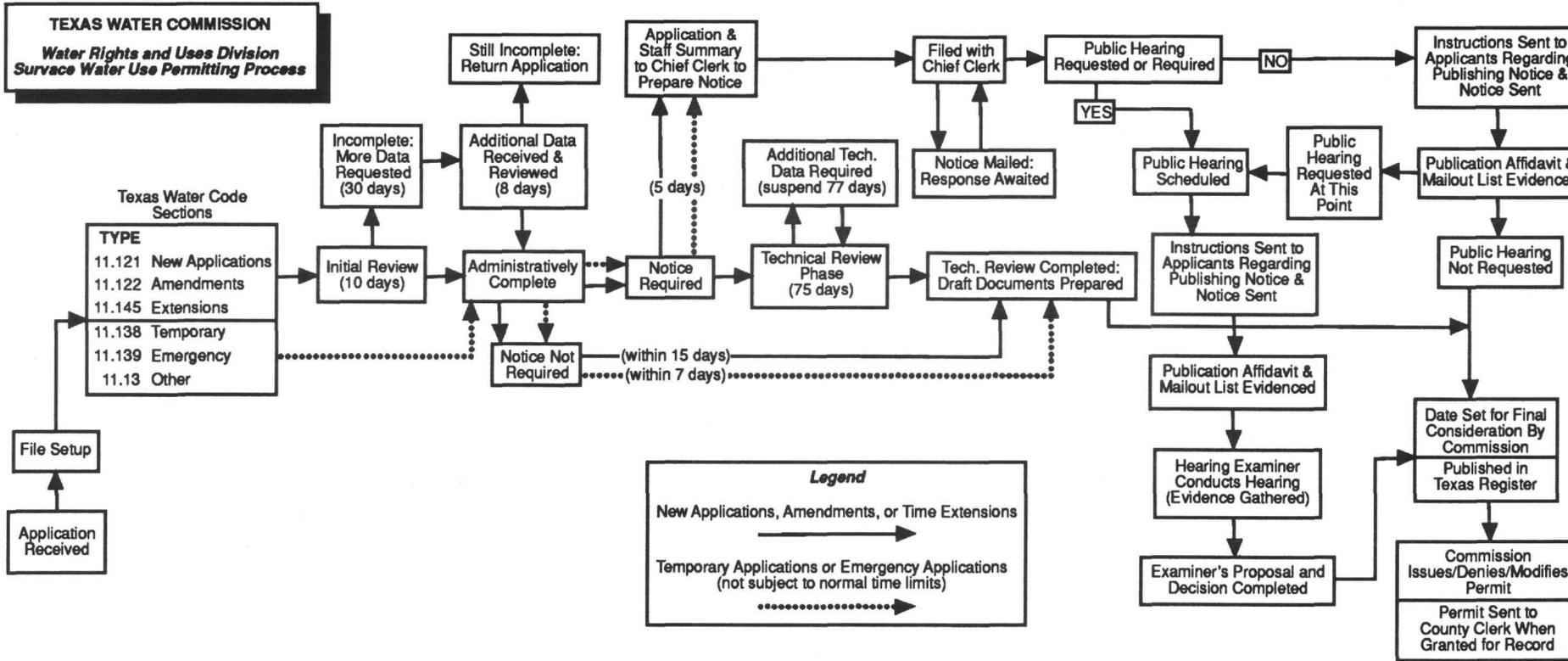
Within ten days, the application is reviewed for completeness. If staff deem it incomplete, it is returned to the permittee, who has thirty days to supply the additional information. Then, within another eight days, TWC again decides whether the application is complete, with incomplete applications again returned to the applicant for more data. For complete applications, the permitting process now takes two divergent paths. One path considers public comment while the other involves a more thorough internal review of the permit application. Within five days after ensuring that an application for a permit is administratively complete, the Water Rights Team must file the permit application with the Chief Clerk of the Water Commission. The Chief Clerk gives notice to every single diverter of surface water, downstream and upstream of the point of diversion on behalf of the permit applicant, who has an obligation to notify these people. The applicant is also informed of the procedures to follow to provide public notice regarding the pending application. If public hearings are requested by any thus notified, hearings are scheduled on the application. If hearings are not requested, then a permit is drafted, prepared for distribution, and placed on the weekly agenda for the Commissioners.

The internal technical review, called the Technical Review Phase, lasts 75 days. Several different units of the TWC are sent copies of the permit application for their review, including Environmental Systems, Water Availability, Hydrology, Conservation, Dam Safety (if necessary). The permit is also sent to the Coastal Studies Group of the Texas Parks and Wildlife Department, which may comment on the permit's effect on bays and estuaries. The different units within TWC have a sixty-day deadline in which to respond with technical comments to the permit writers. After this time the Water Rights Permit Team sends the draft permit application to the Water Rights Legal Team in the TWC Office of Legal Services and Compliance, who have 15 days to review the draft and make final comments. At the end of the 75-day period, comments from TPWD, if there are any, are also considered.

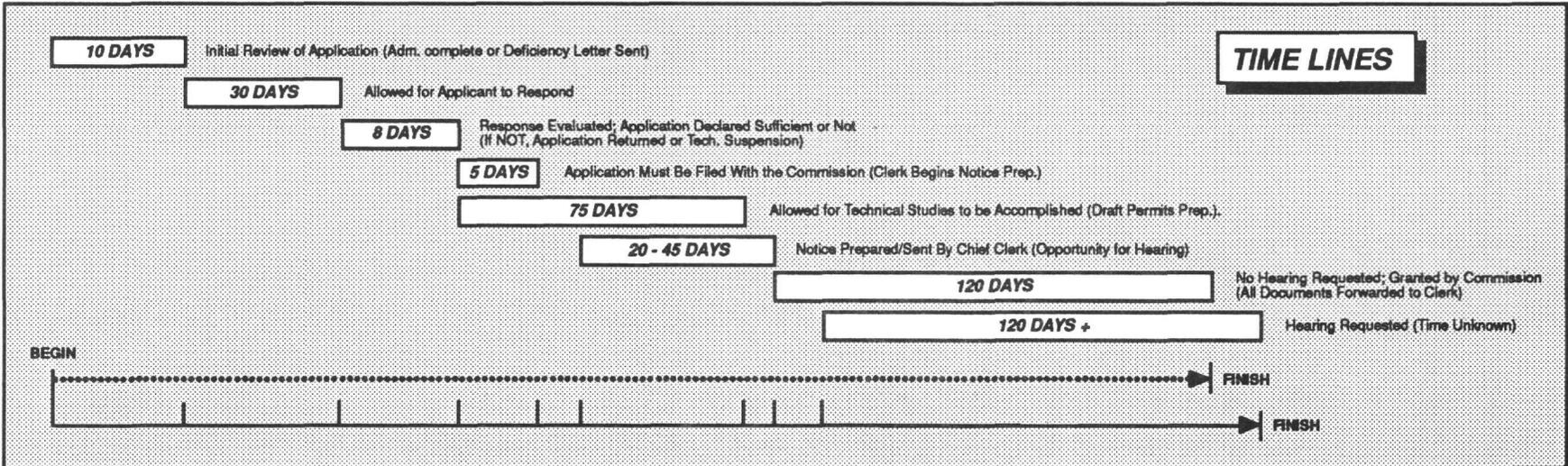
If no hearing is requested, the date for final consideration of the Water Rights Permit is set and published in the *Texas Register*. The Commissioners vote to issue, deny, or alter the permit. If a hearing is requested on the permit then hearings are held before a Hearing Examiner, who gathers evidence and proposes a decision within sixty days of the hearings. Then the date for the hearing is published and the procedure completed.

The Water Rights Team comprises one support person and five professional and technical staff with experience ranging from three to twenty years. In 1991, they processed over 500 water rights permits or amendments. However, in the spring 1992 reorganization, the separate unit which processed the annual water use forms was eliminated, and the Water Rights team has assumed these responsibilities. Finally, the Water Rights staff assist other programs, such as conservation (Water Policy), in the internal review process, further straining staff resources. A Water Rights Team within the Office of Legal Services and Compliances provides legal support.

Figure 7-2



150



Environmental Systems Team. The Environmental Systems Team, which until the TWC's winter 1992 reorganization was part of the water rights program, assesses permits applications for their effects on the amount and quality of water reaching the Bay. Section 11.147 of the Texas Water Code spells out the conditions for determining the effects of the permit on freshwater inflows. The TWC must consider, among other factors, the following: (1) the need for periodic inflows to supply nutrients and maintain salinity levels necessary for preserving the bay; (2) the ecology and productivity of the bay; (3) expected effects on the public welfare of a failure to include in the permit all or some of the conditions needed to maintain beneficial inflows to the affected bay or estuary; (4) the amount and proposed use of water requested by the applicant; (5) the expected effects on the public welfare of the failure to issue all or part of the permit being considered; and (6) the priority order of beneficial uses.

Because no regulations have been promulgated to implement Section 11.147, the Environmental Systems Team operates directly from the mandate in the Water Code. Maintenance of freshwater inflow to bays and estuaries is being effected through studies, especially computer models of freshwater inflow which are also mandated in the law. The studies are now expected to be completed in fall 1992 and will result in a draft of proposed new regulations.

The computer models of freshwater inflow on bays and estuaries are very complex and large; a simulation which the Texas Water Development Board runs in only 100 hours requires 700 to 1000 hours on the TWC mainframe. A minicomputer for these models has been included in the proposed budget for the Environmental Systems Team for several years, but the team has had to delete it from the final request in order to meet its budget goal. As a result, the team often simply cannot do their own research and must rely upon TWDB, which uses its computers for its own purposes and may not always be able to meet TWC's request in a timely way.

The kind of environmental review mandated in the law is very labor-intensive. However, of the present staff of about 42 people in Environmental Systems, only about one-fourth are knowledgeable about maintaining freshwater inflow; and recently a modeler position was downgraded in order to obtain funds to upgrade another position. Moreover, Environmental Systems staff have many responsibilities beyond their concerns for freshwater inflow, including monitoring, permit reviews, and water quality management planning.

A recent action of the TWC Commissioners appears to support the concerns of the Environmental Systems Team. On March 4, 1992 the Commission approved an agreed order stipulating releases from the Choke Canyon reservoir system for freshwater inflow to Nueces Bay and Rincon Bayou. This is one of the few times that a special provision in a water rights permit has been enforced, but it may augur well for future decisions where environmental and developmental concerns may collide.

## **Texas Parks and Wildlife Department**

As noted, the Texas Parks and Wildlife Department (TPWD) reviews water rights permits. As with TWC's Environmental Systems Team, who assess permits under the same statutory provisions, TPWD derives its authority directly from the law in the absence of implementing regulations.

The permit application arrives at the Coastal Studies Program, where it is logged and sent to three different divisions for review: Endangered Species; Fisheries and Wildlife; and Public Lands (for recreation resource impact). After each of these divisions reviews and comments on the permit, the permit is returned to the Freshwater Inflow Coordinator. The permit is tracked as it moves through the different divisions, a process which takes about three weeks. TPWD then prepares a written comment if one is deemed necessary.

Under Chapter 11 of the Texas Water Code, TWC must consider any comments from TPWD on permit applications to store, take, or divert water. TPWD also has the option to be a party to hearings on water rights permit applications. The law does not require TWC to adopt any of TPWD's comments, although the agency may request a hearing in order to publicize its concerns.

TPWD was reorganized in early 1992. The former Environmental Assessment Branch included three programs: Coastal Resources, Wetland Resources, and Habitat Resources. The new Aquatic Studies Branch has two programs: Freshwater Studies and Coastal Studies. The Coastal Studies Program will focus on reviewing freshwater inflow, while Freshwater Studies will concentrate mostly on streamflows. The Coastal Studies Program will have the lead in reviewing major water rights applications located in all other areas of the state.

Funding for the Coastal Studies Program comes from Fund 9, the general legislative fund for TPWD. The program currently has six staff members. However, only 1.5 staff currently spend all of their time coordinating water rights application reviews. The remainder of the staff will be involved in determining freshwater inflow needs for the bay and estuaries and flow requirements for streams.

## **Texas Water Development Board**

Among its other duties, the Texas Water Development Board (TWDB) collects and evaluates data about the state's bays and estuaries and conducts studies and analyses to determine bay conditions necessary to support a sound ecological environment. The Legislature required TPWD to complete the analysis of freshwater inflow by December 31, 1989, but the studies were still under review by TPWD, TWC, and TWDB in summer 1992. These studies will be used by both TWC and TWDB to develop the missing regulations on freshwater inflow.

The Environmental Systems Section of the TWDB has a budget of \$400,000, which supports ten staff members, eight of whom are scientists or engineers, and one secretary. Approximately 50 percent of staff time is spent on freshwater inflow.

Thirty percent is spent on instream flow, and the remaining 20 percent is spent on other environmental analyses for the Texas Water Plan, which the TWDB is required to prepare and maintain. Because developing the complex models of freshwater inflow into bays and estuaries is central to the section's mandate, it has included a request for an improved computer in its Strategic Plan for Computer Resources. At present, it takes five months of calibration (100-150 hours) before the model can be run on the minicomputer. The new computer would reduce this time by an order of magnitude—down to a couple of days.

In 1981, taxpayers voted to establish a \$50 million Water Research and Planning Fund in the Water Assistance Fund. So far, \$3 million has been used for research on bays and estuaries. Because the research funds came from the general revenue, however, the Legislature reappropriated large portions to other purposes, and the fund is now almost depleted. Federal research grants often require state matching moneys; if the Research Fund is depleted, the state will not be able to accept federal grants and will have difficulty conducting necessary research.

TWDB's studies can play an important role in decisionmaking about water rights. When the TWC entered into the agreed order with the City of Corpus Christi, the Nueces River Authority, and the City of Three Rivers over freshwater releases from Choke Canyon Reservoir and Lake Corpus Christi in March 1992, the numbers used to calculate timing and amount of releases came from data supplied by the TWDB and suggested by a Technical Advisory Committee.

### **ENFORCEMENT**

In contrast to water quality law, where violations can be enforced straightforwardly, the structure of Texas water law makes enforcement of violations of water rights, such as overappropriations or unauthorized diversions, very difficult. Enforcement of water rights is the responsibility of the Office of Legal Services and Compliance of the Texas Water Commission. Initial complaints are usually filed by a citizen or a TWC district inspector. Once it has been ascertained that an unauthorized diversion has been made, the TWC district office notifies the diverter of the illegal diversion and asks him to apply for a permit. If the diverter does not request a permit, then a report is filed with the Attorney General's Office (AG). The TWC can issue a \$1,000 per day penalty, but ultimately enforcement requires a suit to be filed by the AG.

Enforcement of existing permits is based largely on the annual reports of water use that water rights holders must submit. These self-reporting forms require information detailing amounts of surface water used. However, a powerful incentive to report use inaccurately is built into the system because nonuse of a water right for ten or more years results in the loss of that right. Currently, there is no means of ensuring permittees report accurately, and no requirement to assess whether water treatment equipment or irrigation or other equipment is functioning efficiently. Therefore, users who do not divert their full entitlement still have an incentive to report that they are using all the water. The self-reports are thus likely to overreport water use.

This inaccuracy has some serious consequences in that it provides a poor basis for calculating how much water remains to be allocated. From a planning standpoint, it is difficult to predict water demand when there is no means for calculating actual usage. Efforts should be made to proactively manage demand, rather than simply meet demand as it arises. In the past, water authorities have issued "doubled" or "stacked" appropriations, when they knew that all of the water allocated in permits was not being used. To the extent that this practice continues, in whatever form including term permits, it creates the possibility for overallocation and special harm to the uses lowest on the water rights ladder; namely, bays and estuaries.

In general there are few enforcement incentives to report accurately. TWC resolves many permitting problems through informal means, and those that are referred to the Attorney General's Office sometimes escape prosecution. The Attorney General's office pursues only three or four water rights cases each year, in part because prosecution is so difficult without measurements of actual water use. If reports that overstate water use are not detected and penalized, users will recognize that reports that understate water use will be similarly ignored. Since water has no cost in Texas, there are few economic incentives for permittees to conserve it. Thus the entire basis of the permit process is undermined. Applicants for new or amended water rights can be required by the TWC to submit a water conservation plan but, given that monitoring is so difficult, it is not clear how often TWC makes use of this provision. Full implementation of State House Bill 1, passed in 1985, would constitute a step towards improving the water rights situation. The legislation required TWC to adopt water conservation rules, but the agency is only now in the process of drafting these rules.

## EVALUATION

The Texas Water Commission bears primary responsibility for ensuring adequate freshwater inflow into Texas' bays and estuaries, issuing permits based on studies conducted by TWC, TPWD, and TWDB. Thus far, lack of freshwater inflow has not been a serious problem for Galveston Bay, but several factors should prevent too complacent an attitude.

First, the agencies have not yet promulgated regulations implementing the statutory requirement to protect bays and estuaries in granting rights to divert water. In the absence of regulations, inconsistencies in administration may arise, permittees' expectations are unclear, and any agency action may be challenged in court. The regulations are expected to be promulgated by the end of 1992, pending the completion of the multi-agency review of the mandated studies. They must be carefully examined to ensure they do fully protect the bays and estuaries.

Second, the reorganization of TWC has separated staff that used to conduct a unified review of water rights permits. Now Environmental Systems reviews effects on estuaries while Water Rights actually grants the permits. While the permitting process is well-established, constituting one of the oldest functions of

the earliest water agency in Texas, environmental review has been mandated only since 1985. By putting environmental review in a different administrative unit, the reorganization may peripheralize it, symbolically making its review analogous to that of TPWD, which also comments on habitat and species preservation as well as effects on recreation. The fact that TPWD's comments are sent to Environmental Systems rather than directly to Water Rights only enhances this symbolic removal of environment from other water rights concerns. Conflicts between the two sections can be resolved only at the level of the Assistant Executive Director, Office of Water Resources Management.

Third, TPWD comments may not be included in the permit consideration. The law does not require TWC to adhere to TPWD comments, only to obtain them. However, under the current water rights permitting process, Water Rights may proceed with the permit even without comments from TPWD in an effort to stay within the 75-day deadline for the internal review process. Often this reflects TWC's assumption that TPWD did review but had no comment to make. A simple change in procedure, requiring TPWD to make a written comment on every permit, even to say that it has no comments, could ensure that a permit is not granted without TPWD review. It is especially important to ensure that TPWD at least has a chance to indicate its views because its staff are the experts on endangered species and other species- and habitat-related issues.

Fourth, enforcement of water rights is weak and, in some cases, undermines the very purpose of the program. Data collection is almost entirely dependent on self-reporting by permit holders, who have a strong incentive to report that they use all the water they have been allocated, even when they actually use less (or more). Without accurate data, regulators have no basis for determining whether a watershed can sustain additional diversions without hurting downstream bays and estuaries. Since regulators cannot monitor water use themselves, they have no basis for penalizing false reports. Finally, without monitoring, regulators must rely on rare complaints by citizens or field staff who are conducting inspections for other programs to detect water users who do not hold diversion permits at all. Even when such violators are detected, the law provides TWC with virtually no power to penalize them, forcing the agency to expend considerable resources in getting the Attorney General's Office to take the case.

A Watermaster program similar to that in place in South Texas, which covers the Guadalupe, Nueces, and San Antonio Rivers, could remedy many of these problems. Under the Water Rights Adjudication Act of 1967, TWC is empowered to create water divisions. In each division, the watermaster protects the rights of water users by ensuring that surface water is used in accordance with allocated rights. Holders of water rights pay for the administrative costs of the program, including meters and measuring devices (\$300-\$600 for a four-to-six inch pump), a base fee (\$50 annually in the South Texas Division), and a fee based on water usage (three to four cents per acre foot for most uses). When a water right holder plans to use water, the watermaster is notified so that he can determine whether streamflow is adequate. The watermaster also responds to complaints about illegal diversions.

The intent of the law was to add watermaster programs working eastward through the state's watersheds. However, the public, although recognizing the salutary effects that improved information could have on downstream users access to water, were concerned about the costs of the programs, especially the paperwork entailed in the weekly notice of intent to pump, and it seems unlikely that such programs will be implemented. Even in the absence of a watermaster program, certain of its central features can be imposed with salutary effects. In particular, metering and imposing a fee for water use are two measures that together overcome difficulties in the present enforcement program: they remove incentives to over-report or under-report water usage, make water a costly rather than a free resource, and provide regulators with accurate information on water availability. Using this information, TWC can more adequately meet the needs of all those who need water, including bays and estuaries.

Potential problems with the existing process for maintaining freshwater inflow are indicated by the fact that maintenance of bays and estuaries falls into the lowest priority category of "beneficial uses." Moreover, permit conditions concerning beneficial flows to bays and estuaries may be suspended during emergencies upon notification of TPWD. Since the primary condition under which a permit would be suspended is a drought, bays and estuaries are at double risk: first from the drought itself, and second from diversion of additional water to upstream cities.

This approach to setting priorities for water use is made still more problematic for regulating freshwater inflow by the number of different agencies that may construct surface water impoundments, primarily for drinking water for the growing population of the Galveston Bay region. Both the Trinity and the San Jacinto River Authorities, whose charge is to develop fully the water resources of their respective watersheds, operate surface water impoundments and propose additional ones. Lake Livingston, which supplies water to the City of Houston, is managed by the Trinity River Authority (TRA). The TRA, together with the city of Houston and the Chambers-Liberty Counties Navigation District, is the sponsor of the proposed Wallisville Project, a dam at the lower end of the Trinity River that will prevent saltwater intrusion and supplement Houston's water supply. The San Jacinto River Authority, along with the Bureau of Reclamation, proposed a new reservoir on Lower Lake Creek, a tributary of the San Jacinto River, to serve as water supply for The Woodlands; although an EIS has been submitted to EPA, the project is not being considered because of the absence of adequate local funding. Finally, the Texas Water Development Board makes loans to communities for reservoirs for water supplies through the Water Development Fund; the Tennessee Colony project in the Trinity Basin is described as a possible new project in the TWDB's 1990 State Water Plan.

Freshwater inflow is central to maintaining the unique character of Galveston Bay (and all of Texas' other estuaries as well). Yet the statutory and regulatory frameworks for controlling it are both rather weak. Other states are finding that economic or market-based regulations for water allocation are much more effective than direct regulation; they are also cheaper to implement and may not require legislative action. A metering and water fee program (the former would

not require new legislation; the latter might) would bring the market to bear on water allocation in Texas and would at a minimum ensure that data about water use are accurate enough to form a basis for further water rights allocations. In the absence of good data, ensuring that Galveston or any other bay receives adequate water is a matter of luck rather than management. If the legislature were to give maintenance of bays and estuaries priority over at least some human uses, then the state's policy would also support environmental protection of one of its most productive and attractive resources.

## SUMMARY EVALUATION: FRESHWATER INFLOW

1. **Problem.** Freshwater inflow is needed to maintain the productivity of the estuary.
2. **Authority.** The Texas Water Commission appropriates water rights on a "use it or lose it" basis. Bays and estuaries are 8th in a list of possible water uses that places all human uses, including drinking water and irrigation, much higher. TWC assigns rights and receives self-reporting data on actual water use. Texas Parks and Wildlife Department reviews permits for environmental concerns.
3. **Capacity.** Low. TWC processes 500 permits or amendments a year with only 5 staff members, and the number of permits is expected to rise significantly due to events outside Galveston Bay. TPWD staff increasing. Monitoring of use not required, making self-reporting inaccurate.
4. **Policy.** TWC Environmental Systems Team moved out of the Water Rights Permitting group, separating environmental review still further from the central concern of permitting. TPWD comments not necessarily influential. No enforcement because no monitoring. Slow in developing estuary regulations.
5. **Technical and environmental results.** Without more detailed monitoring and accurate use information, environmental results cannot be related to policy.
6. **Barriers and problems.**
  - a. Incentive in "use it or lose it" policy to overreport water use up to permitted limit, undermining planning.
  - b. All human uses more important than environmental.
  - c. Surface water impoundments that limit freshwater inflow constructed by many agencies—river authorities, cities, Bureau of Reclamation, others—without coordination.
7. **Recommendations.**
  - a. Move TWC Environmental Systems Team back into the Water Rights Permitting group.
  - b. Meter water.
  - c. Consider water use fees, which provide an incentive to report use accurately and repay part of the cost of permitting, metering, monitoring, and water use.
  - d. Promulgate the estuary regulations as soon as possible.
  - e. Ensure that TPWD comments on water rights permits are always provided and timely by requiring departmental notation that the permit has been reviewed. Now, no notation by TPWD may mean either that the permit is acceptable or that TPWD has not seen it. The process should also not let TPWD kill permits by inaction.

## REFERENCES

Dawson, Bill. "New Wallisville Dam Environmental Study Ordered." Houston Chronicle. January 29, 1992.

Kaiser, Ronald A. Handbook of Texas Water Law: Problems and Needs. Texas Water Resources Institute. College Station, 1986.

Lyndon B. Johnson School of Public Affairs. Texas and Global Warming: Emissions, Surface Water Supplies and Sea Level Rise. Policy Research Report Series. Austin, Texas, 1991. (Draft)

National Oceanographic and Atmospheric Administration (NOAA). Galveston Bay: Issues, Resources, Status and Management. Department of Commerce. Washington, D.C., March 1988.

Texas Water Development Board. Water for Texas: Today and Tomorrow. Austin, Texas, 1990.

Texas Water Development Board. COMPAS Water Rights Files. Austin, Texas, 1991.

