TABLE OF CONTENTS – CHAPTER 7

LIST OF TABLES

APPENDICES

CHAPTER 7.0: REGIONAL PLAN CONSISTENCY WITH STATE'S LONG-TERM RESOURCE PROTECTION GOALS

A major goal of the regional water planning process is the protection of the State's water, agricultural, and natural resources. This focus has been considered throughout the planning process by the Lower Colorado Regional Water Planning Group (LCRWPG) when selecting strategies to meet water needs for the future. Conservation has been recommended as a first strategy for meeting shortages. Impacts on the State's resources have been thoroughly considered before recommending other strategies.

The effects of the recommended water management strategies on specific resources are discussed in further detail within this chapter.

7.1 WATER RESOURCES WITHIN THE LOWER COLORADO REGIONAL WATER PLANNING AREA (LCRWPA)

Water resources available by basin within the LCRWPA are discussed in further detail below.

7.1.1 Brazos River Basin

Portions of Bastrop, Burnet, Fayette, Mills, Travis, and Williamson Counties are within the Brazos River Basin. Local supplies are the only surface water sources originating from the Brazos River Basin in the LCRWPA. The portion of Williamson County within the LCRWPA is within the service boundary of the City of Austin (COA) and the Lower Colorado River Authority and is served by their water supplies in the Colorado River Basin. Groundwater supplies in the Brazos River Basin are obtained primarily from the Carrizo-Wilcox, Hickory, and Trinity aquifers. Groundwater is also available in lesser quantities from the Edwards-Balcones Fault Zone (BFZ), Ellenburger-San Saba, Gulf Coast, Marble Falls, Queen City, Sparta, Yegua-Jackson, and other unnamed aquifers.

Municipal conservation measures recommended by the Plan may have the effect of elevating the level of contaminants introduced to streams in the Brazos River Basin from wastewater treatment facilities if treatment standards are insufficient to meet total maximum daily loading limitations. Areas that are supplied from groundwater in the Brazos River Basin would be expected to discharge less water from treatment plants after implementing conservation measures. As wastewater effluent is often an important portion of instream flows, especially during dry periods, conservation measures may result in reduced streamflows. Expanding the use of groundwater will generally increase the amount of return flows to streams, though the possibility of introducing low quality groundwater, particularly from the Hickory aquifer, to surface systems may have an unfavorable effect on surface water quality. The implementation of House Bill (HB) 1437 may somewhat increase the instream flows in the Brazos River Basin absent significant reuse. However, with this additional supply comes additional usage and resulting contaminants that may pose water quality concerns unless treated to appropriate water quality standards.

7.1.2 Brazos-Colorado Coastal River Basin

The Brazos-Colorado Coastal River Basin includes portions of Colorado, Matagorda, and Wharton Counties. The only surface water source for this basin in the LCRWPA that is not a local supply is a run-of-river (ROR) right from the San Bernard River. However, large amounts of surface water originating in the Colorado River Basin are transferred to the Brazos-Colorado Coastal River Basin for

agricultural use and are subsequently released to streams in the process of rice production. The entirety of the Brazos-Colorado River Basin within the LCRWPA is served by the Gulf Coast aquifer.

As in the other basins of the LCRWPA, increased groundwater usage may have potential impacts on water quantity in stream channels but possible adverse effects on water quality in some cases. Conservation programs implemented through the Lower Colorado River Authority-San Antonio Water System (LCRA-SAWS) Water Project may decrease streamflows during dry periods and introduce less water from the Colorado River Basin for irrigation use. Conjunctive use of groundwater and surface water supplies will decrease aquifer levels.

7.1.3 Colorado River Basin

Because the LCRWPA is centered on the Colorado River Basin, nearly every recommended management strategy has the potential to impact water quantity and quality in the basin.

The Colorado River Basin constitutes the largest portion of the LCRWPA as well as the single largest source of water for the region. The Highland Lakes System, operated by the Lower Colorado River Authority (LCRA), provides firm surface water supplies throughout the basin. An even larger amount of water is available from ROR supplies in the basin. Other reservoirs in the system provide small yields or receive their water through the Highland Lakes System or a ROR right. The largest amounts of groundwater in the Colorado River Basin are available from the Gulf Coast, Carrizo-Wilcox, Hickory, and Ellenburger-San Saba aquifers. These four aquifers represent approximately 60 percent of the available groundwater supply with various other aquifers providing the remaining 40 percent.

Currently, the use of COA effluent discharges downstream to increase the reliability of existing diversion rights maintains flow rates from Austin to the downstream point of diversion until COA reuse becomes comprehensive enough to reduce these total flows considerably in later decades. New contracts, reallocation of surplus supplies, and contract increases may also decrease total flow and concentrate chemical constituents in certain areas during low flow periods.

The direct transfer of raw water from the Guadalupe River to the Colorado River may result in issues arising from the mixing of water from two sources.

Construction of an instream channel dam at Goldthwaite will slightly reduce instream flows by capturing interruptible flows under normal conditions. During drought, the reservoirs would allow water to pass downstream to provide water to firm right holders. Water quality will benefit from the settling action behind the dam that will allow suspended materials to settle out.

Operation of the Highland Lakes System to allow interruptible water supplies to be supplemented with available firm water during drought periods will be beneficial to instream flows during these periods, although the use of these stored water supplies will reduce the amount of water available in the Highland Lakes. Conservation practices implemented as part of the LCRA-SAWS Water Project will result in reduced streamflow, although sediment and nutrient loads from irrigation tail water would be reduced, as well. As noted above, conjunctive use of groundwater and surface water will decrease aquifer levels in the Colorado-Lavaca Coastal River Basin.

Portions of Matagorda and Wharton Counties are within the Colorado-Lavaca Coastal River Basin. All surface water sources in these areas are associated with local supplies. However, as in the Brazos-

Colorado Coastal River Basin, water from the Colorado River Basin is discharged into streams following its use in rice production, and all groundwater supplies are obtained from the Gulf Coast aquifer.

As in the other basins of the LCRWPA, increased groundwater usage may have potential positive impacts on water quantity in stream channels but possible adverse effects on water quality in some cases. Again, conservation programs implemented through the LCRA-SAWS Water Project may decrease streamflows during dry periods and introduce less water from the Colorado River Basin for irrigation use.

7.1.4 Lavaca River Basin

The western portions of Colorado and Fayette Counties are located in the Lavaca River Basin. There are no firm surface water rights available from the Lavaca River Basin within these two counties. Additionally, the only reservoir in this basin, Lake Texana, is not located in the LCRWPA, and no surface water contracts serve water user groups (WUGs) in the region from Lavaca River Basin supplies. All surface water supplies in the basin are obtained from local supplies. The primary source of groundwater for the Lavaca River Basin in the LCRWPA is the Gulf Coast aquifer.

As in the Brazos and Colorado River Basins, municipal conservation could possibly impair water quality. However, areas served by groundwater would experience some benefit from increased streamflows from additional pumpage, although groundwater quality issues may introduce additional problems to stream water quality in certain instances. As in the other basins expected to benefit from the LCRA-SAWS Water Project, conservation programs implemented through the program may decrease streamflows during dry periods and introduce less water from the Colorado River Basin for irrigation use. As in the other basins subject to the LCRA-SAWS Water Project, conjunctive use of groundwater and surface water supplies will sustain aquifer levels when irrigators use available surface supplies rather than groundwater.

7.1.5 Guadalupe River Basin

The Guadalupe River Basin includes portions of Bastrop, Blanco, Fayette, Hays, and Travis Counties within the LCRWPA. No major reservoirs exist within the LCRWPA section of the Guadalupe River Basin, and the only firm surface water source is provided by two minor reservoirs operated by the City of Blanco. Other surface water sources are obtained from local supplies. The Carrizo-Wilcox and Ellenburger-San Saba aquifers are the major groundwater sources for the Guadalupe River Basin. Other smaller groundwater sources include the Edwards-BFZ, Edwards-Trinity, Gulf Coast, Queen City, Sparta, Trinity, and Yegua-Jackson aquifers.

As in the other basins, expanded groundwater usage is expected to increase streamflows with a possibility of negatively impacting water quality from additional discharges and groundwater quality issues.

7.2 AGRICULTURAL RESOURCES WITHIN THE LCRWPA

Rice production in the lower counties of the LCRWPA is the agricultural resource most dependent upon a reliable, extensive water supply. Water rights in these counties used for rice farming are some of the most senior rights within the entire Colorado River Basin. However, as a result of certain Region K Cutoff Model assumptions related to the Upper Colorado River Basin made when determining supplies within the Colorado River, these users do not have a sufficiently reliable supply of water under drought-of-record (DOR) conditions without the implementation of one or more future water management strategies.

The management strategies introduced in Chapter 4 of this Plan were created to meet the needs of all WUGs including agricultural needs. Primarily, the unmet agricultural needs in the LCRWPA are related to rice irrigation in the lower counties of Colorado, Wharton, and Matagorda. These needs have been met with sufficient new strategies to overcome the predicted shortages, including strategies to convert agricultural rights to firm water rights for municipal or other demands. The use of interruptible water supplies and return flows from the COA in the near future will eventually give way to conservation programs through an LCRA-SAWS agreement to reduce overall irrigation demands with on-farm conservation, conveyance improvements, conjunctive use of groundwater, and the development of more efficient rice varieties.

7.3 NATURAL RESOURCES WITHIN THE LCRWPA

The water management strategies recommended for the LCRWPA in this Plan are intended to protect natural resources while still meeting the projected water needs of the region. The impacts of recommended strategies on specific resources are discussed below.

7.3.1 Threatened and Endangered Species

The LCRWPA contains an array of habitats for a variety of wildlife species. A number of these species are listed as threatened or endangered by federal or state authorities, proposed as candidates to be listed, or are otherwise rare but unlisted species. A comprehensive list of these species can be found in *Appendix 1A* of this Plan.

The quantitative environmental impacts of the individual water management strategies discussed in Chapter 4 varied from positive impact to minimal or no impact to negative impact. A discussion of the individual environmental impacts can be found in Chapter 4 and a discussion of the comprehensive impacts is in *Section 7.3.3* of this chapter. The potential impacts to threatened and endangered species are expected to be limited. The construction of infrastructure related to these strategies may potentially impact one or more of the species identified in *Appendix 1A*.

7.3.2 Parks and Public Lands

As described in Chapter 1, over 28,000 acres of state parks are within the boundaries of the LCRWPA. These 14 state facilities host a variety of outdoor recreational opportunities for visitors from around the state of Texas. None of the recommended water management strategies are expected to have impacts on public lands. In addition, there are no foreseen impacts to stream segments traversing public lands. Additional information concerning impacts from each strategy can be found in Chapter 4.

7.3.3 Impacts of Water Management Strategies on Matagorda Bay System

The Matagorda Bay system represents a significant ecological resource to the LCRWPA and provides habitat for a number of species while supporting recreation and industry. As the second largest estuary system in Texas, it represents a major priority in protecting the state's natural resources.

Matagorda Bay receives inflows from the Colorado and Lavaca Rivers as well as a coastal contributing area. The target and critical freshwater inflow needs were estimated in a study conducted in 1997 by the LCRA, TNRCC, TWDB, and TPWD and for the Matagorda Bay system from the Colorado River Basin are included in the *Water Management Plan for the Lower Colorado River Basin* (1999) *Table 7.1*. The target inflow is described as the necessary long-term inflows that produce 98 percent of the maximum

normalized population biomass for nine key estuarine species while maintaining certain criteria for salinity, population density, and nutrient inflow. The minimum inflow for critical needs represents the amount of water required for bay and estuary inflows to keep salinity at the mouth of the Colorado River to a level of 25 parts per thousand or less. This condition is expected to provide for fish habitat during extreme drought conditions without impacting the long-term ecology of Matagorda Bay.

A revision of the Freshwater Inflow Needs Study (FINS) was completed in 2006. The results of this study showed increased target and critical needs for Matagorda Bay. The 2006 FINS critical and target flows were used in this round of planning when determining the quantitative environmental impacts of the water management strategies. *Table 7.1* also shows the increased required monthly flows from the Colorado River as shown in the 2006 Freshwater Inflow Needs Study. The critical needs from the 2006 Study are approximately 150 percent higher than the 1997 Study, while the target needs from the 2006 Study are approximately 40 percent higher.

Table 7.1 Target and Critical Freshwater Inflow Needs for the Matagorda Bay System From the Colorado River

Month	1997 FINS Freshwater Inflows (1,000 ac-ft)[1]		2006 FINS Freshwater Inflows (1,000 ac-ft)[1]	
	Critical	Target	Critical	Target
January	14.26	44.1	36	205.6
February	14.26	45.3	36	194.5
March	14.26	129.1	36	63.2
April	14.26	150.7	36	60.4
May	14.26	162.2	36	255.4
June	14.26	159.3	36	210.5
July	14.26	107.0	36	108.4
August	14.26	59.4	36	62.0
September	14.26	38.8	36	61.9
October	14.26	47.4	36	71.3
November	14.26	44.4	36	66.5
December	14.26	45.2	36	68.0
Annual Totals	171	1,033	432	1,428

[1] Schedule of flows is designed to optimize biodiversity/productivity under normal rainfall. Under drought conditions, target flows should be curtailed in accordance to the severity of the drought and flows should be maintained at or above critical levels based on water quality considerations.

The freshwater inflow values presented in *Table 7.1* were developed following the methodology presented in "Characteristics of an Ecologically Sound Environment for the Guadalupe Estuary" by Boyd and Green, presented in *Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determination of Needs* by TPWD, dated 1994. The process of determining freshwater inflow needs was carried out in three distinct phases:

Phase 1: Develop statistical relationships between freshwater inflows and key indicators such as salinity, species productivity, and nutrient inflows.

Phase 2: Use the developed statistical functions to compute optimal monthly and seasonal freshwater needs using the Texas Estuarine Mathematical Programming (TXEMP) Model developed by TWDB.

Phase 3: Simulate salinity conditions throughout the estuary using the TxBLEND model developed by TWDB and LCRA.

Phases 2 and 3 were carried out in an iterative process that compared simulated and desired salinity levels throughout the estuary. If the modeled salinity levels were outside of the ranges desired, the TXEMP model was adjusted accordingly. Additional information concerning the development of the target and critical freshwater inflows to the Matagorda Bay system can be found in *Freshwater Inflow Needs of the Matagorda Bay System* (LCRA 1997).

Additional data collection after the development of the 1997 inflows in *Table 7.1* showed that trends in salinity levels in Matagorda Bay did not corresponded to the projections made by the model, and changes were made to the target and critical inflows to better reflect the collected data. The results of the revised modeling are presented in *Table 7.1* as the 2006 FINS.

Additional studies were performed as part of the LSWP analysis. The Matagorda Bay Health Evaluation Study was completed in 2008, and recommended inflow criteria from the Colorado River that covered a wide range of inflow conditions to Matagorda Bay. Low-flow (threshold), long-term average, and four additional volumes of flow with associated percentages of time they should be met were part of the recommendations. The criteria from this study were used by the LCRWPG as a benchmark for evaluating the environmental impacts of the new and changed condition water management strategies in this round of planning. The use of the criteria as a benchmark does not imply that the LCRWPG endorses the results of the study at this time, but rather it is the most up-to-date scientific data available. For further detail, please see the study results at http://www.lcra.org/lswp/about/study/matagorda_bay.html.

The impacts of individual water management strategies on Colorado River instream flows and bay and estuary freshwater inflows were modeled in Chapter 4. A comprehensive model containing all of the water management strategies was also run to determine what the overall impacts would be to the Colorado River and Matagorda Bay. The results were compared to a base model without any of the strategies incorporated. The results were evaluated using the recommended guidelines from the Matagorda Bay Health Evaluation Study and Colorado River Instream Flow Guidelines Study done as part of the LSWP studies. More discussion of these studies and their recommended guidelines is available in *Section 4.17*.

The tabular results of the comprehensive strategy model comparison can be found in *Appendix 7A*. The following is a list of all the strategies incorporated into the model:

- LCRA New Contracts and Contract Amendments
- Construct Goldthwaite Channel Dam
- HB 1437
- LCRA-SAWS Water Sharing Project (LSWP)
- City of Austin Return Flows and Reuse
- LCRA Excess Flows Permit and Off-Channel Storage

- LCRA Aquifer Storage and Recovery (ASR)
- STPNOC Water Right Permit Amendment
- Groundwater Importation

Overall, the comprehensive strategy model results showed positive impacts to the Instream Flows and Freshwater Inflows to Matagorda Bay. For the Bay and Estuary Freshwater Inflows comparison, with the strategies, the percentage of time the Threshold level of 15,000 ac-ft/month was met an additional 10% of the time. There were negative impacts at the highest criteria level (MBHE 4) for two out of the three seasons, where the target volume of water was met three percent less of the time as compared to the base model with no strategies.

For the Colorado River instream flows comparison, with the strategies, the impacts were nearly all positive, especially in the lower Wharton reach of the river. The Bastrop and Columbus reaches each showed a few months with negative impacts of eight percent or less under Base Flow conditions, but no negative impacts to the Subsisentence Flows.

The transfer of water anticipated under HB 1437 would constitute an inter-basin transfer to the Brazos River Basin. With this distinction comes the potential for environmental impacts from the introduction of invasive species and issues resulting from mixing water supplies from multiple sources. The greatest potential impacts on the Colorado River Basin would result from the reduced streamflow resulting from the transfer. However, LCRA will continue to meet the environmental flow requirements as specified in its WMP.

Overall, based upon the modeling assumptions developed as a part of the First Biennium Studies, the individual water management strategies evaluated appear reasonable and consistent with the long-term protection of the state's water resources, natural resources, and agricultural resources. Likewise, the cumulative impacts of all of these strategies are generally within expected ranges. The LCRWPG will continue to consider all of these strategies in further detail during future regional water planning updates, as well as examine potential alternative strategies for selected areas and for changed conditions.

APPENDIX 7A

ENVIRONMENTAL IMPACTS OF THE COMPREHENSIVE WATER MANAGEMENT STRATEGIES