



Neches River at east edge of Davy Crockett National Forest





**COASTAL FISHERIES DIVISION:
WATER RESOURCES BRANCH**

Ecologically Significant River & Stream
Segments of Region I (East Texas)
Regional Water Planning Area

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1.3 ACRONYM LIST

CIR - Color Infrared
 CTC - Central Texas Coast
 DOQ - Digital Orthophoto Quadrangle
 E - Endangered
 Fed. - Federal
 GBRA - Guadalupe-Blanco River Authority
 GTCBT - Great Texas Coastal Birding Trail
 NHP - National Historic Park
 NPS - National Park Service
 NWI - National Wetlands Inventory
 NWR - National Wildlife Refuge
 RWPG - Regional Water Planning Group
 SHP - State Historical Park
 SNA - State Natural Area
 SOC - Species of Concern
 SP - State Park
 St. - State
 T - Threatened
 TAC - Texas Administrative Code
 TCEQ - Texas Commission on Environmental Quality
 TPWD - Texas Parks and Wildlife Department
 TNRCC - Texas Natural Resources Conservation Commission
 TWDB - Texas Water Development Board
 TxDOT - Texas Department of Transportation
 USFWS - United States Fish and Wildlife Service
 WMA - Wildlife Management Area

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1.5 INTRODUCTION

Texas contains a wide variety of natural resources, climates and ecosystems that are as diverse, broad and complex as the people who call Texas home. The 11 natural regions of Texas reflect the wide range of climatic conditions, geology, flora, and fauna found in the state. In the 23 river basins of Texas are over 191,000 miles of streams and rivers that vary from the clear spring-fed streams of the Hill Country to the saline creeks and rivers of the Panhandle to the sluggish bayous of southeast Texas. Due to the climatic variability in the state, and the geographic expanse of Texas, there can be large differences between streams in the upper and lower part of a river basin, and among streams in different river basins. Texas' rivers and streams provide habitat for 247 total species of fishes (Hubbs et al. 1991), as well as a variety and diversity of aquatic plants and animals. In addition to supplying water to riparian areas, bottomland-hardwoods, and other wetland ecosystems, the natural flow conditions of rivers and streams also provide freshwater inflows to the state's bays and estuaries.

Texas is a state of extremes. While the southeastern part of the state receives as much as 60 inches of rain annually, portions of West Texas average only 8 inches of rain per year (Ramos 1999). This contributes to greater biodiversity in east Texas, and west Texas having higher levels of endemism and more threatened and endangered species. This climatic pattern has resulted in the majority of water development projects occurring in the eastern part of the state, while west Texas relies primarily upon groundwater (TWDB 1997).

Perhaps no natural resource has influenced the development of the state as distinctively as water. Modifications to natural stream systems to provide water for municipal, agricultural, industrial and other needs and to control flooding have been commonplace for the past 150 years. Such modifications have altered the hydrology of many streams in the state, with a concomitant change in the biotic communities of many of these systems. Diminished flows can cause losses in habitat diversity, reduce stream productivity, and degrade water quality. Reservoirs also directly impact physical and water quality characteristics of the impounded stream and may cause significant changes in downstream biological community structure.

In 1913, the state had only eight major reservoirs with a storage capacity of 5,000 acre-feet or larger and a total storage capacity of 376,000 acre-feet (Ramos 1999). Currently, Texas has 214 major reservoirs with a total storage capacity of approximately 41 million acre-feet (TWDB 2001). This boom in water development was in part the result of an increase in population that has seen the state's population grow to over 20 million people. Considering that the population is expected to reach about 40 million people by the year 2050, protecting environmental resources while allowing for water development is more important than ever.

As a result of the passage of Senate Bill 1 in 1997, water planning in Texas became the province of regional planning groups rather than the Texas Water Development Board (TWDB). Senate Bill 1 directed the TWDB to designate regional water planning areas, taking into consideration such factors as river basin and aquifer delineations, water utility development patterns, socioeconomic characteristics, existing regional water planning areas, political subdivision boundaries, public comment, and other factors that the TWDB deemed relevant. One of the other relevant factors considered by the TWDB was the delineation of climatic zones. From this process, the TWDB identified 16 water planning regions. The water planning regions are represented by regional water planning groups that are charged with planning for regional water demands for the next 50 years. The Region I (East Texas) Regional Water Planning Area consists of all or a portion of 20 counties located in the Neches, Sabine, and Trinity River basins, and Neches-Trinity Coastal Basin, including the counties of Anderson, Angelina, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity, and Tyler (Figure 1).

As part of the planning process, the regional planning groups were given the option to identify stream segments for designation as ecologically unique according to a process outlined in Texas Administrative Code (TAC) Section 357 and Texas Water Code (TWC) Section 16.051. The criteria to be used in evaluating a stream segment's ecological importance are based on factors related to biological function, hydrologic function, presence of riparian conservation areas, high water quality/exceptional aquatic life/high aesthetic value, and threatened or endangered species/unique communities (Appendix A).

Using the criteria set forth in 31 TAC § 357.8, the TPWD compiled a cursory list of ecologically significant stream segments in each region. TPWD used readily available studies, existing data, and in-house expertise to identify stream segments that met at least one of the criteria for designation as ecologically unique.

Sources of information that the TPWD used in this analysis included state-conducted studies on ecoregion streams (Bayer et. al 1992), the Nationwide Rivers Inventory (Appendix B) (NPS 1995), the State of Texas Water Quality Inventory (TNRCC 1996, TCEQ 2004), data on threatened and endangered species (Campbell 1995, TPWD 2005), a variety of TPWD reports and studies (Bauer et. al 1991, Howells et. al 1996, Linam and Kleinsasser 1998, Linam et al. 2002), and personal communications with TPWD biologists. In addition, graphic information in the form of USGS topographic maps, digital ortho-quads, and national wetland inventory maps were consulted. It was important that ecologically significant stream segments be objectively identified based upon the best available information.

TPWD's analysis identified 228 stream segments throughout the state that met at least one of the criteria listed for identifying ecologically unique stream segments. In producing its list of ecologically significant stream segments, TPWD did not consider other important factors such as recreation. The analysis was not definitive or exhaustive, but based on existing and readily available information. The regional water planning groups in their considerations of ecologically unique river and stream segments can use the stream segment list compiled by the TPWD as a starting point. The act of officially designating a stream segment as ecologically unique is a combined effort of the regional water planning groups, the TWDB, and the Texas legislature. Designation of a stream segment as ecologically unique does not impart protection from degradation, but solely means that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under § 16.051 (f) of the Texas Water Code. Designation also recognizes the importance of protecting the ecological legacy of Texas' rivers and streams by affording the

segment and its natural resources a certain degree of protection from activities (such as reservoir construction) that may distract from its uniqueness.

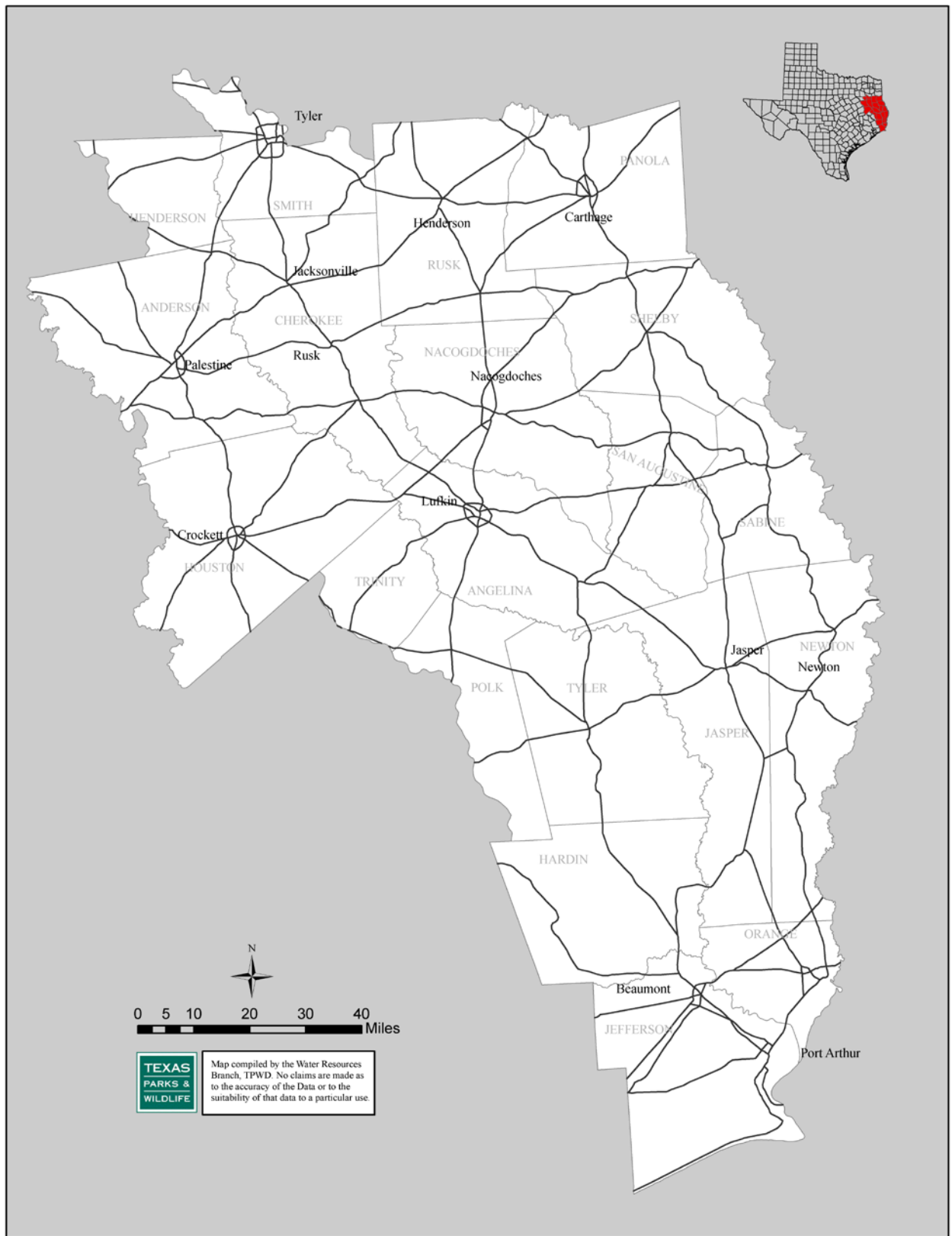


Figure 1. Map of Region I with Cities

Region I contains three of the ten natural subregions that comprise our state including the East Central Texas Plains, Western Gulf Coast Plains, and the South Central Plains. The South Central Plains ecoregion, locally termed the "piney woods", covers the majority of Region I. Prior to European settlement, this area of Texas supported longleaf pine, shortleaf pine, loblolly pine, and oak-hickory forests. Today the region is composed of fragmented pine and pine-hardwood forests with some cropland and pastureland (TPWD 2005). The majority of national forests and other forestland located in Texas are found in this region, including the Big Thicket National Preserve, Davy Crockett National Forest, Angelina National Forest, and Sabine National Forest. Swamps, bogs, man-made lakes, and an array of streams ranging from spring-fed blackwater streams to sluggish coastal creeks extend through the region, which has the state's highest rainfall with annual precipitation of 32 to 56 inches (NCDC 2005). Many of these streams provide habitat for rare and endemic species (Table 1) and provide the public with ample opportunities for outdoor recreation, wildlife viewing, and other forms of nature tourism; a fast growing segment of the travel industry.

1.6 OBJECTIVE

The purpose of this report is to identify and document those river and stream segments that meet the outlined criteria established by 31 TAC 357.8(b) as having significant ecological value. The report is intended to provide the Region I RWPG with the technical information necessary to prepare a recommendation package of ecologically unique river and stream segments under 31 TAC 357.8(a), which may be included in the regional water plan.

1.7 METHODS

Aerial photographs, maps, and the Gazetteer of Streams and Rivers of Texas (TPWD 1998) were used to identify the boundaries of the Region I Regional Water Planning Area and the major water courses contained within. Each of the criteria listed in 31 TAC §357.8 (b) was then addressed individually in an effort to identify all rivers or streams that met the criteria. The majority of the research performed in the preparation of this report is secondary in nature, largely due to the amount of time and staff power that would be necessary to do primary research. Because the outlined criteria has specific requirements and the fact that few rivers or streams in the state have been studied to such an extensive degree to cover all of the criteria, it was often difficult to address some of the criteria for certain stream segments.

State and federal agencies and universities were contacted to solicit river and stream segment information along with supporting data and documentation for inclusion in the final report. Those contacted include the TCEQ, TPWD, USFWS, U.S. Forest Service, Texas A&M University, and the University of Texas. Information was received in the form of personal communication, reports, and studies, all of which are documented in the References section. This information proved to be most helpful in identifying streams that met the biological function criteria.

National Wetland Inventory Maps and USFWS documents and resources were used to identify river or stream segments bordered by wetlands displaying "significant overall habitat value" (31 TAC §357.8 (b) (1)), thus meeting the biological function criteria. Significant wetland habitat within Region I was determined to include any freshwater or estuarine wetlands of considerable size that offer valuable habitat. Forested wetlands and riparian zones of significant size were determined to be the most important of these habitat types.

National Wetland Inventory Maps were also used to identify those river or stream segments that "perform valuable hydrologic functions relating to water quality and flood attenuation" (31 TAC §357.8 (b) (2)). A river or stream was considered to perform these functions if it was bordered by significant wetlands or acreage that would help filter excess nutrients, sediment, and contaminants from runoff and prevent or minimize flooding of downstream cities or urban areas. Rivers or streams that "perform valuable hydrologic functions relating to groundwater recharge and discharge" (31 TAC §357.8 (b) (2)) were identified through the use of TWDB reports and Gunnar Brune's (1981) Springs of Texas: Volume 1.

River and stream segments fringed by significant riparian conservation areas were mainly identified using maps and webpages (TPWD 2005a), but also through personal communication with staff of government agencies. Only those stream segments fringed by federal or state owned conservation areas were deemed as meeting the riparian conservation area criteria. River and stream segments deemed significant due to "unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality" (31 TAC §357.8 (b) (4)) were identified through the TCEQ's State Water Quality Inventory (1996) and personal communication with government agencies and universities. Among the segments included are those that the TPWD in cooperation with the TCEQ identified as ecoregion reference streams. Ecoregions, as delineated by Omernik (1987), are based upon land surface form, land use, soils, and potential natural vegetation. The joint project identified streams within each of the respective ecoregions that were minimally or only slightly disturbed in order to develop a potential list of reference stations that could be used to evaluate the conditions of other streams within the ecoregion. The criteria for becoming an ecoregion reference stream included the lack of urban development in the watershed, no point sources of pollution, no channelization, and no atypical non-point sources of pollution. Ecoregion reference streams serve as examples of the physical habitat, physiochemical character, and biological attributes that other streams within the respective ecoregions could likely attain under the right set of circumstances.

Unique communities and "sites along streams where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species" (31 TAC §357.8 (b) (5)) were identified through personal communication with TPWD and USFWS staff. Habitats that support threatened, endangered, and rare species were identified using county lists of rare species prepared by the TPWD Wildlife Diversity Program, personal communication, and reports of documented occurrences (Table 1). Because of the low population numbers of most of these species and their transient nature, it was often difficult to pinpoint exact locations or streams for many of the species. However, the specific habitat requirements of many of the species along with the county list of occurrences made it possible to identify rivers or streams that may currently support these species or may provide habitat for these species at some point in the future.

Table 1. Endangered Species of Region I (Texas Parks and Wildlife Department 2007/2008)

| Scientific name | Common name | Fed. Status | State Status |
|-------------------------------------|-------------------------------------|-------------|--------------|
| AMPHIBIANS | | | |
| <i>Plethodon serratus</i> | Southern Redback Salamander | | SOC |
| <i>Rana grylio</i> | Pig Frog | | SOC |
| BIRDS | | | |
| <i>Aimophila aestivalis</i> | Bachman's Sparrow | | T |
| <i>Ammodramus henslowii</i> | Henslow's Sparrow | | SOC |
| <i>Charadrius alexandrinus</i> | Snowy Plover | | SOC |
| <i>Charadrius melodus</i> | Piping Plover | LE | E |
| <i>Egretta rufescens</i> | Reddish Egret | | T |
| <i>Elanoides forficatus</i> | Swallow-tailed Kite | | T |
| <i>Falco peregrinus anatum</i> | American Peregrine Falcon | | E |
| <i>Falco peregrinus tundrius</i> | Arctic Peregrine Falcon | | T |
| <i>Grus americana</i> | Whooping Crane | LE | E |
| <i>Haliaeetus leucocephalus</i> | Bald Eagle | DL | T |
| <i>Laterallus jamaicensis</i> | Black Rail | | SOC |
| <i>Mycteria americana</i> | Wood Stork | | T |
| <i>Pelcanus occidentalis</i> | Brown Pelican | LE-PDL | E |
| <i>Picoides borealis</i> | Red-cockaded Woodpecker | LE | E |
| <i>Plegadis chihi</i> | White-faced Ibis | | T |
| <i>Sterna antillarum athalassos</i> | Interior Least Tern | LE | E |
| <i>Sterna fuscata</i> | Sooty Tern | | T |
| CRUSTACEANS | | | |
| <i>Fallicambarus devastator</i> | Texas prairie crayfish | | SOC |
| <i>Procambarus nechesae</i> | A crayfish | | SOC |
| FISHES | | | |
| <i>Ammocrypta clara</i> | Western Sand Darter | | SOC |
| <i>Anguilla rostrata</i> | American eel | | SOC |
| <i>Cycleptus elongatus</i> | Blue Sucker | | T |
| <i>Erimyzon oblongus</i> | Creek Chubsucker | | T |
| <i>Etheostoma radiosum</i> | Orangebelly darter | | SOC |
| <i>Notropis chalybaeus</i> | Ironcolor shiner | | SOC |
| <i>Polyodon spathula</i> | Paddlefish | | T |
| INSECTS | | | |
| <i>Cheumatopsyche morsei</i> | Morse's Net-spinning Caddisfly | | SOC |
| <i>Chimarra holzenthali</i> | Holzenthal's Philopotamid Caddisfly | | SOC |
| <i>Euphyes bayensis</i> | Bay skipper | | SOC |
| <i>Gomphus modestus</i> | Gulf Coast clubtail | | SOC |
| <i>Hydroptila ouachita</i> | A Purse Casemaker Caddisfly | | SOC |
| <i>Phylocentropus harrisi</i> | (no common name) | | SOC |
| <i>Plauditus gloveri</i> | A mayfly | | SOC |
| <i>Somatochlora margarita</i> | Big Thicket Emerald Drangonfly | | SOC |

| MAMMALS | | | |
|-------------------------------------------------|-------------------------------|---------|-----|
| <i>Corynorhinus rafinesquii</i> | Rafinesque's big-eared bat | | T |
| <i>Myotis austroriparius</i> | Southeastern myotis bat | | SOC |
| <i>Spilogale putorius interrupta</i> | Plains spotted skunk | | SOC |
| <i>Ursus americanus</i> | Black bear | T/SA;NL | T |
| <i>Ursus americanus luteolus</i> | Louisiana black bear | LT | T |
| REPTILES | | | |
| <i>Cemophora coccinea copei</i> | Northern Scarlet snake | | T |
| <i>Chelonia mydas</i> | Green sea turtle | LT | T |
| <i>Crotalus horridus</i> | Timber/Canebrake rattlesnake | | T |
| <i>Dermochelys coriacea</i> | Leatherback sea turtle | LE | E |
| <i>Eretmochelys imbricata</i> | Atlantic hawksbill sea turtle | LE | E |
| <i>Graptemys ouachitensis sabinensis</i> | Sabine map turtle | | SOC |
| <i>Lepidochelys kempii</i> | Kemp's Ridley sea turtle | LE | E |
| <i>Macrochelys temminckii</i> | Alligator Snapping Turtle | | T |
| <i>Malaclemys terrapin littoralis</i> | Texas Diamondback Terrapin | | SOC |
| <i>Nerodia clarkii</i> | Gulf Saltmarsh Snake | | SOC |
| <i>Pituophis ruthveni</i> | Louisiana Pine Snake | C | T |
| PLANTS | | | |
| <i>Galins parviflora</i> | Navasota false foxglove | | |
| <i>Bartonia texana</i> | Texas screwstem | | SOC |
| <i>Clematis carrizoensis</i> | Carrizo leather flower | | |
| <i>Eriocaulon koernickianum</i> | Small-headed pipewort | | SOC |
| <i>Gaillardia aestivalis var winkleri</i> | White firewheel | | SOC |
| <i>Geocarpon minimum</i> | Earth fruit (Tinytim) | LT | T |
| <i>Helianthus occidentalis ssp plantagineus</i> | Shinner's sunflower | | SOC |
| <i>Hibiscus dasycalyx</i> | Neches River rose-mallow | C | SOC |
| <i>Hymenopappus carrizoanus</i> | Sandhill woollywhite | | SOC |
| <i>Leavenworthia texana</i> | Texas golden glade cress | C | SOC |
| <i>Phlox nivalis ssp texensis</i> | Texas trailing phlox | LE | E |
| <i>Physaria pallida</i> | White bladderpod | LE | E |
| <i>Physostegia longisepala</i> | Long-sepaled false dragonhead | | SOC |
| <i>Platanthera chapmanii</i> | Chapman's orchid | | SOC |
| <i>Quercus boyntonii</i> | Boynton's oak | | SOC |
| <i>Spiranthes parksii</i> | Navasota ladies'-tresses | LE | E |
| <i>Symphotrichum puniceum var scabricaule</i> | Rough-stem aster | | SOC |
| <i>Trillium texanum</i> | Texas trillium | | SOC |
| <i>Xyris chapmanii</i> | Chapman's yellow-eyed grass | | SOC |
| <i>Yucca cernua</i> | Nodding yucca | | SOC |

Status Code: LE, LT – Federally Listed Endangered/Threatened; E/SA – Federally Endangered by Similarity of Appearance; E, T – State Endangered/Threatened; PT – Federally Proposed Threatened; C – Federal Candidate, Category 1, information supports proposing to list as endangered/threatened; SOC – Species of Concern.

After identifying river and stream segments meeting the criteria, a preliminary list consisting of the ecologically significant segments was compiled (Table 2). The list consists of the segments that best fit the criteria and does not rank the river or stream segments in order of importance or significance.

1.8 RESULTS

In the Region I RWPG, 41 river or stream segments were identified as meeting at least one of the outlined criteria (Table 2). Seven of the streams identified were found to meet the biological function criteria. These streams “displayed significant overall habitat value...considering the degree of biodiversity, age, and uniqueness.” The hydrologic function criterion was not met by any streams perhaps because insufficient data on groundwater-surfacewater interactions is available. Thirty-three streams met the riparian conservation area criteria, which primarily included those in the Davy Crockett National Forest and the Big Thicket National Preserve. Twelve streams met the high water quality/exceptional aquatic life/high aesthetic value criteria, while the threatened or endangered species/unique communities criteria was met by 18 streams.

Table 2. Ecologically significant stream segments in the Region I (East Texas) Regional Water Planning Area

| River or Stream Segment | Biological Function | Hydrologic Function | Riparian Conservation Area | High Water Quality/Aesthetic Value | Endangered Species/Unique Communities | Total # of criteria met |
|--------------------------|---------------------|---------------------|----------------------------|------------------------------------|---------------------------------------|-------------------------|
| Alabama Creek | | | x | | | 1 |
| Alazan Bayou | x | | x | | x | 3 |
| Upper Angelina River | x | | x | | x | 3 |
| Lower Angelina River | x | | x | | x | 3 |
| Attoyac Bayou | | | | | x | 1 |
| Austin Branch | | | x | | | 1 |
| Beech Creek | | | x | x | | 2 |
| Big Cypress Creek | | | | x | | 1 |
| Big Hill Bayou | x | | x | | | 2 |
| Big Sandy Creek | x | | x | x | x | 4 |
| Bowles Creek | | | x | | | 1 |
| Camp Creek | | | x | | x | 2 |
| Catfish Creek | | | x | x | x | 3 |
| Cochino Bayou | | | x | | | 1 |
| Hackberry Creek | | | x | | x | 2 |
| Hager Creek | | | x | | | 1 |
| Hickory Creek | | | x | | | 1 |
| Hillebrandt Bayou | | | x | | | 1 |
| Irons Bayou | | | | x | | 1 |
| Little Pine Island Bayou | | | x | | | 1 |
| Lynch Creek | | | x | | x | 2 |
| Menard Creek | | | x | | | 1 |
| Mud Creek | x | | | | x | 2 |
| Upper Neches River | x | | x | x | x | 4 |
| Lower Neches River | x | | x | x | x | 4 |
| Pine Island Bayou | | | x | | | 1 |
| Piney Creek | | | x | x | x | 3 |
| Upper Sabine River | x | | | x | x | 3 |
| Middle Sabine River | x | | | x | | 2 |
| Lower Sabine River | x | | x | | | 2 |
| Salt Bayou | x | | x | | | 2 |
| San Pedro Creek | | | x | | | 1 |
| Sandy Creek (Trinity Co) | | | x | | x | 2 |
| Sandy Creek (Shelby Co) | | | | | x | 1 |
| Taylor Bayou | | | x | | | 2 |
| Texas Bayou | | | x | | | 1 |
| Trinity River | x | | x | | x | 3 |
| Trout Creek | | | x | | | 1 |
| Turkey Creek | | | x | | | 1 |
| Village Creek | x | | x | x | x | 4 |
| White Oak Creek | | | | x | | 1 |

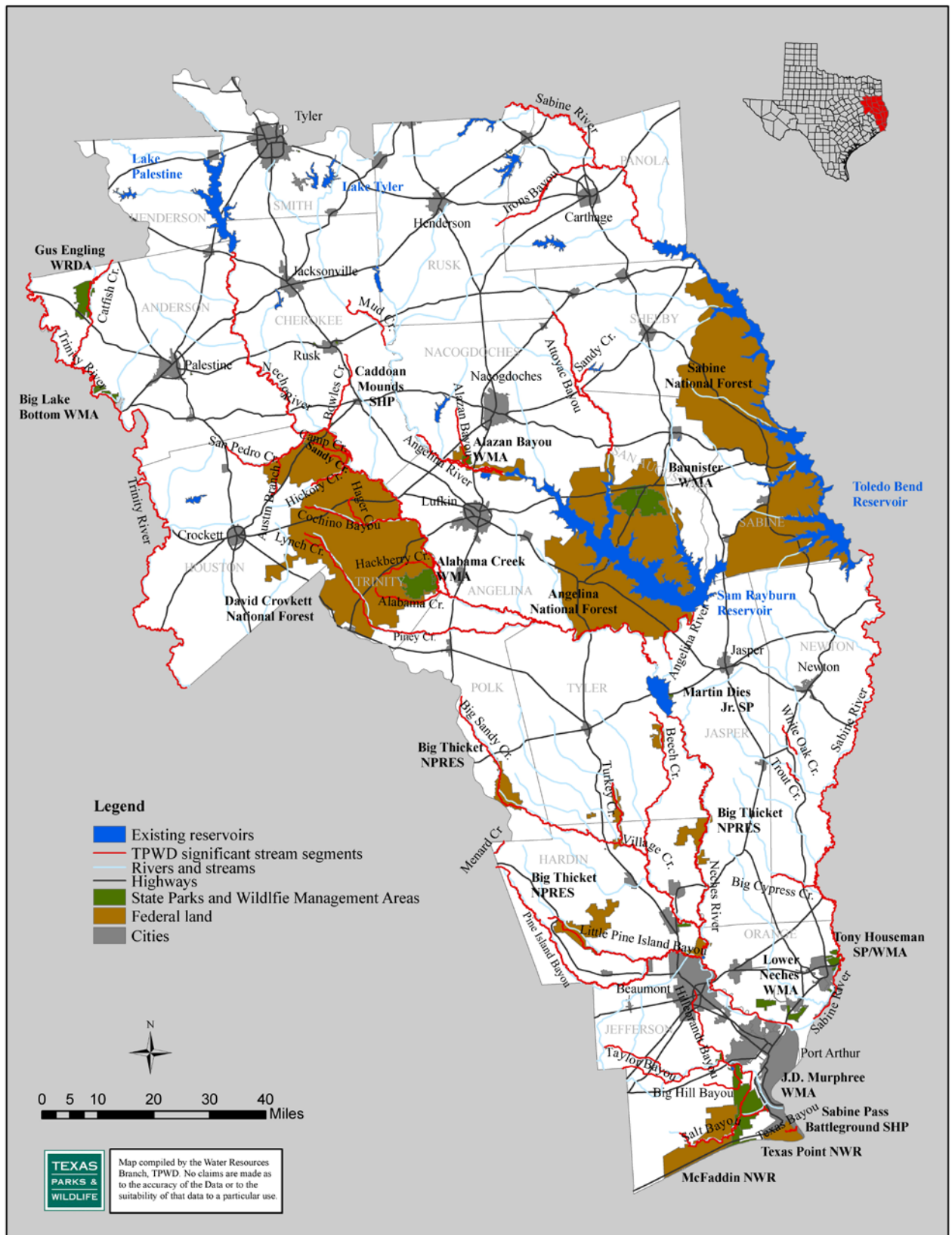


Figure 2. Ecologically Significant Stream Segments of Region I

ECOLOGICALLY SIGNIFICANT RIVER AND STREAM SEGMENT DESCRIPTIONS

1.9 MAJOR RIVERS

1.9.1 Upper Angelina River

The Angelina River begins in the southwestern part of Rusk County at the confluence of Barnhardt, Scober, and Shawnee Creeks and joins the Neches River about 12 miles west of Jasper. The Angelina River is the principal tributary of the Neches River and is impounded in northern Jasper County to form the 114,500-acre Sam Rayburn Reservoir (Belisle and Josselet 1974). Both rivers rise in a region consisting of flat to rolling terrain surfaced by sandy and clay loams that support water-tolerant hardwoods, conifers, and grasses and flow through an area of moderately hilly relief to the vicinity of Jasper and Woodville where the rolling terrain abruptly changes to the flat coastal prairie. The 30-year (1961-1990) mean precipitation in the Angelina basin ranges from about 45 inches (in) near the headwaters to about 53 in near the confluence with the Neches River (Dallas Morning News, Inc. 2001). Annual mean discharge of the Angelina River as measured upstream of Sam Rayburn Reservoir at USGS streamflow gaging station 08036500 near Alto is 901 cubic feet per second (651,152 acre-feet per year) based on water years 1960–2000. This upper section of the river meanders through heavily forested bottomlands, mostly owned by lumber companies, upstream of Sam Rayburn Reservoir. Numerous tributaries and braided streams that provide additional flow and a diversity of habitats join this section of the Angelina River. Fish species native to the Angelina and Neches rivers are listed in Appendix C. The ecologically significant segment is from the aquaduct crossing 0.6 mile upstream of the confluence with Paper Mill Creek in Angelina/Nacogdoches Counties upstream to the FM 1911 crossing in Cherokee/Nacogdoches County (within TCEQ stream segment 0611).

- **Biological function-** approximately 18,000 acres of priority bottomland hardwood habitat associated with the river displays significant overall habitat value considering the diverse assemblage of flora and fauna (USFWS 1984).
- **Riparian conservation area-** fringed by the 153,179-acre Angelina National Forest and the 2,075-acre Alazan Bayou Wildlife Management Area.
- **Threatened or endangered species/unique communities-** significant due to the presence of the paddlefish (*Polyodon spathula*) (St.T) (Wilde 2000), the alligator snapping turtle (*Macrolemys temminckii*) (SOC/St.T) (Rudolph et al. 2002), and the American bald eagle (*Haliaeetus leucocephalus*) (Fed.T/St.T) (TPWD 2005).



Figure 3. Angelina River north of SH 7 (8/14/01)

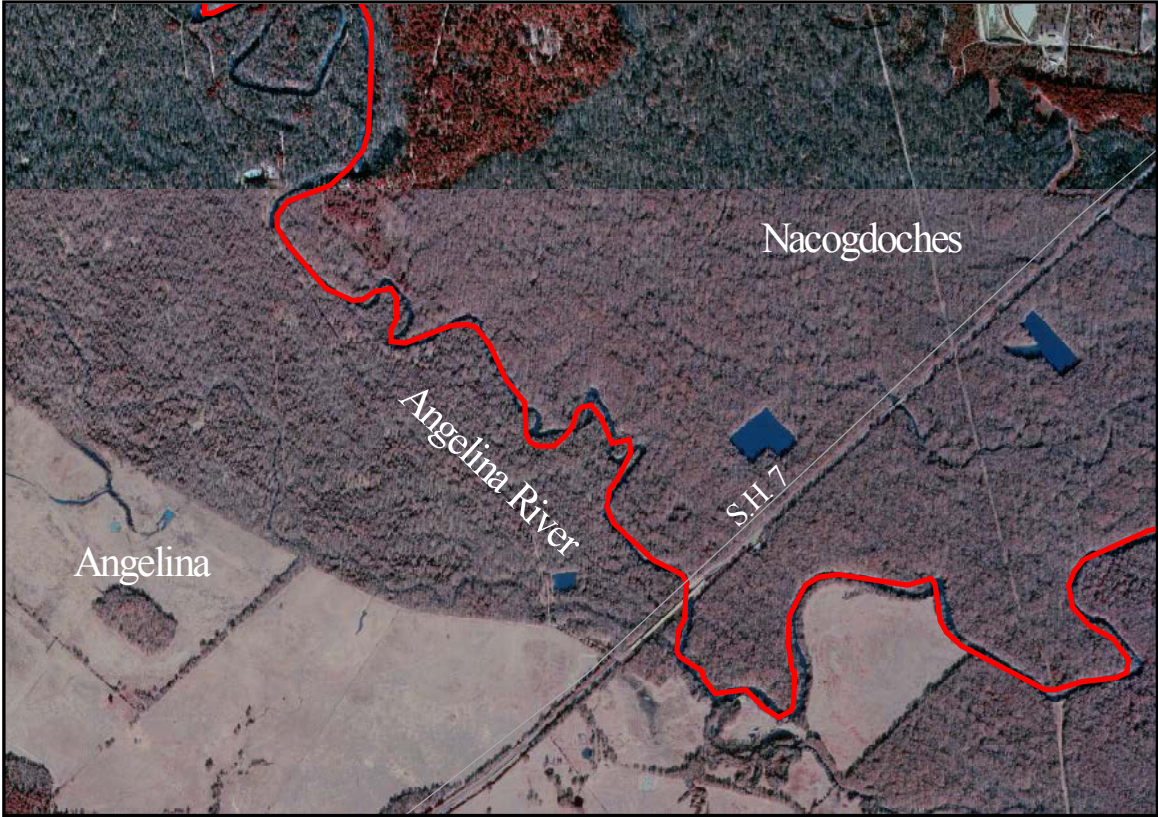


Figure 4. Angelina River at SH 7, Angelina/Nacogdoches County line. Source: Lake Nacogdoches DOQ, 1996, 1m CIR (TNRIS, 1995-1997).

1.9.2 Lower Angelina River

The Angelina River downstream of Sam Rayburn Reservoir flows for approximately 21 miles before forming B. A. Steinhagen Reservoir at the confluence of the Neches River. The confluence of the two rivers forms an area known as “The Forks,” which is characterized by a maze of sloughs and oxbow lakes that connect the rivers and the upper portion of the reservoir. Bottomlands associated with this section of the river are dominated by broad and narrow leaf deciduous forests, composed primarily of water oak (*Quercus nigra*) and sweet gum (*Liquidambar styraciflua*), but also contain cypress-tupelo bottomlands, shrub swamps, and open water habitats (USFWS 1984). These bottomlands provide high quality habitat for wintering waterfowl as well as common and rare wildlife species. Fish species native to the Angelina and Neches rivers are listed in Appendix C. The ecologically significant segment is from a point immediately upstream of the confluence of Indian Creek in Jasper County upstream to Sam Rayburn Dam in Jasper County (TCEQ classified stream segment 0609).

- **Biological function-** approximately 20,000-acres of priority two bottomland hardwood habitat associated with the river displays significant overall habitat value considering the diverse assemblage of flora and fauna (USFWS 1984).
- **Riparian conservation area-** fringed by the 154,245-acre Angelina National Forest and the 12,636-acre Angelina-Neches Dam B Wildlife Management Area.
- **Threatened or endangered species/unique communities-** significant due to the presence of the paddlefish (*Polyodon spathula*) (St.T) (Pitman 1991, Wilde 2000), the alligator snapping turtle (*Macrolemys temminckii*) (SOC/St.T) (Rudolph et al 2002), and the American bald eagle (*Haliaeetus leucocephalus*) (Fed.T/St.T) (TPWD 2005).



Figure 5. Angelina River south of SH 63 in Jasper County (8/14/01).

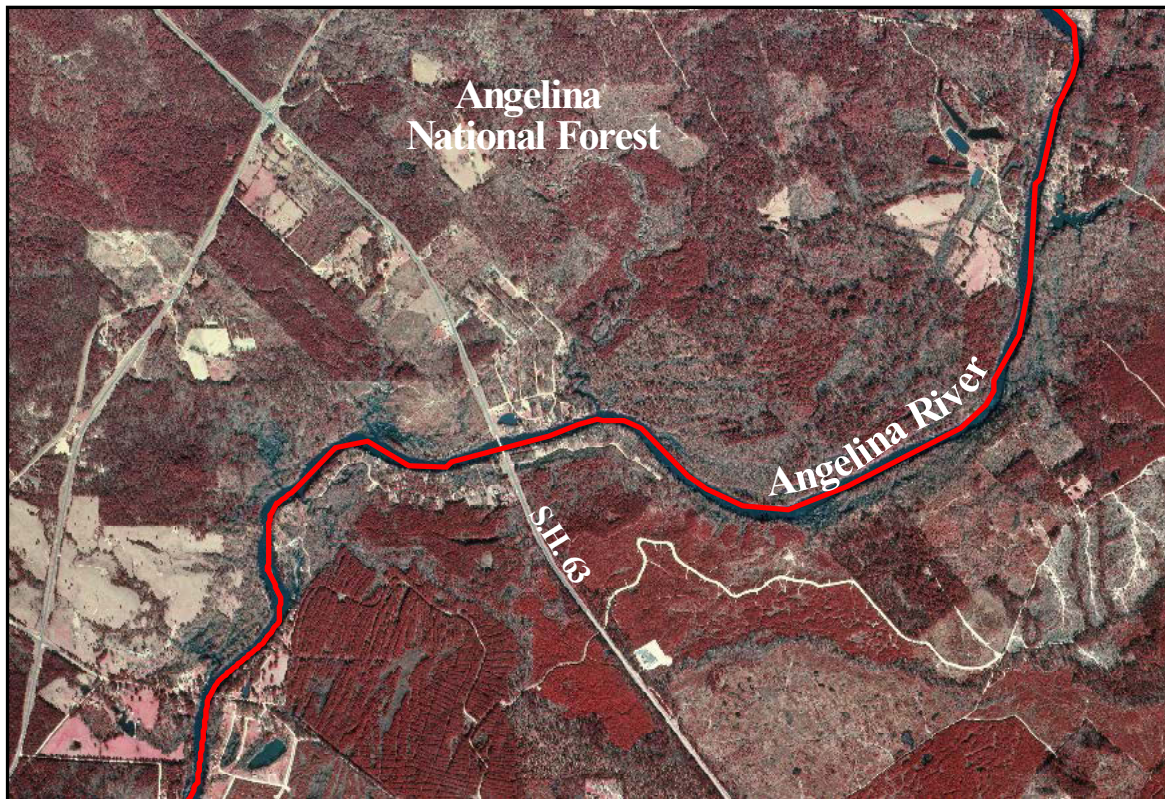


Figure 6. Angelina River at SH63 in Angelina National Forest, Jasper County. Source: Ebenezer DOQ, 1995, 1m CIR (TNRIS, 1995-1997).

1.9.3 Upper Neches River

The Neches River begins about 12 miles southeast of Canton in Van Zandt County and flows southeasterly about 260 miles before emptying into Sabine Lake between Jefferson and Orange Counties. The river has a large number of tributaries and a drainage area of approximately 10,100 square miles. The upper section of the Neches River drains the majority of the Davy Crockett National Forest and the Angelina National Forest. No levees or major channel modifications occur in the floodplain, which is characterized by frequent flooding and a significant amount of permanent water, sloughs, and oxbows (USFWS 1984). The ecologically significant stream segment is from a point immediately upstream of the confluence of Hopson Mill Creek in Jasper/Tyler County upstream to the Blackburn Crossing Dam in Anderson/Cherokee County (TCEQ classified stream segment 0604).

- **Biological function-** extensive priority one bottomland hardwood habitat performs valuable biological function (USFWS 1984).
- **Riparian conservation area-** fringed by the Davy Crockett National Forest, Angelina National Forest, Big Thicket National Preserve, State Wildlife Scientific Area, and Alabama Creek Wildlife Management Area.
- **High water quality/exceptional aquatic life/high aesthetic value-** Texas Natural Rivers system nominee for exceptional aesthetic value (NPS 1995).
- **Threatened or endangered species/unique communities-** significant due to presence of a unique, exemplary, and unusually extensive natural aquatic community including the creek chubsucker (*Erimyzon oblongus*) (SOC/St.T), alligator snapping turtle (*Macrolemys temminckii*) (SOC/St.T) (Rudolph et al. 2002), blue sucker (*Cycleptus elongatus*) (ST.T.) (Moring 2003), and Neches River rose-mallow (*Hibiscus dasycalyx*) (Candidate for listing) (TPWD 2005).



Figure 7. Neches River south of SH 21 in Houston County (8/14/01).



Figure 8. Neches River south of SH 294 in Houston County (8/13/01).

1.9.4 Lower Neches River

Below B.A. Steinhagen Reservoir, the Neches River becomes part of the Big Thicket National Preserve until it reaches Beaumont. The channel through the lower Neches River is wide and open and the river is flanked by numerous backwater sloughs and oxbows. Moring (2003) collected 47 species of fish from this section of the Neches River, including several species considered intolerant of degradation (Appendix C). B.A. Steinhagen Reservoir and the Neches and Angelina rivers support one of the most abundant and diverse assemblages of Unionids (freshwater mussels) remaining in Texas (Howells 1997b, Howells et al 1996). The abundance and diversity of freshwater mussels is significant considering the general decline in distribution and abundance of Unionids observed in North America and Texas due to overharvest, pollution, and habitat alteration over the last century. The ecologically significant stream segment is from the confluence with Sabine Lake in Orange County upstream to Town Bluff Dam in Jasper/Tyler County (TCEQ classified stream segments 0601 and 0602).

- **Biological function-** extensive freshwater palustrine and riverine wetland habitats associated with the river display significant overall habitat value considering the quantity and quality (USFWS 2005).
- **Riparian conservation area-** fringed by the Canyonlands, Upper Neches River Corridor, Jack Gore Baygall, Neches Bottom, Lower Neches River Corridor, and Beaumont units of the Big Thicket National Preserve and the 7,988-acre Lower Neches River Wildlife Management Area.
- **High water quality/exceptional aquatic life/high aesthetic value-** Texas Natural Rivers system nominee for exceptional aesthetic value (NPS 1995).
- **Threatened or endangered species/unique communities-** significant due to presence of unique, exemplary, and unusually extensive natural community including the blue sucker (*Cycleptus elongatus*) (St.T) (Moring 2003), paddlefish (*Polyodon spathula*)(St.T) (Wilde 2000), and alligator snapping turtle (*Macrolemys temminckii*) (SOC/St.T) (Rudolph et al 2002).



Figure 9. Neches River north of US 96/FM 2246 in Jasper County (8/14/01).



Figure 10. Backwater habitat of Neches River east of US 96 road crossing (8/14/01).

1.9.5 Upper Sabine River

Several small streams join in Collin County in the northeast portion of the state to form the Sabine River. From its source to its mouth on Sabine Lake, the river flows about 360 miles and drains approximately 9,756 total square miles, of which about 7,360 square miles are in Texas (Ramos 1999). The upper segment is characterized by a relatively low gradient streambed with a broad deeply cut channel. Numerous marshes, sloughs, bayous, oxbows and backwaters are associated with the river, which has a near total lack of riffle, rapid and waterfall areas through this section (NPS 1995). The banks contain a diverse mixture of bottomland hardwood forests, pine ecosystems and wetland habitats with all stages of the hydric-xeric successional continuum being well represented and a diverse plant and animal assemblages (NPS 1995). There are at least seven natural areas along this section of the river, including "Woodland Cathedral", a natural oxbow lake amphitheater containing a nearly pristine oak-cypress-sweetgum forest. The ecologically significant stream segment is from the headwaters of Toledo Bend Reservoir in Panola County upstream to the Panola/Rusk County line (within TCEQ classified stream segments 0504 and 0505).

- **Biological function-** Texas Natural Rivers Systems nominee for outstandingly remarkable wildlife values (NPS 1985) and extensive priority one bottomland hardwood habitat performs valuable biological function (USFWS 1984).
- **High water quality/exceptional aquatic life/high aesthetic value-** Texas Natural Rivers Systems nominee for outstandingly remarkable scenic value (NPS 1995).
- **Threatened or endangered species/unique communities-** significant due to presence of state threatened paddlefish (*Polyodon spathula*) (St.T) and the alligator snapping turtle (*Macrolemys temminckii*) (SOC/St.T) (Rudolph et al 2002).



Figure 11. Upper Sabine River south of FM 1794 in Panola County (8/13/01).



Figure 12. Upper Sabine River north of FM 1794 in Panola County (8/13/01).

1.9.6 Middle Sabine River

The middle section of the Sabine River is undeveloped and relatively remote with numerous long isolated stretches. Slow moving current, white sand bars, and cypress trees lined with Spanish moss distinguish much of the Sabine River downstream of Toledo Bend Reservoir. The surrounding cypress swamps combined with the numerous creeks and bayous that join the Sabine River in this section provide habitat for a wide variety of wildlife, including white-tailed deer, feral hog, dove, woodcock, squirrel, and rabbits. Belisle and Josselet (1974) referred to this section of the Sabine River as “one of the more scenic, quality waterways in the State.” The river generally maintains abundant flow due to heavy rainfall and numerous tributaries and springs, with long isolated stretches. This section of the river is popular for float trips and the fine white sand bars that dot the banks are often utilized for camping and day use. The ecologically significant stream segment is from the IH-10 crossing in Orange County upstream to Toledo Bend Dam in Newton County (TCEQ classified stream segment 0503 and part of 0501).

- **Biological function-** extensive palustrine and riverine freshwater wetlands display significant overall habitat value considering the quantity and quality (USFWS 2005). Texas Natural Rivers System nominee for outstandingly remarkable fish and wildlife values (NPS 1995).
- **High water quality/exceptional aquatic life/high aesthetic value-** Texas Natural Rivers System nominee for exceptional aesthetic value (NPS 1995).



Figure 13. Middle Sabine River north of SH12 in Newton County (8/14/01).

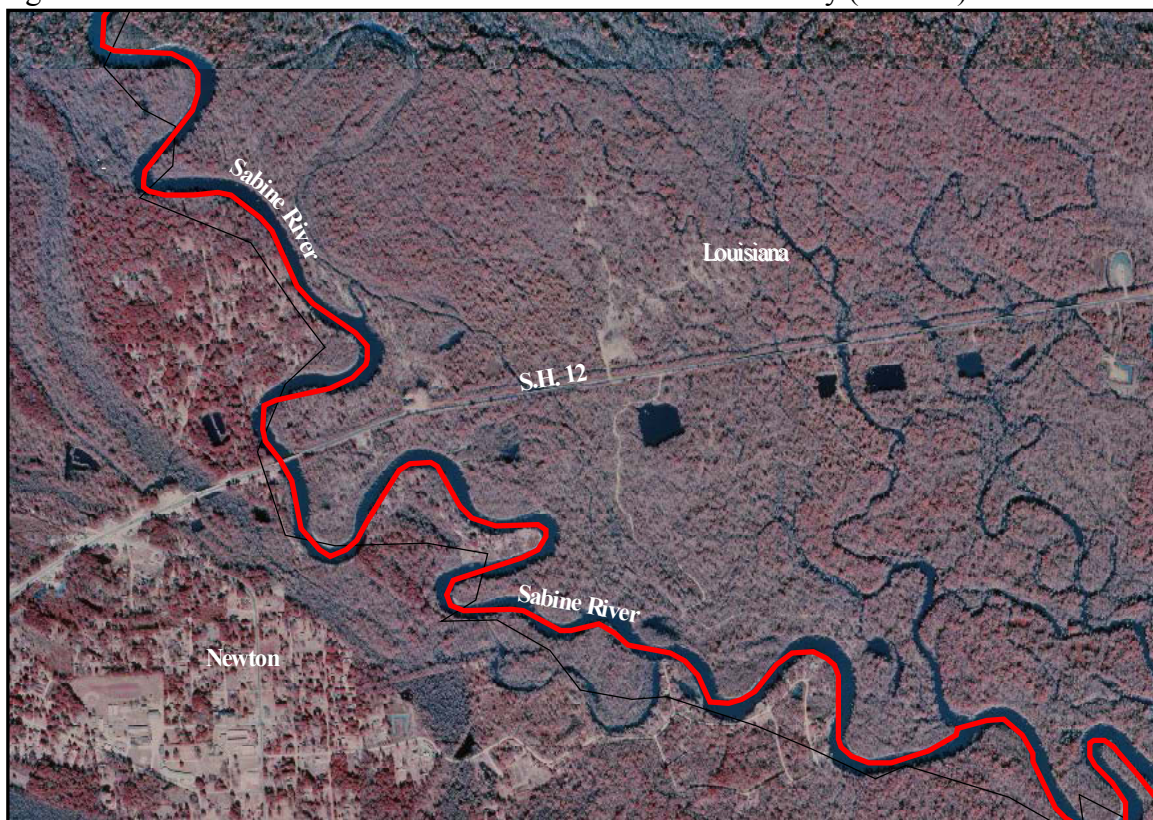


Figure 14. Sabine River at SH 12 in Newton County. Source: Starks DOQ, 1996.

1.9.7 Lower Sabine River

The Sabine River extends northeast of Sabine Lake and provides the lake with the largest discharge of freshwater at its mouth of any Texas river at about 6.8 million acre-feet of water annually. The river is slow moving, wide, and deep throughout the lower section allowing for the passage of ocean-going vessels (Belisle and Josselet 1974). Brackish-water marshes are common along the western margin of the river between the town of Orange and Sabine Lake (White et al 1987). Dredged canals and industrial ponds divide and compartmentalize much of the marshes along this stretch. Of particular interest along the lower Sabine River is Blue Elbow Swamp and surrounding bottomland forest that consists primarily of bald cypress (*Taxodium distichum*) and sweetgum (*Liquidambar styraciflua*). Also along this section of the Sabine River are two sites on the Great Texas Coastal Birding Trail, the Tony Houseman State Park and Wildlife Management Area (UTC 001) and the Lower Neches Wildlife Management Area (UTC 021). The ecologically significant stream segment is from the confluence with Sabine Lake in Orange County upstream to the IH-10 crossing (within TCEQ classified stream segment 0501).

- **Biological function-** extensive freshwater and estuarine wetlands display significant overall habitat value considering the quantity and quality (Bauer et al 1991, Moulton and Jacob 2001, USFWS 2005).
- **Riparian conservation area-** fringed by the 3,313-acre Tony Houseman State Park/Wildlife Management Area and the 7,998-acre Lower Neches River Wildlife Management Area.

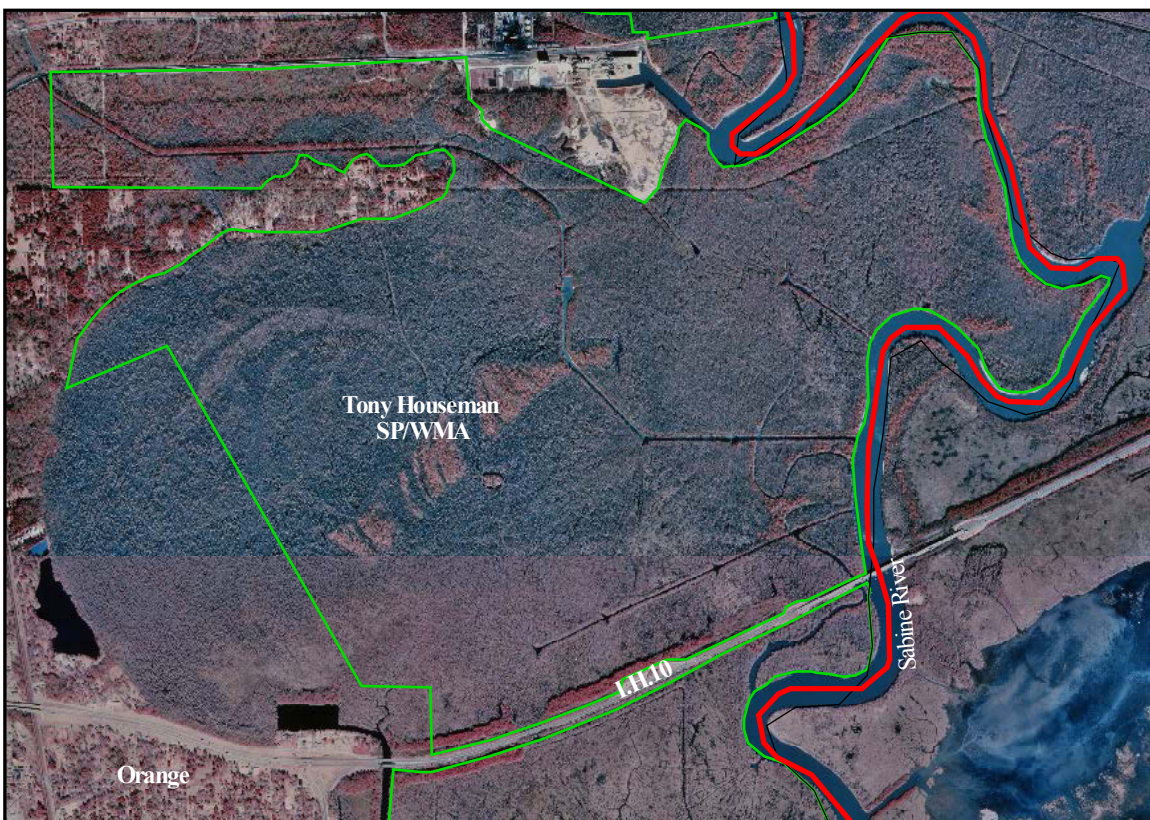


Figure 15. Sabine River at IH 10 in Orange County. Source: Orange DOQ, 1996.

1.9.8 Trinity River

The Trinity River upstream of Lake Livingston has steep muddy banks lined with elm (*Ulmus* sp.), sycamore (*Platanus occidentalis*) and willow (*Salix* sp.) trees. The river meanders through isolated areas and is fed by numerous scenic creeks that provide habitat to abundant fish and wildlife. The channel is wide and contains many sandbars that can be utilized for camping and day use (Belisle and Josselet 1974). A variety of game fishes can be caught upstream of Lake Livingston including freshwater drum (*Aplodinotus grunniens*), striped bass (*Morone saxatilis*), white bass (*Morone chrysops*), yellow bass (*Morone mississippiensis*), flathead catfish (*Pylodictis olivaris*), channel catfish (*Ictalurus punctatus*), blue catfish (*Ictalurus furcatus*), as well as a number of sunfish (*Lepomis*) species. Additional fish species collected from the Trinity River Basin are presented in Appendix C. This section of the Trinity River flows primarily through the Post Oak Savannah ecoregion of the state. The Big Lake Bottom WMA was purchased to preserve the rapidly disappearing bottomland hardwood habitat associated with this ecoregion. The ecologically significant stream segment is from the Houston/Trinity County line upstream to the Anderson/Henderson County line (within TCEQ classified stream segments 0803 and 0804).

- **Riparian conservation area-** fringed by the 4,071-acre Big Lake Bottom Wildlife Management Area.
- **Threatened or endangered species/unique communities-** One of the two largest populations of rare, endemic Texas heelsplitter (*Potamilus amphichaenus*) (SOC) remaining in the state (Howells et al 1996, Howells 1997).



Figure 16. Trinity River north of SH 21 in Houston County (8/15/01).



Figure 17. Trinity River south of SH 21 in Houston County (8/15/01).

1.10 BIG THICKET

The Big Thicket region of east Texas is a transition zone where southeastern swamps, eastern deciduous forest, central plains, pine savannas, and dry sandhills meet and intermingle. Variations in geology, climate, soils, elevation, and drainage have resulted in a rich biological diversity within the Big Thicket region that marks the western most distribution for many species. The diversity of ecosystems and species found within this region has led many to refer to the area as the “Biological Crossroads of North America” and “America’s Ark.” Peacock (1994) delineated the Big Thicket region as the area “from Pine Island Bayou on the south to the Sabine River on the east, north for about sixty or so miles, west-ward along a geological line that passes below Lufkin to about Shiro or Roan’s Prairie, then swings southward in a modified curve to the mixed-grass prairie of east Liberty County, and on to Pine Island Bayou.” Based on plant associations, the National Park Service has identified eleven plant communities within the Big Thicket region (Peacock 1994), including:

| | |
|-------------------------|-------------------------|
| Baygall | Beech-Magnolia-Loblolly |
| Pine Savannah Wetlands | Mixed-Grass Prairie |
| Cypress Slough | Roadside |
| Longleaf Pine Upland | River Edge |
| Oak-Gum Floodplain | Arid Sandylands |
| Palmetto-Hardwood Flats | |

To ensure the preservation, conservation, and protection of a portion of the Big Thicket region that once totaled more than 3,000,000 acres, the Big Thicket National Preserve was established in 1974. The Big Thicket Preserve was the first preserve established as part of the National Park System. The Preserve consists of nine land units connected by six stream corridor units encompassing more than 97,000 acres. Of the eleven plant communities found in the Big Thicket region, ten can be found within the Big Thicket National Preserve (only Mixed-Grass Prairies are absent). Underscoring the importance of these communities, the Big Thicket National Preserve was designated an International Biosphere Reserve by the United Nations Education, Scientific and Cultural Organization (UNESCO) Man and the Biosphere Program in 1981. Additionally, in 2001 the American Bird Conservancy recognized the Preserve as a Globally Important Bird Area.

Best estimates of the flora and fauna found in the Big Thicket region include approximately 300 species of birds that live in or migrate through the area, about 50 species of reptiles, nearly 25 mammals, more than 30 kinds of orchids, over 150 species of trees and shrubs, and nearly 1,000 other flowering plants, including four of the five species of carnivorous plants found in North America (Gunter 1993, Peacock 1994). In terms of aquatic species, there are approximately 375 aquatic and/or wetland plant species, 100 native aquatic vertebrates (James Barker personal communication 2003) and one of the most abundant and diverse populations of freshwater mussels remaining in Texas (Howells et al. 1996). While little is known about the diversity of the insect fauna of this region, Abbott et al. (1997) collected 249 species of aquatic insects representing only 4 orders (Plecoptera, Odonata, Trichoptera, and Ephemeroptera), indicating a high degree of diversity among aquatic invertebrates associated with the Big Thicket region.

East Texas waterways are generally characterized by lush vegetation, deep channels with slow-moving water, relatively low banks, and meandering courses. Water clarity ranges from muddy brown (Neches River), due to the abundance of fine silt and sediments transported in the water column, to clear blackwater (Village Creek), due to the leaching of tannic acids from decomposing organic material. Sediments tend to be dominated by clay and silt, although large sand deposits are found throughout the region and are characteristic of blackwater streams such as Village Creek.

The Neches River is the primary drainage of Big Thicket National Preserve, capturing the majority of water from precipitation and overland flow. There are numerous streams and creeks within the Big Thicket region and several, such as Turkey Creek, Menard Creek and Village Creek, serve as main corridors of the Big Thicket National Preserve. These water bodies and others provide an invaluable resource to the biota of the Big Thicket region and local communities rely on water from these areas for various needs. As such, preserving the natural character of these streams will aid in preserving the character of the Big Thicket region as a whole. The following streams within the Big Thicket region have been identified by the TPWD as meeting one or more of the criteria for designation as Ecologically Unique as defined by Senate Bill 1 (1997):

| | |
|--------------------------|-------------------|
| Beech Creek | Pine Island Bayou |
| Big Cypress Creek | Trout Creek |
| Big Sandy Creek | Turkey Creek |
| Little Pine Island Bayou | Village Creek |
| Menard Creek | White Oak Creek |

A brief characterization of these streams and a description of the criteria they meet follows.

1.10.1 Beech Creek

Beech Creek begins in eastern Tyler County and flows southerly into Hardin County where it joins Village Creek about seven miles northeast of Kountze. The Beech Creek drainage basin is 98 square kilometers (38 square miles) in size and is within the Neches River Basin (Bayer et al 2002). The creek is spring-fed and contains clear, cool water and white sand bars (Belisle 1974). The northern portion of the creek has high sloping banks lined with beech and magnolia trees and is characteristic of a temperate blackwater creek, while the southern portion of Beech Creek more closely resembles a blackwater cypress-tupelo slough (Gunter 1993). The substrate in the southern reach is comprised primarily of silt and sand with decaying organic matter (Bayer et al 1992) and instream cover is provided by overhanging vegetation, woody debris, and roots and knees of cypress trees (Figure 19). Bayer et al (1992) collected 25 fish species (Appendix C), including several species intolerant of degradation, from Beech Creek in southeast Tyler County where the stream channel braided through an extensive wooded swamp. The large number of intolerant species present indicates Beech Creek remains relatively undisturbed. Freshwater mussels collected further attest to the relatively undisturbed nature of Beech Creek as mussels are good indicators of water quality and are often the first organisms to decline during adverse conditions (Howells et al 1996). Bordelon and Harrel (2004) reported collecting eight species of freshwater mussels from Beech Creek between August 2001 and November 2002. The ecologically significant segment is from the confluence with Village Creek in Hardin County upstream to the headwaters in east Tyler County.

- **Riparian conservation area-** fringed by the 5,089-acre Beech Creek Unit of the Big Thicket National Preserve in east Tyler County.
- **High water quality/exceptional aquatic life/high aesthetic value-** identified as a South Central Plains ecoregion reference stream for diversity of benthic macroinvertebrates (Bayer et al 1992).



Figure 18. Beech Creek north of Gore Store Road/FM 3063 in Hardin County (8/15/01).

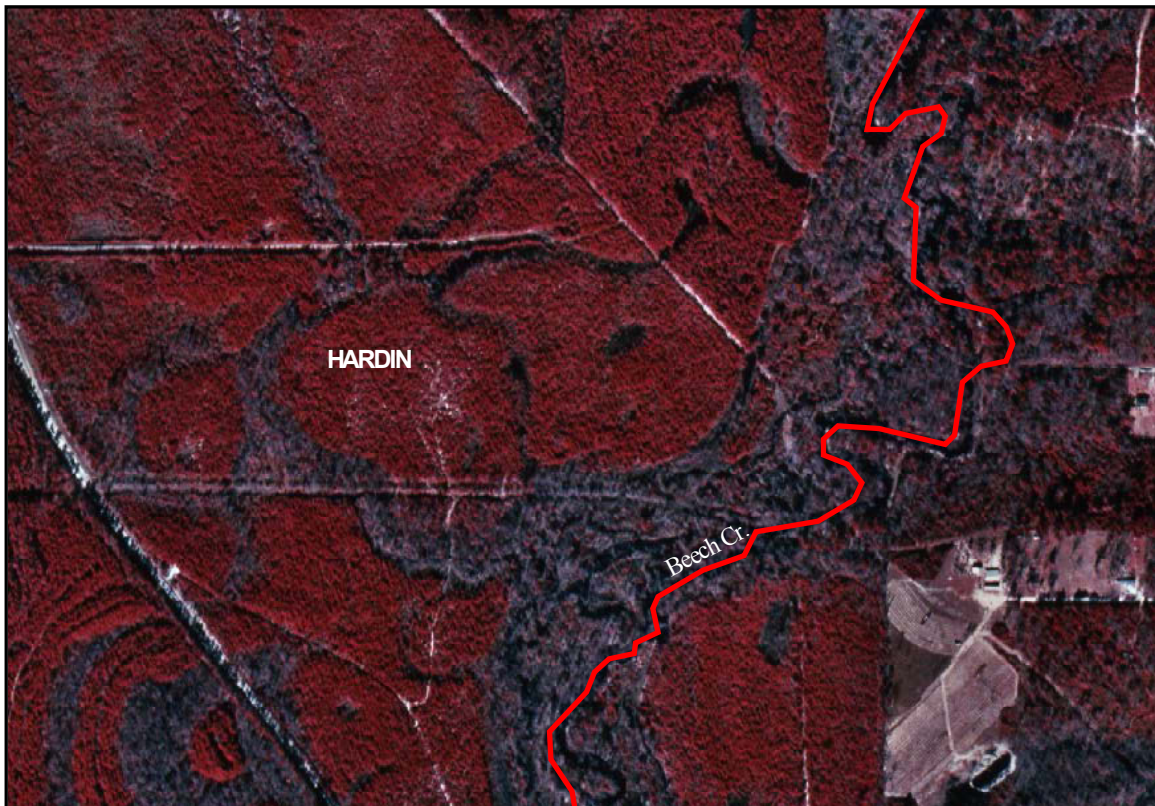


Figure 19. Beech Creek at FM 3063/Gore Store Road, Hardin County. Source: Fred DOQ, 1m CIR (TNRIS, 1995-1997).

1.10.2 Big Cypress Creek

Big Cypress Creek begins about two miles northeast of Bessmay in Jasper County and flows southeasterly 20 miles before joining the Sabine River in Newton County at Deweyville. Timber production and woodland grazing dominate land use within the 142 square mile watershed (Neitsh 1982). A thick canopy composed of bald cypress (*Taxodium distichum*), water oak (*Quercus nigra*), black willow (*Salix nigra*), box elder (*Acer negundo*), and sweetgum (*Liquidambar styraciflua*) among others shade the majority of Big Cypress Creek. Abundant instream cover is provided by woody debris, overhanging vegetation, and bald cypress knees and roots (Figure 21). The substrate is composed primarily of silt and clay with an abundance of detritus due to a large input of organic material. Bayer et al (1992) collected 25 fish species (Appendix C), including two species intolerant of degradation, from a braided portion of the creek within a large swamp complex. The ecologically significant stream segment is from the confluence with the Sabine River in Newton County upstream to the Newton/Jasper County line.

- **High water quality/exceptional aquatic life/high aesthetic value-** identified as a South Central Plains ecoregion reference stream by the TPWD and received an exceptional aquatic life use rating based on diversity of fish sampled (Bayer et al 1992, Linam et al 2002).

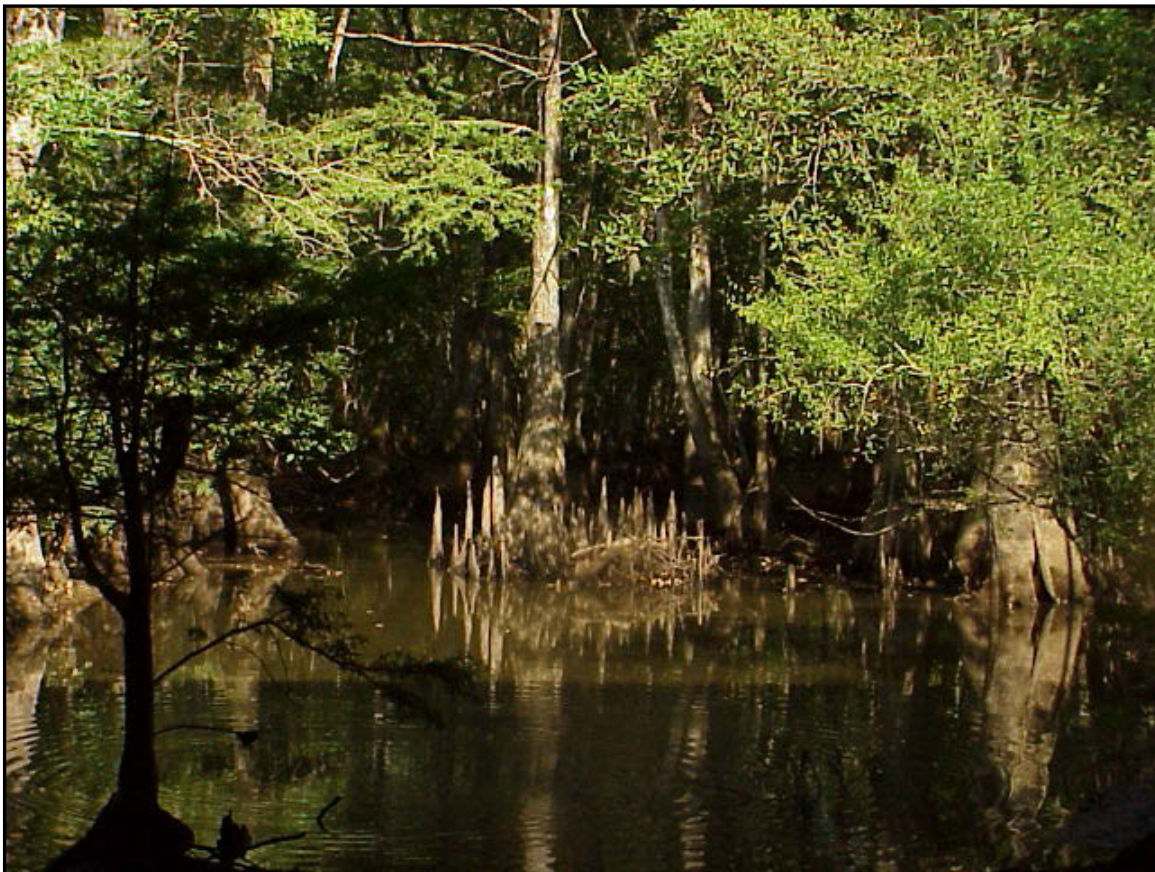


Figure 20. Big Cypress Creek east of SH 87 in Newton County (08/14/01).

1.10.3 Big Sandy Creek

Big Sandy Creek begins in central Polk County and flows south/southeasterly 47.9 miles through Polk and Tyler Counties and joins Village Creek in north Hardin County. The creek flows primarily through the Upper Thicket, which is a distinct subregion within the Big Thicket region composed primarily of American beech (*Fagus grandifolia*), southern magnolia (*Magnolia grandiflora*), and loblolly pine (*Pinus taeda*) (McLeod 1967). Soils in the area are characterized by sand with some clay and silt and an abundance of organic matter (Bureau of Economic Geology 1968). The banks of Big Sandy Creek are heavily vegetated with bald cypress (*Taxodium distichum*), sycamore (*Platanus occidentalis*), sweet gum (*Liquidambar styraciflua*), river birch (*Betula nigra*), and water oak (*Quercus nigra*) among others, which greatly reduces light penetration to the creek's channel (Rizzo et al. 2000). Abundant woody debris and logjams that result from the dense vegetation provide instream cover and habitat for aquatic organisms. Evans and Noble (1979) reported collecting 46 species of fish representing 13 families between June 1974 and January 1976, including seven species intolerant of degradation. Subsequent fish collections by Moring (2003) yielded only 25 species of fish, including just five intolerant species, representing 10 families between 1999 and 2001 (Appendix C). Although the Big Sandy Creek Unit of the Big Thicket Preserve was created shortly after the collections were performed by Evans and Noble, the large decrease in number of fish species collected between the late 70's and the late 90's suggests the creek has been impacted to some extent. However, the persistence of five intolerant fish species and the presence of nine species of freshwater mussels (Bordelon and Harrel 2004), one of which is considered of "special concern" by the American Fisheries Society (Williams et al 1993), indicate the creek is still relatively undisturbed. The ecologically significant stream segment is from the confluence with Village Creek in Hardin County upstream to the Polk/Trinity County line.

- **Biological function-** Texas Natural Rivers System nominee for outstandingly remarkable fish and wildlife values (NPS 1995).
- **Riparian conservation area-** fringed by the 14,346-acre Big Sandy Creek Unit of the Big Thicket National Preserve.
- **High water quality/exceptional aquatic life/high aesthetic value-** exceptional aesthetic value (NPS 1995).
- **Threatened or endangered species/unique communities-** significant due to the presence of the creek chubsucker (*Erimyzon oblongus*) (SOC/St. T) (Evans and Noble 1979). The state threatened paddlefish (*Polyodon spathula*) historically occurred (pre-1977) in Big Sandy Creek, but has not been collected in almost 30 years (Pitman 1991).



Figure 21. Big Sandy Creek east of FM 1276 in Polk County (8/15/01).



Figure 22. Big Sandy Creek west of FM 1276 in Polk County (8/15/01).

1.10.4 Little Pine Island Bayou

Little Pine Island Bayou begins near Votaw in northwest Hardin County and flows southeasterly about 45 miles into Pine Island Bayou about 12 miles northwest of Beaumont. The bayou contains clear water that flows over a predominantly sand and gravel substrate. The channel of the bayou is relatively narrow and is shaded by abundant overhanging brush and tree limbs. The banks of the bayou are lined with beech (*Fagus grandifolia*), magnolia (*Magnolia grandiflora*), and loblolly pine (*Pinus taeda*) as well as several bald cypress (*Taxodium distichum*) that measure between sixteen and nineteen feet in circumference, which would put them at between three and four hundred years of age (Gunter 1993). From the Lance Rosier Unit of the Big Thicket Preserve eastward to the Beaumont Unit, the Little Pine Island Bayou Corridor Unit averages less than 1,000 feet in width (Peacock 1994). This is one of five slender corridor units within the Preserve designated to protect water quality and quantity as well as the vegetation within the floodplains. Moring (2003) collected 43 species of fish from two sampling sites on Little Pine Island Bayou (Appendix C), including several species intolerant of degradation. The ecologically significant stream segment is from the confluence with Pine Island Bayou northwest of Beaumont upstream to the FM 770 crossing in Saratoga in Hardin County.

- **Riparian conservation area-** fringed by the 2,209-acre Little Pine Island Bayou Corridor Unit, the 5,955-acre Beaumont Unit and the 24,942-acre Lance Rosier Unit, which is the largest segment of the Big Thicket National Preserve.



Figure 23. Little Pine Island Bayou west of FM 770 in Hardin County (8/15/01).



Figure 24. Little Pine Island Bayou east of FM 770 in Hardin County (8/15/01).

1.10.5 Menard Creek

Menard Creek begins east of Livingston in central Polk County and flows southeasterly to the county line where it turns westward through Hardin County and then northwesterly through Liberty County. The Menard Creek Corridor Unit of the Big Thicket National Preserve is a slender strip of land along Menard Creek between the Big Sandy Creek Unit and the Trinity River. The creek empties into the Trinity River near the Polk/Liberty County line. Dense overhanging vegetation shades the surface of the creek and provides abundant woody debris for instream cover. Dominant riparian vegetation observed included sweet gum (*Liquidambar styraciflua*), river birch (*Betula nigra*), water oak (*Quercus nigra*) and bald cypress (*Taxodium distichum*). Moring (2003) collected 16 species of fish from two sampling sites on Menard Creek (Appendix C), including two species intolerant of degradation. Of the six stream Corridor Units sampled by Moring (2003), Menard Creek yielded the fewest total number of fish species and intolerant species, suggesting habitat quality is low as compared to the other creeks in the Big Thicket Corridor Units. Although aquatic insect collections from Menard Creek yielded a moderately high species richness, the Ephemeroptera, Plecoptera, Trichoptera (EPT) index was low, which also indicates habitat quality is low as compared to the other creeks in the Big Thicket Corridor Units. The ecologically significant stream segment is from the confluence with the Trinity River near the Polk/Liberty County line upstream to its headwaters east of Livingston in Polk County.

- **Riparian conservation area-** fringed by the 14,346-acre Big Sandy Creek Unit and the 3,805-acre Menard Creek Corridor Unit of the Big Thicket National Preserve.

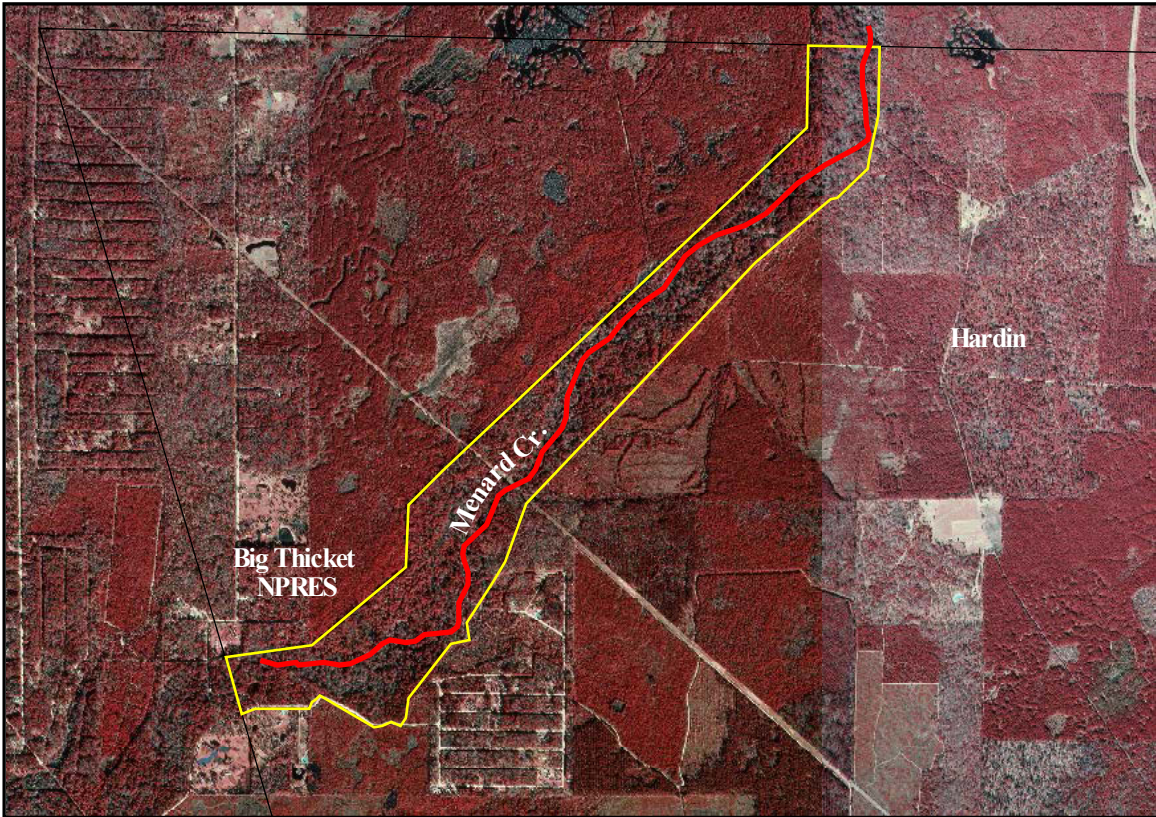


Figure 25. Menard Creek in Big Thicket National Preserve, Hardin County. Source: Votaw DOQ, 1995.



Figure 26. Menard Creek Corridor, Big Thicket National Preserve (8/15/01).

1.10.6 Pine Island Bayou

Pine Island Bayou begins in east Liberty County and flows southeasterly through Hardin County where it joins the Neches River about six miles north of Beaumont. The bayou is a low gradient, slow-moving stream with relatively clear water that flows about 92 miles over a predominantly sand substrate. The bayou has a drainage area of 657 square miles and the only major tributary to this segment is Little Pine Island Bayou (Adsit and Hagen 1978). The confluence of Pine Island Bayou and the Neches River is surrounded by extensive palustrine and riverine freshwater wetlands composed primarily of palmetto thickets and cypress sloughs (USFWS 2005). Dominant riparian vegetation observed at the SH 105 road crossing included bald cypress (*Taxodium distichum*), sweet gum (*Liquidambar styraciflua*), water oak (*Quercus nigra*), willow oak (*Quercus phellos*), and dwarf palmetto (*Sabal minor*). Historically, the narrow channel and dense overhanging vegetation shaded much of the waters surface and provided abundant woody debris for instream cover (Adsit and Hagen 1978). However, development within much of the riparian zone has decreased the density of vegetation, resulting in an increase in the amount of light penetration and a decrease in the amount of woody debris within the stream channel (Rizzo et al 2000). The Bayou's close proximity to the city of Beaumont has made it a popular waterway for recreational activities and has likely contributed to historical water quality concerns. Rizzo et al. (2000) found Pine Island Bayou to have the poorest water quality of seven streams studied within the Big Thicket National Preserve. Water quality concerns have been attributed to the naturally slow currents within the bayou, saltwater intrusion, substantial development within the riparian zone, and nutrient inputs from sewage outfalls and septic tanks within the basin (Harrel 1975, Hughes et al 1986, Rizzo et al 2000). Historical pollution in Pine Island Bayou has greatly reduced freshwater mussel populations (Harrel 1993) and few living mussels were found in 1994 during surveys performed by TPWD (Howells 1997). Despite historic water quality concerns, Halstead (1981) reported the occurrence of 86 species of fish within the Pine Island Bayou watershed (Appendix C). However, only 29 fish species were collected from four sites on Pine Island Bayou in August 1987 (Kleinsasser and Linam 1987) (Appendix C). The ecologically significant stream segment is from the confluence with the Neches River in Hardin/Jefferson County upstream to FM 787 in Hardin County (TCEQ stream segment 0607).

- **Riparian conservation area-** fringed to the north by the 5,955-acre Beaumont Unit of the Big Thicket National Preserve.
- **Threatened or endangered species/unique communities-** significant due to the presence of the alligator snapping turtle (*Macroclmys temminckii*) (SOC/St.T) (Rudolph et al. 2002), creek chubsucker (*Erimyzon oblongus*) (SOC/St.T) and blue sucker (*Cycleptus elongatus*) (ST.T.) (Halstead 1981).



Figure 27. Pine Island Bayou north of SH 105 in Hardin County (8/15/01).



Figure 28. Pine Island Bayou south of SH 105 in Hardin County (8/15/01).

1.10.7 Trout Creek

Trout Creek begins about four miles west of Roganville in Jasper County and flows southeasterly 20 miles before joining Big Cow Creek in Newton County. The creek is formed by springs and seeps associated with a flat area approximately 150 meters long and 35 meters wide (Nixon and Ward 1988). The creek contains clear blackwater, which is characteristic of many of the sandy bottom creeks in East Texas. Riparian vegetation observed at the SH 87 road crossing included water oak (*Quercus nigra*), sweetbay magnolia (*Magnolia virginiana*), river birch (*Betula nigra*), and bald cypress (*Taxodium distichum*). The dense canopy shades much of the creek and provides abundant instream cover for aquatic organisms in the form of woody debris and cypress knees. The ecologically significant stream segment is from the confluence with Big Cow Creek in Newton County upstream to the northern boundary of the E.O. Siecke State Forest in Newton County.

- **Riparian conservation area-** fringed by the 1,722-acre E.O. Siecke State Forest.



Figure 29. Trout Creek west of SH 7 in Newton County (8/14/01).

1.10.8 Turkey Creek

Turkey Creek begins approximately five miles north of Woodville in Tyler County and flows intermittently to the southeast with perennial flow beginning about 12 miles southeast of Woodville before the confluence of Village Creek about eight miles north of Kountze in Hardin County. The Turkey Creek Unit is arguably the most biologically diverse unit within the Big Thicket National Preserve, as 70 species of trees, 50 kinds of wild shrubs, 40 plus varieties of vines, and about 486 species of herbaceous plants have been identified within the unit (Peacock 1994). Numerous cypress sloughs, baygalls, swamps, and beaver ponds border the creek, many of which depend on overbank flows from Turkey Creek (Gunter 1993, Peacock 1994). Logging activities adjacent to the Turkey Creek Unit over the last few decades have reduced forested lands within the Turkey Creek watershed (Gunter 1993). Land use analysis of drainage areas upstream of sampling reaches within the Turkey Creek watershed showed a ten percent decrease in forested lands upstream of Hwy 1943 (Moring 2003). Because the Corridor Units of the Big Thicket National Preserve are relatively thin strips of land, increased deforestation within the watershed could impact the aquatic community of Turkey Creek as the physical characteristics of the drainage area are altered. Rizzo et al. (2000) monitored water quality (2-4 week intervals) in six drainage basins of the Big Thicket National Preserve between 1996 and 1999 and found Turkey Creek to be among those with the best water quality (i.e. low nutrients, low chlorophyll a, no hypoxia). Biological collections from Village Creek also indicate water quality is excellent. Bordelon and Harrel (2004) collected six species of freshwater mussels from Turkey Creek. Because freshwater mussels are good indicators of water quality and are often the first organisms to decline during adverse conditions (Resh and Rosenberg 1993, Howells et al 1996), the presence of six species indicates the creek is still relatively undisturbed. Additional biological collections from two locations on Turkey Creek have documented 27 species of fish (Appendix C), including seven species intolerant of degradation, and 139 taxa of benthic macroinvertebrates, including 113 aquatic insect taxa (Moring 2003). The ecologically significant stream segment is from the confluence with Village Creek in Hardin County upstream to FM 1943 in Tyler County.

- **Riparian conservation area-** fringed by the 7,784-acre Turkey Creek Corridor Unit of the Big Thicket National Preserve



Figure 30. Turkey Creek north of FM 3063 in Hardin County (8/15/01).



Figure 31. Turkey Creek south of FM 3063 in Hardin County (8/15/01).

1.10.9 Village Creek

Village Creek rises near the Alabama-Coushatta Indian Reservation in southern Tyler County and flows through Hardin County in a southeasterly direction 69 miles to the confluence with the Neches River. Village Creek is a relatively free-flowing, low gradient stream that meanders its way through cypress swamps and pine and hardwood forests. Dominant streamside vegetation observed includes bald cypress (*Taxodium distichum*), river birch (*Betula nigra*), water tupelo (*Nyssa aquatica*), and water tolerant oaks (*Quercus* sp.) that shade much of the creek and provide abundant instream cover in the form of leaf litter and woody debris. The streambed is composed primarily of sand with pockets of leaf litter accumulating adjacent to the channel and in backwater cypress sloughs (Moriarty and Winemiller 1997, Bordelon and Harrel 2004). The relatively narrow channel is lined with white sandbars in some sections and steep banks cut by floodwaters in other stretches. Because of its outstanding scenic qualities, lack of impoundments, and pristine characteristics, Village Creek is a popular flat-water canoe stream (Belisle and Josselet 1974, Nolen and Narramore 2000). Rizzo et al. (2000) monitored water quality in six drainage basins of the Big Thicket National Preserve between 1996 and 1999 and found Village Creek to be among those with the best water quality (i.e. low nutrients, low chlorophyll a, no hypoxia). Biological collections from Village Creek also indicate water quality is excellent. Bordelon and Harrel (2004) collected 17 species of freshwater mussels from Village Creek, three species of which are considered of “special concern” by the American Fisheries Society (Williams et al. 1993) and seven species are considered to be uncommon or rare. Fish collections from Village Creek have yielded between 44 and 48 species (Moriarty and Winemiller 1997, Moring 2003), including numerous species intolerant of degradation (Appendix C). Moring (2003) collected 190 taxa of benthic macroinvertebrates, including 157 aquatic insect taxa, from three locations on Village Creek. The excellent water quality and high diversity of aquatic life observed reflect the relatively undisturbed nature of Village Creek. The ecologically significant stream segment is from the confluence with the Neches River in Hardin County upstream to Lake Kimble Dam in Hardin County (TCEQ classified stream segment 0608).

- **Biological function-** Texas Natural Rivers System nominee for outstandingly remarkable fish and wildlife values (NPS 1995).
- **Riparian conservation area-** fringed by the Village Creek Corridor Unit of the Big Thicket National Preserve, and the 1,003-acre Village Creek State Park.
- **High water quality/exceptional aquatic life/high aesthetic value-** ranked as the #1 scenic river in East Texas (NPS 1995). Exceptional aquatic life based on fish community metrics (i.e. has a species composition, diversity, and functional organization comparable to the natural habitat of the region) (Moriarty and Winemiller 1997, Moring 2003) and diversity of benthic macroinvertebrates (Moring 2003) and freshwater mussels (Bordelon and Harrel 2004).
- **Threatened or endangered species/unique communities-** Unique, exemplary, and unusually extensive natural aquatic community (NPS 1995). Significant due to presence of the alligator snapping turtle (*Macrolemys temminckii*) (SOC/St.T) (Rudolph et al 2002).



Figure 32. Village Creek at Village Creek State Park in Hardin County (8/14/01).



Figure 33. Village Creek at Village Creek State Park in Hardin County (8/14/01).

1.10.10 White Oak Creek

White Oak Creek begins about five miles southwest of Newton and flows southeasterly 12 miles into Big Cow Creek in Newton County. The creek lies within the Sabine River Basin and has a drainage basin of 119 square kilometers (46 square miles) (Bayer et al. 1992). The creek meanders through a riparian corridor dominated by box elder (*Acer negundo*), water oak (*Quercus nigra*), sweetgum (*Liquidambar styraciflua*), river birch (*Betula nigra*), and bald cypress (*Taxodium distichum*) and contains several well-developed bends. The substrate of the stream at FM 363 was composed primarily of silty sand and flow occurred primarily in deep pools and runs. Abundant instream cover was provided by fallen logs, undercut banks, root snags, bald cypress knees, and overhanging vegetation. Bayer et al. (1992) reported collecting 20 fish species, including several species intolerant of degradation, from White Oak Creek at FM 363 east of Blackwood in central Newton County (Appendix C). The ecologically significant stream segment is from the confluence with Big Cow Creek in Newton County to its headwaters located about five miles southwest of Newton in Newton County.

- **High water quality/exceptional aquatic life/high aesthetic value-** identified as a South Central Plains ecoregion least impacted reference stream for diversity of benthic macroinvertebrates (Bayer et al. 1992).

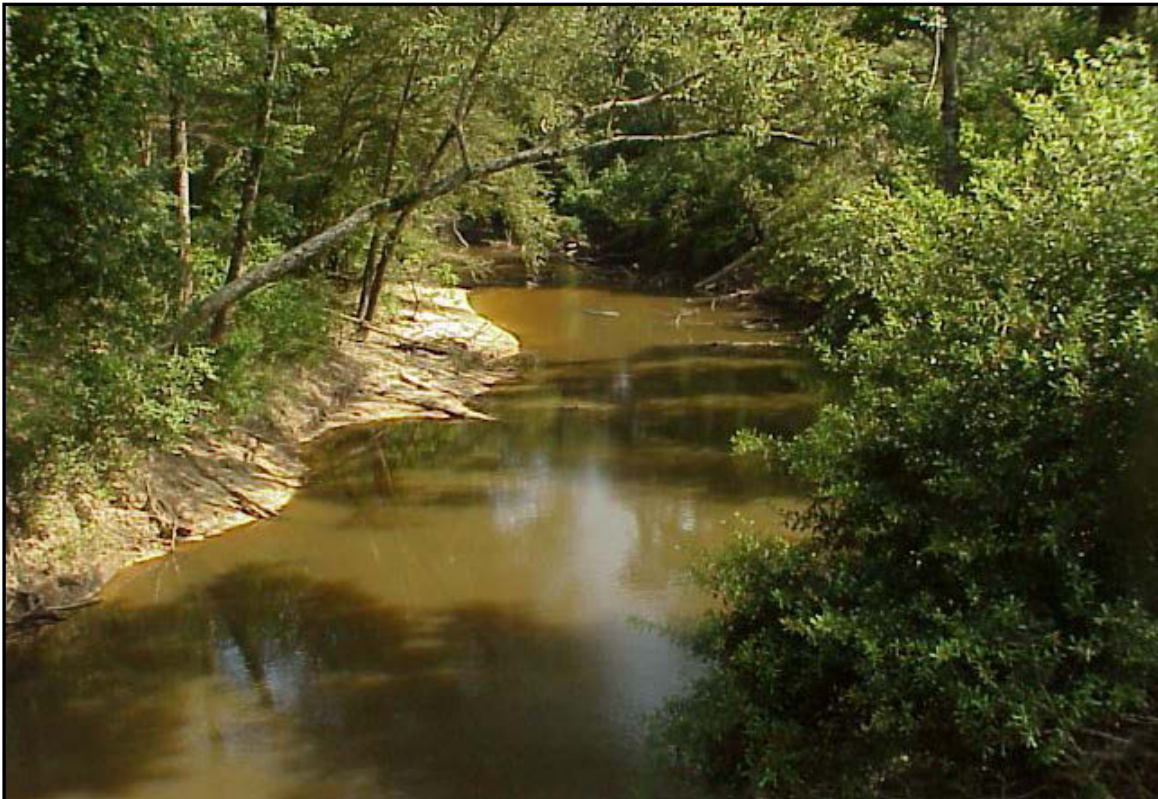


Figure 34. White Oak Creek at FM 363 in Newton County (8/14/01).

1.11 DAVY CROCKETT NATIONAL FOREST

The Davy Crockett National Forest (DCNF) contains more than 161,000 acres of forested woodlands, streams, recreation areas, and wildlife habitat. Proclaimed a national forest in 1936, the DCNF is located in Houston and Trinity Counties and is centrally located within the Neches and Trinity River basins. It is one of four national forests in East Texas and is the only one that does not contain or is bounded by a major reservoir. As such, the principal water source for wildlife within the DCNF is the numerous creeks and bayous that bisect it and the Neches River, which forms its eastern boundary.

The area is generally characterized by level to gently rolling uplands and broad, flat bottomlands bisected by shallow creeks, while steeper slopes are found along the Neches River. The soils of the area consist of light-colored, acid sandy loams, and sands with some red soils in the uplands and light brown to dark grey, acid sandy loams, clay loams, and limited clays in the bottomlands (Texas Almanac, 2001). The area has poor drainage that results in numerous small ponds and backwater areas as many of the streams quickly flood during periods of heavy rainfall (Kelly 1995). The 30-year (1961-1990) mean precipitation in the DCNF ranges from about 42 in/yr in Houston County to 45 in/yr in Trinity County (Dallas Morning News, Inc., 2001).

Since unmanaged logging ended in the 1920's, the pine-hardwood forest has made a dramatic recovery. Numerous game species, including squirrel, deer, quail, dove, turkey, and waterfowl and at least one federally listed endangered species, the red-cockaded woodpecker (*Picoides borealis*), can be found within the forest. The DCNF is within the Austroriparian biotic province, which has been shown to contain 105 native fish species (Edwards et al. 1989). The majority of the DCNF lies within the South Central Plains ecoregion (Omernik and Gallant 1987). The least impacted stream of this ecoregion was identified by Twidwell et al. (1992) as Piney Creek. While performing quarterly sampling at ten streams within the DCNF between May 1994 and May 1995, Kelly (1995) collected 53 fish species from ten unclassified streams.

The following streams within the DCNF have been identified by the TPWD as meeting one or more of the criteria for designation as Ecologically Unique as defined by Senate Bill 1 (1997):

- Alabama Creek
- Austin Branch
- Camp Creek
- Cochino Creek
- Hackberry Creek
- Hager Creek
- Hickory Creek
- Lynch Creek
- Piney Creek
- San Pedro Creek
- Sandy Creek (Houston Co.)

A brief characterization of these streams and a description of the criteria they meet follows.

1.11.1 Alabama Creek

Alabama Creek begins in eastern Trinity County and flows east approximately 11 miles through the Davy Crockett National Forest into the Neches River southwest of the city of Diboll. Alabama Creek is a fourth-order stream with a dependable volume of water (Neck 1986) and is generally slow-moving with a sand-gravel-detritus substrate (Feaster 1998). The creek is bordered by the 14,561-acre Alabama Creek Wildlife Management Area (WMA), which is located within the Davy Crockett National Forest and is operated under a Memorandum of Agreement between TPWD and the U.S. Forest Service. The WMA offers opportunities for paddling, camping, fishing, trapping, and public hunting (Hodge 2000). Hardwoods such as sweet gum (*Liquidambar styraciflua*), magnolia (*Magnolia grandiflora*), tupelo (*Nyssa* sp.), elm (*Ulmus* sp.), and ash (*Fraxinus* sp.) follow the course of Alabama Creek and dominate the sandy soils of the lowlands (TPWD 2005). These trees coupled with other riparian vegetation provide a dense canopy of vegetation that covers Alabama Creek and contributes abundant woody debris and instream cover for aquatic organisms. The fish assemblage from Alabama Creek is representative of the overall assemblage known to exist in the Davy Crockett National Forest. Kelly (1995) collected 27 fish species from Alabama Creek (Appendix C), including two species intolerant of degradation and ten species of sunfish. Biodiversity indices calculated by Kelly (1995) indicate that Alabama Creek supports a stable fish community and is relatively unimpacted. Furthermore, the freshwater mussel *Uniomerus declivus* has been collected from Alabama Creek which indicates the relatively undisturbed nature of the creek (Feaster 1998). The ecologically significant stream segment is from the confluence with the Neches River in northeast Trinity County upstream to the headwaters in east Trinity County.

- **Riparian Conservation Area-** fringed by the 160,000 plus acre Davy Crockett National Forest and the 14,561-acre Alabama Creek Wildlife Management Area.



Figure 35. Alabama Creek east of FM 357 in Trinity County (8/14/01).

1.11.2 Austin Branch

Austin Branch is a third-order stream that begins about nine miles northeast of Crockett in Houston County and flows north/northwest into San Pedro Creek on the northern edge of the Davy Crockett National Forest. The slow-moving waterbody has a substrate composed primarily of deep-shifting sand (Feaster 1998) and is covered by a dense canopy of vegetation. Dominant vegetation observed at the FM 1365 crossing included box elder (*Acer negundo*), sweet gum (*Liquidambar styraciflua*), pecan (*Carya illinoensis*), and sugarberry (*Celtis laevigata*). Kelly (1995) reported collecting 30 fish species from Austin Branch (Appendix C), including several species intolerant of degradation. Of the ten streams sampled in the Davy Crockett National Forest by Kelly (1999), the southern brook lamprey (*Ichthyomyzon gagei*) was only collected from Austin Branch, where it was found in great abundance. Biodiversity indices calculated by Kelly (1995) and the relatively high number of intolerant species present indicate Austin Branch is relatively unimpacted. The ecologically significant stream segment is from the confluence with San Pedro Creek upstream to the headwaters.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.



Figure 36. Austin Branch east of CR 1560 in Houston County (08/14/01).



Figure 37. Austin Branch west of CR 1560 in Houston County (08/14/01).

1.11.3 Camp Creek

Camp Creek is a third order stream that begins in northeastern Houston County and flows southeasterly for approximately 11 miles through the Davy Crockett National Forest, where it joins the Neches River. The creek has a sandy substrate and a moderate canopy of vegetation that allows a substantial amount of sunlight to reach its surface (Kelly 1995). Dominant vegetation observed at the FM 511 road crossing included sweet gum (*Liquidambar styraciflua*), pecan (*Carya illinoensis*), elderberry (*Sambucus canadensis*) and sugarberry (*Celtis laevigata*). Kelly (1995) collected 28 species of fish from Camp Creek between May 1994 and May 1995, including three species intolerant of degradation (Appendix C). Nine of ten sunfish species known to occur in streams of the Davy Crockett National Forest were collected from Camp Creek. Measures of biological integrity, diversity, richness, and evenness as reported by Kelly (1999) indicate the fish assemblage is stable. The ecologically significant stream segment is from the confluence with the Neches River in Houston County upstream to its headwaters east of Weches.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.
- **Threatened or endangered species/unique communities-** significant due to the presence of the creek chubsucker (*Erimyzon oblongus*) (SOC/St.T) (Kelly 1995).



Figure 38. Camp Creek west of FR 511 in Houston County (8/14/01).

1.11.4 Cochino Bayou

Cochino Bayou, also known as Hog Creek, is a fifth order stream that begins in east Houston County and flows easterly 17 miles into the Neches River in northern Trinity County. The bayou has a loam and detritus dominated substrate and a moderate canopy of vegetation (Kelly 1995). Dominant vegetation observed at the CR 4740 road crossing included sweet gum (*Liquidambar styraciflua*), sycamore (*Platanus occidentalis*), water oak (*Quercus nigra*), sugarberry (*Celtis laevigata*), and boxelder (*Acer negundo*). Flow was sluggish and instream cover was abundant in the form of woody debris and fallen timber in August 2001. Kelly (1995) reported collecting 37 fish species, including several species intolerant of degradation and the Sabine shiner (*Notropis sabinae*) (Appendix C). There were no previous records of the Sabine shiner within the drainages of the Davy Crockett National Forest. Biodiversity indices calculated by Kelly (1999) and the presence of several intolerant species indicate Cochino Bayou is relatively unimpacted. The ecologically significant stream segment is from the confluence with the Neches River in northern Trinity County upstream to its headwaters in eastern Houston County.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.



Figure 39. Cochino Bayou west of CR 4740 in Houston County (8/14/01).

1.11.5 Hackberry Creek

Hackberry Creek is a third order stream that begins in east Trinity County and flows easterly through the Davy Crockett National Forest about 12 miles and joins the Neches River at the Trinity/Angelina County line. The creek has sand and clay dominated substrate and a reduced canopy composed primarily of tall grasses and shrubs (Kelly 1995). The fish assemblage collected from Hackberry Creek was dominated by long-lived, tolerant species (e.g. black bullhead (*Ameiurus melas*), yellow bullhead (*A. natalis*), grass pickerel (*Esox americanus*), and many of the larger sunfish species), indicating the creek has been moderately impacted (Kelly 1999). Additionally, Kelly (1999) reported several sources of impairment to water quality including garbage, furniture, plastic products, fecal material, and orange to brown water color at his sampling station downstream of a large bridge. Feaster (1998) reported no freshwater mussels from a collection site on Hackberry Creek that displayed erosion due to cattle activity. However, two species of freshwater mussel were collected at an upstream site where no impairments were reported (Feaster 1998). The presence of freshwater mussels and the creek chubsucker (*Erimyzon oblongus*) in the upper reaches of Hackberry Creek suggest water quality impairment are limited to the lower reaches of the creek. The ecologically significant stream segment is from the confluence with the Neches River upstream to its headwaters in east Trinity County.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.
- **Threatened or endangered species/unique communities-** significant due to the presence of the creek chubsucker (*Erimyzon oblongus*) (SOC/St.T) (Kelly 1995).



Figure 40. Hackberry Creek east of FM 2501 in Trinity County (8/14/01).

1.11.6 Hager Creek

Hager Creek is a third order stream that begins about four miles east of Ratcliff in east Houston County and flows southeasterly for about 10 miles where it joins Cochino Bayou in southeastern Houston County. The creek is relatively narrow and has a loam and detritus dominated substrate with some pebbles and cobble present and a dense canopy of overhanging vegetation (Figure 42). Kelly (1995) reported collecting 23 species of fish from Hager Creek, including three species intolerant of degradation (Appendix C). While the fish assemblage from Hager Creek was not as diverse as those from other streams sampled within the Davy Crockett National Forest, biodiversity indices indicate the creek is relatively unimpacted. Feaster (1998) collected one species of freshwater mussel, *Unio merus declivus*, from Hager Creek. The ecologically significant stream segment is from the confluence with Cochino Bayou upstream to its headwaters east of Ratcliff in east Houston County.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.



Figure 41. Hager Creek east of CR 4740 in Houston County (8/14/01).

1.11.7 Hickory Creek

Hickory Creek is a fourth order stream that begins about 10 miles northeast of Crockett in central Houston County and flows northeasterly for approximately 23 miles where it empties into the Neches River at the Houston/Cherokee County line. It has a loam and detritus dominated substrate and a moderate canopy of vegetation (Kelly 1995). Kelly (1995) collected 30 fish species, including nine cyprinids (minnows) and ten sunfish species. Biodiversity indices calculated by Kelly (1999) indicate that Hickory Creek is relatively unimpacted and supports a stable fish community. The ecologically significant stream segment is from the confluence with the Neches River upstream to a point one mile southwest of the FM 227 crossing in northeast Houston County.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.



Figure 42. Hickory Creek west of FR 511 in Houston County (8/14/01).

1.11.8 Lynch Creek

Lynch Creek is a first order stream that begins about 14 miles east of Crockett in Houston County and flows southeasterly for about five miles before emptying into Piney Creek. The creek is intermittent in nature and generally only flows four months of the year on average (Kelly 1999). The creek has sand and loam dominated substrate and a dense canopy of vegetation (Kelly 1995). Kelly (1995) collected 23 fish species, including three darter species, eight sunfish species, and five cyprinids. Biodiversity indices and the high ratio of tolerant to intolerant individuals captured (50:1) indicate Lynch Creek has been impacted to some extent (Kelly 1999). Reduced water quality due to the intermittent nature of the creek in warmer months is likely the primary impact to the fish community. The ecologically significant stream segment is from the confluence with Piney Creek upstream to its headwaters near an unmarked county road in Houston County.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.
- **Threatened or endangered species/unique communities-** significant due to presence of the creek chubsucker (*Erimyzon oblongus*) (SOC/St.T) (Kelly 1995).



Figure 43. Lynch Creek east of FM 2781 in Houston County (8/14/01).

1.11.9 Piney Creek

Piney Creek is a fourth order stream that begins in east Houston County and flows approximately 57 miles into the Neches River southeast of Lufkin. The creek flows southeasterly through the Davy Crockett National Forest for the majority of its length before turning easterly about four miles southeast of Groveton. The drainage basin size is 264 square kilometers (102 square miles) (Bayer et al. 1992). The creek has a loam and clay dominated substrate and a moderate canopy of vegetation (Kelly 1995). The riparian forest observed at the FM 358 crossing was dominated by sweet gum (*Liquidambar styraciflua*), sycamore (*Platanus occidentalis*), box elder (*Acer negundo*), and sugarberry (*Celtis laevigata*). Piney Creek was identified as one of the least impacted streams of the South Central Plains ecoregion (Bayer et al. 1992). A survey of freshwater mussels in the Davy Crockett National Forest found Piney Creek contained the greatest number of mussel taxa with six species present (Feaster 1998). Because freshwater mussels are indicators of good water quality and are often the first organisms to decline during adverse conditions (Resh and Rosenberg 1993, Howells et al. 1996), the presence of six species supports Piney Creek's designation as a least impacted stream. Fish collections from Piney Creek have yielded a total of thirty-four fish species, including three species intolerant of degradation (Appendix C) (Bayer et al. 1992, Kelly 1995). The ecologically significant stream segment is from the confluence with the Neches River upstream to the headwaters in east Houston County.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.
- **High water quality/exceptional aquatic life/high aesthetic value-** identified as a South Central Plains ecoregion reference stream for diversity of benthic macroinvertebrates (Bayer et al 1992).
- **Threatened or endangered species/unique communities-** significant due to presence of the creek chubsucker (*Erimyzon oblongus*) (SOC/St.T) (Bayer et al. 1992).



Figure 44. Piney Creek at FM 358 in Trinity County (8/14/01).

1.11.10 San Pedro Creek

San Pedro Creek begins in north Houston County about 5 miles north of Grapeland and flows southeasterly about 8 miles before turning to the northeast where it forms the northwestern boundary of the Davy Crockett National Forest. The creek joins the Neches River in northeastern Houston County. The creek is impounded to form Grapeland Lake in its intermittent headwaters. Perennial flow in San Pedro Creek begins about eight miles from the headwaters at the confluence of Bennett Creek. The ecologically significant stream segment is from the confluence with the Neches River upstream to its headwaters in Houston County.

- **Riparian conservation area-** fringed by the 162,012-acre Davy Crockett National Forest.

1.11.11 Sandy Creek

Sandy Creek is a first order stream that begins in the northern portion of the Davy Crockett National Forest and flows approximately nine miles before joining Camp Creek in Houston County. Flow in Sandy Creek is sustained by a series of springs located near its headwaters (Kelly 1995). The substrate is dominated by sand and loam and the banks are lined with a moderate canopy of vegetation (Feaster 1998). The freshwater mussel little spectaclecase (*Villosa lienosa*) was collected from Sandy Creek (Feaster 1998). This species is reportedly abundant in headwater creeks in Louisiana (Vidrine 1993), but appears to be declining in abundance in Texas (Howells 1996). The ecologically significant stream segment is from the confluence with Camp Creek in Houston County upstream to its headwaters east of FM 227.

- **Riparian conservation area-** fringed by the 162,102-acre Davy Crockett National Forest.
- **Threatened or endangered species/unique communities-** significant due to presence of the creek chubsucker (*Erimyzon oblongus*) (SOC/St.T) (Kelly 1995).

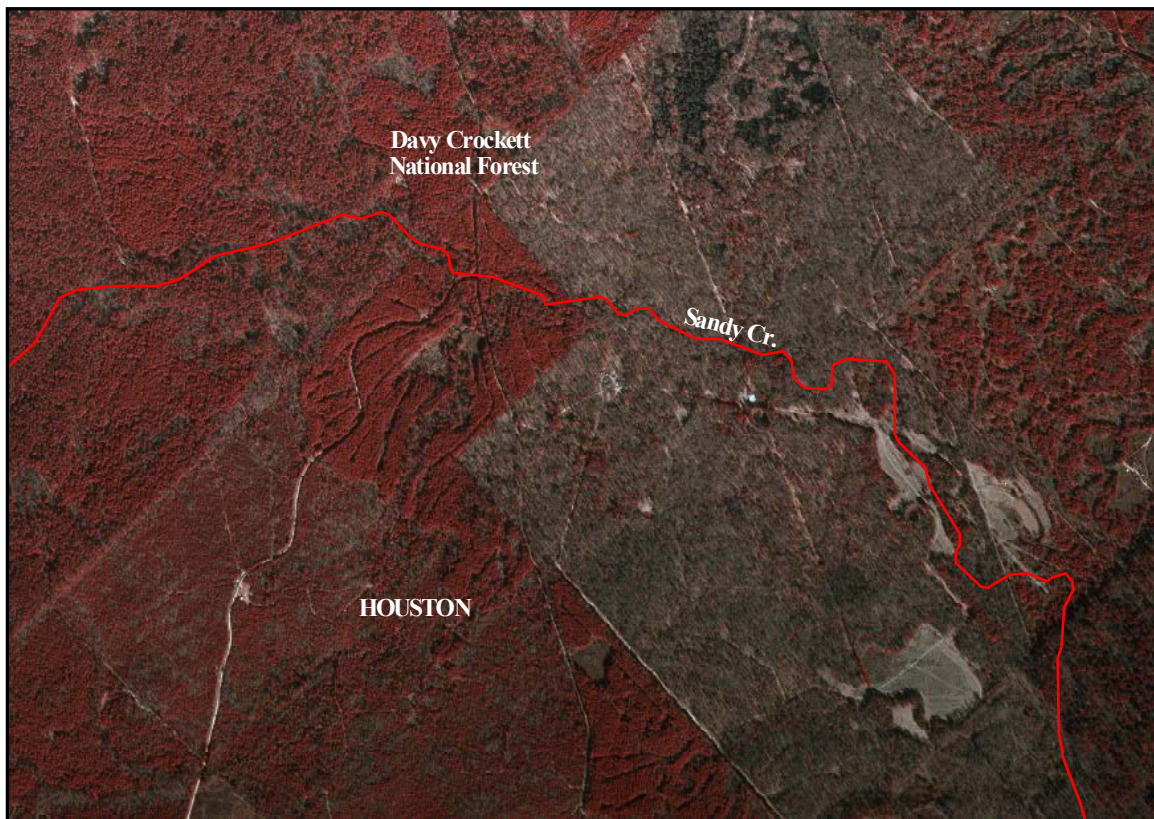


Figure 45. Sandy Creek within Davy Crockett National Forest, Houston County. Source: Weches DOQ, 1995.

1.12 EAST TEXAS STREAMS

Stream segments included in this group are those that were not contained within the Big Thicket region as defined by Peacock (1994) or the boundaries of the Davy Crockett National Forest. The following streams within this group were identified by the TPWD as meeting one or more of the criteria for designation as Ecologically Unique as defined by Senate Bill 1 (1997):

Alazan Bayou
Attoyac Bayou
Bowles Creek
Catfish Creek
Irons Bayou
Mud Creek
Sandy Creek (Shelby Co.)

A brief characterization of these streams and a description of the criteria they meet follows.

1.12.1 Alazan Bayou

Alazan Bayou begins in central western Nacogdoches County and flows southerly into Loco Bayou, which empties into the Angelina River about one mile west of U.S. Hwy 59. The bayou is a third-order stream with a sandy substrate and contains abundant woody debris that is provided by the dense vegetative canopy. The Alazan Bayou Wildlife Management Area (WMA) is located approximately 10 miles southwest of Nacogdoches and contains approximately 2,075-acres on the Angelina River in Nacogdoches County (Hodge 2000). The Texas Parks and Wildlife Department purchased the property in 1991 to preserve over 1,300-acres of mature bottomland hardwood forest (Hodge 2000). Newly developed wetland habitats, totaling about 100-acres, are used extensively by waterfowl each winter. Typically, the bottomlands begin to flood during midwinter as the river and bayous begin to overbank, creating backwater and slough habitats, and inundation continues through the spring (TPWD 2004). These backwater and slough habitats are important for a variety of fish and wildlife species; including the river otter (*Lutra canadensis*), which frequents streams in the area. The ecologically significant segment is from the confluence with Loco Bayou in Nacogdoches County upstream to the headwaters west of Nacogdoches.

- **Biological function-** mature bottomland hardwood habitat along the Angelina River displays significant overall habitat value considering the diverse assemblage of flora and fauna observed in the terrestrial and aquatic habitats (TPWD 2004).
- **Riparian conservation area-** fringed by the 2,075-acre Alazan Bayou Wildlife Management Area.
- **Threatened or endangered species/unique communities-** significant due to the presence of the wood stork (*Mycteria americana*) (Fed.E/St.T), which roosts at the Alazan Bayou WMA in summer (Hodge 2000).



Figure 46. Alazan Bayou north of SH 7 in Nacogdoches County (8/14/01).

1.12.2 Attoyac Bayou

Attoyac Bayou begins five miles east of Mount Enterprise, in southeastern Rusk County and flows southeasterly 58 miles into the Angelina River in southeastern Nacogdoches County. The bayou flows through forested bottomland hardwoods, much of which is owned by lumber companies (Belisle and Josselet 1974). Dominant vegetation observed at the SH 7 road crossing included sweet gum (*Liquidambar styraciflua*), black willow (*Salix nigra*), sycamore (*Platanus occidentalis*), and American elm (*Ulmus americana*). The ecologically significant stream segment is from a point 2.4 miles downstream of the Curry Creek confluence in Nacogdoches/San Augustine County upstream to US 59 in Shelby/Rusk County (within TCEQ stream segment 0612).

- **Threatened or endangered species/unique communities-** significant due to the presence of the only known remaining population of triangle pigtoes (*Fusconaia lananensis*), an endemic freshwater mussel (Howells 1996, Howells et al. 1996).



Figure 47. Attoyac Bayou south of SH 7 in San Augustine County (8/13/01).

1.12.3 Bowles creek

Bowles Creek begins about two miles east of Overton in Rusk County and flows southwesterly 21 miles into Striker Creek, a tributary to the Angelina River, in southeastern Cherokee County. In August 2001, Bowles Creek at the SH 294 road crossing was relatively narrow with a dense canopy composed primarily of small river birch (*Betula nigra*), box elder (*Acer negundo*), and elderberry (*Sambucus canadensis*). The ecologically significant stream segment is from the confluence with Striker Creek upstream to the headwaters east of Overton in Cherokee County.

- **Riparian conservation area-** fringed by the 93.8-acre Caddoan Mounds State Historical Site.



Figure 48. Bowles Creek north of SH 294 in Cherokee County (08/14/01).

1.12.4 Catfish Creek

Catfish Creek, also known as Catfish Bayou, begins about nine miles southwest of Athens in Henderson County and flows southwesterly 30 miles into the Trinity River in western Anderson County. There are 26 reservoirs in the Trinity River Basin upstream of Catfish Creek and, more importantly, Catfish Creek is the only tributary of comparable size that has not been impacted by a major reservoir (Leifeste and Hughes 1967). The Catfish Creek ecosystem is representative of one of the few remaining relatively undisturbed spring-fed riparian wetlands of the western Gulf Plain natural region (NPS 1983). Soils in the bottomlands along Catfish Creek are moderately permeable, shallow, gray-brown, sandy loams (Leifeste and Hughes 1967). Twenty-four tributaries, many of which are spring-fed (Gibson, Lock, D.D. Spring, Kidd Spring, Long, Berry, Crawford, and Skeet branches), maintain a free-flowing meandering bottomland that consists of forest, marshes, swamps, and bogs. Bottomland forests occupy about 11 percent of the Catfish Creek Basin, while marshes and swamps occupy only about eight percent (Telfair 1988). Marshes and swamps are important to fish and wildlife as many species are dependent upon these areas during all or part of their lifecycle; and they are generally more productive in terms of biomass than surrounding areas (Niering 1985). Telfair (1988) reported 676 species of vascular plants from the Gus Engeling Wildlife Management Area along Catfish Creek, including 112 trees, shrubs, and woody vines, 130 grasses, 57 legumes, 85 composite forbs, 222 other forbs, and 70 wetland and aquatic plants. Forty-eight fish species, including numerous species intolerant of degradation, have been verified from Catfish Creek and its tributaries on the WMA (Telfair 1988). Fish species collected from Catfish Creek proper are listed in Appendix C. The high diversity of fish species and large number of intolerant species reflect the high quality habitat present and the relatively undisturbed nature of Catfish Creek. Other species verifications from the Catfish Creek ecosystem include: 61 species of amphibians and reptiles, 34 species of mammals (Strapper 1984), and 360 species of migratory and breeding birds (Telfair 1988). The ecologically significant stream segment is from the confluence with the Trinity River northwest of Palestine upstream to its headwaters southwest of Athens in Henderson County.

- **Biological function-** designated as a National Natural Landmark for containing the best example of the few remaining undisturbed riparian habitats in the Western Gulf Coast Plain region (NPS 1983)
- **Riparian conservation area-** fringed by the 10,958-acre Gus Engeling Wildlife Management Area
- **High water quality/exceptional aquatic life/high aesthetic value-** identified as an East Central Texas Plains ecoregion reference stream for dissolved oxygen (Bayer et al. 1992).
- **Threatened or endangered species/unique communities-** significant due to presence of the creek chubsucker (*Erimyzon oblongus*) (SOC/St.T) (Kelly 1995), and the alligator snapping turtle (*Macroclemys temminckii*) (SOC/St.T) (Rudolph et al. 2002).



Figure 49. Catfish Creek north of US 287 in Anderson County (8/13/01).



Figure 50. Catfish Creek at CR 473 in Gus Engeling WMA in Anderson County (8/13/01).

1.12.5 Iron Bayou

Irons Bayou begins southwest of Pinehill in eastern Rusk County and flows east/northeast about 24 miles before emptying into the Sabine River about five miles north of Carthage in Panola County. The bayou drains approximately 181 square kilometers (70 square miles) and meanders through an extensive riparian forest. The substrate was composed primarily of clay and instream cover provided by woody debris, cypress stumps and knees, and fallen timber was abundant. Bayer et al (1992) reported collecting 21 fish species from Irons Bayou, including four species intolerant of degradation (Appendix C). The relatively high diversity of fish species and large number of intolerant species reflect the high quality habitat present and the relatively undisturbed nature of Irons Bayou. The ecologically significant stream segment is from the confluence with the Sabine River in Panola County upstream to its headwaters in east Rusk County.

- **High water quality/exceptional aquatic life/high aesthetic value-** identified as a South Central Plains ecoregion reference stream for diversity of benthic macroinvertebrates and fish (Bayer et al. 1992; Linam et al. 2002).



Figure 51. Irons Bayou at SH 149 in Panola County (8/13/01).

1.12.6 Mud Creek

Mud Creek begins about two miles west of Gould in north Cherokee County at the confluence of its east and west forks and flows southeasterly 24 miles into the Angelina River about four miles southeast of Reklaw. The creek drains much of northeastern Cherokee County and receives flow from several large tributaries. The lower reaches of the creek near the confluence with the Angelina River are bordered by extensive bottomland forest and swamp habitat (USFWS 1984). These habitats are frequently flooded and contain an excellent diversity of high quality timber. The forest is dominated by overcup oak (*Quercus lyrata*), willow oak (*Quercus phellos*), green ash (*Fraxinus pennsylvanica*), and sugarberry (*Celtis laevigata*), while swamps are dominated by buttonbush (*Cephalanthus occidentalis*) and water elm (*Planera aquatica*). The ecologically significant stream segment is from the confluence with the Angelina River upstream to the SH 204 crossing west of Ponta in central Cherokee County.

- **Biological function-** performs valuable biological function relating to presence of priority one bottomland hardwood habitat (USFWS 1984) that displays significant overall habitat value (Bauer et al. 1991).
- **Threatened or endangered species/unique communities-** significant due to presence of Neches River rose-mallow (*Hibiscus dasycalyx*) (Federal candidate for listing) (TPWD 2005).



Figure 52. Mud Creek south of SH 204 in Cherokee County (8/13/01).

1.12.7 Sandy Creek (Shelby County)

From the confluence with Attoyac Bayou in Shelby County upstream to Pinkston Dam in Shelby County.

- **Threatened or endangered species/unique communities** - only known remaining population of endemic triangle pigtoe freshwater mussel (*Fusconaia lananensis*) (Howells, 1996).

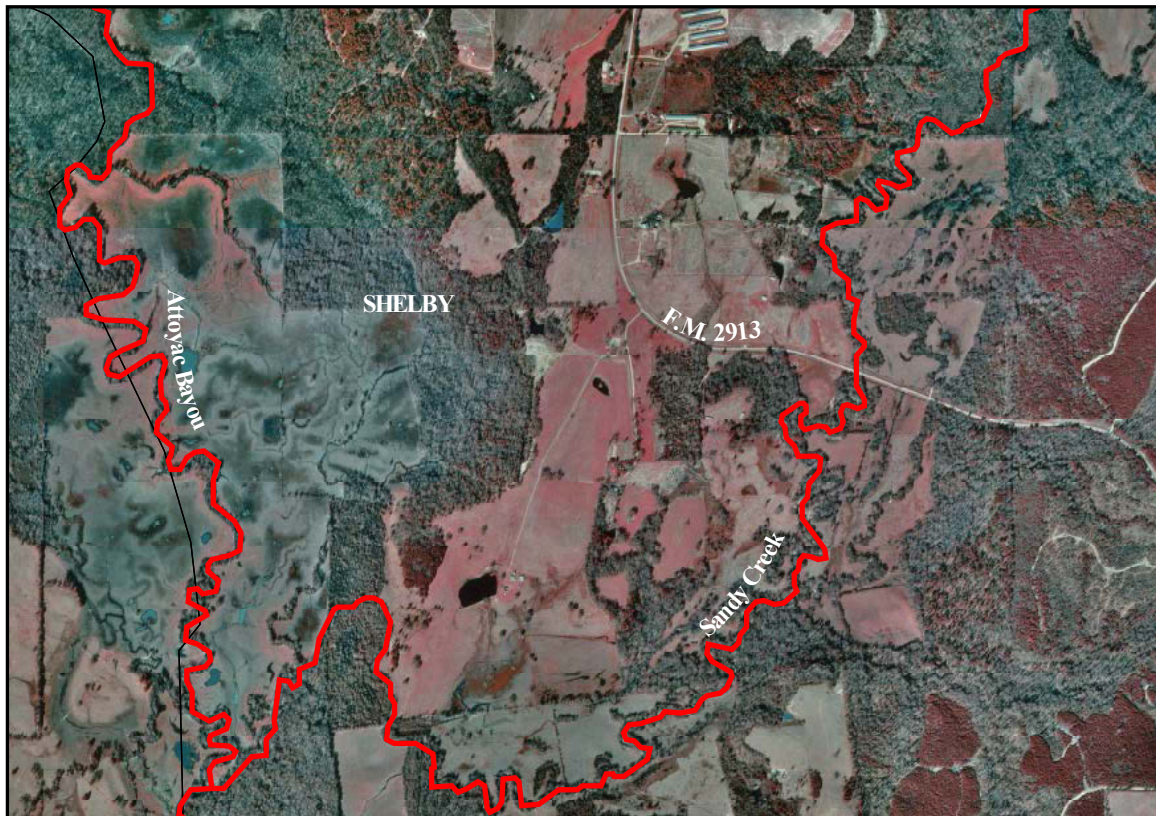


Figure 53. Sandy Creek at FM 2913, Shelby County. Source: Martinsville DOQ, 1995.



Figure 54. Sandy Creek north of FM 2913 in Shelby County (8/13/01).

1.13 COASTAL STREAMS

The following coastal streams in region I have been identified by the TPWD as meeting one or more of the criteria for designation as Ecologically Unique as defined by Senate Bill 1 (1997):

Big Hill Bayou
Hillebrandt Bayou
Salt Bayou
Taylor Bayou
Texas Bayou

A brief characterization of these streams and a description of the criteria they meet follows.

1.13.1 Big Hill Bayou

Big Hill Bayou begins eight miles southwest of Port Arthur in eastern Jefferson County and flows easterly and northerly eight miles into Taylor's Bayou about five miles west of Port Arthur. The bayou traverses marshy terrain through the J. D. Murphree Wildlife Management Area (WMA) and provides habitat for coastal waterfowl, shrimp, blue crab, and finfish. The WMA is located on the Texas portion of the Chenier Plain, which is the westernmost geologic delta of the Mississippi River (Hodge 2000). Vegetative communities within the area include extensive freshwater, intermediate, and brackish wetlands, as well as saline wetlands to a smaller extent (Moulton and Jacob 2001). The WMA is a key nesting and brooding area for mottled ducks as well as other species of waterfowl and the marshlands support one of the densest populations of American alligators (*Alligator mississippiensis*) in Texas (Hodge 2000, TPWD 2004). The Big Hill Unit (8,312-acres) of the WMA is basically a freshwater marsh that has been impounded with levees and divided into compartments in order to control water levels and prevent dewatering of the marsh (Hodge 2000). The ecologically significant stream segment is from the confluence with Taylor Bayou on the J.D. Murphree Wildlife Management Area upstream to the headwaters eight miles southwest of Port Arthur in east Jefferson County.

- **Biological function**– displays significant overall habitat value considering the biodiversity and uniqueness observed in the extensive freshwater and intermediate wetlands (Moulton and Jacob 2001, Hodge 2000).
- **Riparian conservation area**- fringed by the 24,366-acre J.D. Murphree Wildlife Management Area.

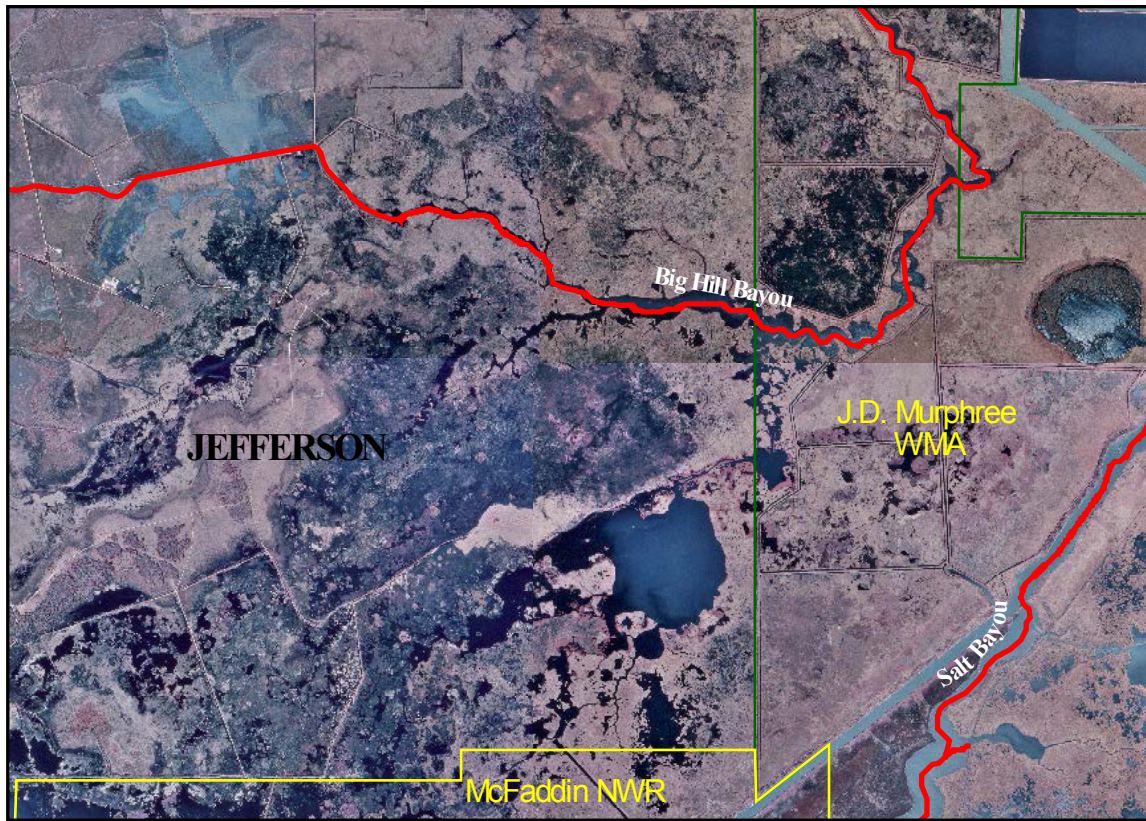


Figure 55. Big Hill Bayou at J.D. Murphree WMA in Jeffesron County. Source: Big Hill Bayou DOQ, 1996, 1m CIR (TNRIS, 1995-1997).

1.13.2 Hillebrandt Bayou

Hillebrandt Bayou begins near Beaumont in northern Jefferson County and flows southeasterly for 18 miles where it empties into Taylor Bayou, which then flows into Sabine Lake and ultimately into the Gulf of Mexico. Hillebrandt Bayou is intermittent in its upper reaches, which were once known as Double Point Bayou (Handbook of Texas Online 2004), and is tidally influenced about 10 miles upstream of its confluence with Taylor Bayou (TCEQ 2004). The bayou has been dredged and channelized in its upper reaches and the lower reaches are characterized by numerous oxbows and backsloughs. Water from the lower portion of the bayou is used for irrigating rice crops in central Jefferson County. Water quality and the structure of the macroinvertebrate community of Hillebrandt Bayou have been impacted by surface runoff and sewage treatment plant effluent from the City of Beaumont (Duplechin 1975, Ray 1999). Fish collections from Hillebrandt Bayou using gill nets and seines yielded 25 species (Linam and Kleinsasser 1987a) (Appendix C). The ecologically significant stream segment is from the confluence with Taylor Bayou upstream to its headwaters near Beaumont in Jefferson County.

- **Riparian conservation area-** fringed by the 24,366-acre J.D. Murphree Wildlife Management Area.

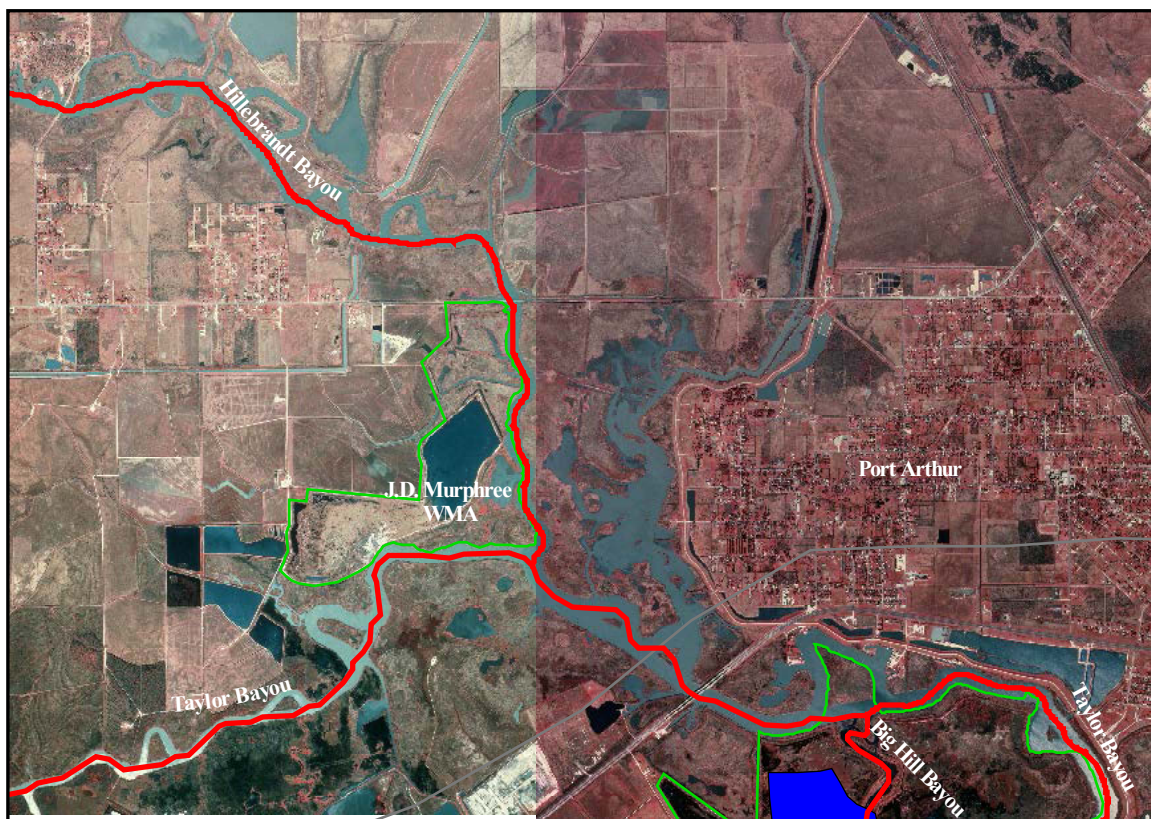


Figure 56. Hillebrandt Bayou. Source: Port Acres DOQ, 1995.

1.13.3 Salt Bayou

Salt Bayou rises in western Jefferson County and flows east through numerous small impoundments before discharging into the Gulf Intracoastal Waterway (GIWW). The bayou flows through the McFaddin National Wildlife Refuge, which protects one of the largest remaining freshwater marshes in Texas as well as thousands of acres of intermediate to brackish marsh (USFWS 2004a). The refuge supplies important feeding and resting areas for migrating and wintering populations of waterfowl. The ecologically significant stream segment is from the confluence with the Gulf Intracoastal Waterway upstream to its headwaters in Jefferson County.

- **Riparian conservation area-** fringed by the 42,995-acre McFaddin National Wildlife Refuge, the 4,141-acre Sea Rim State Park, and the 24,366-acre J.D. Murphree Wildlife Management Area.

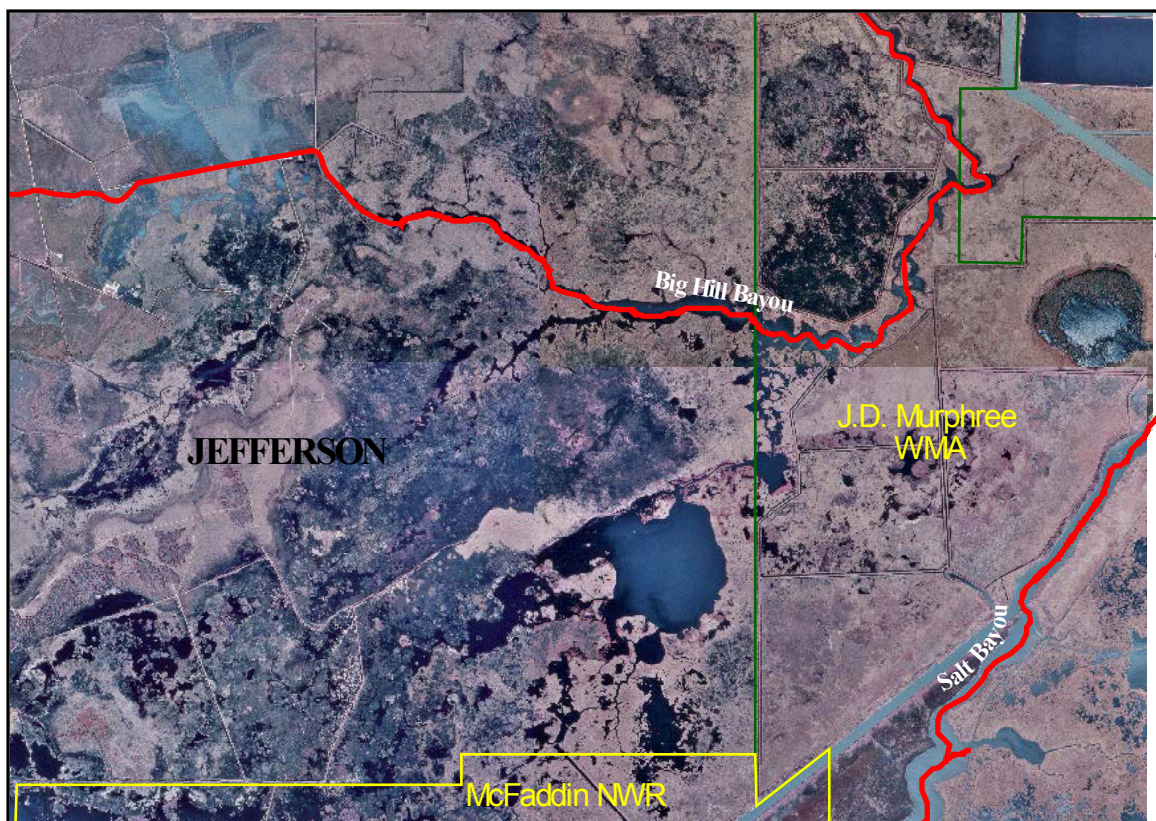


Figure 57. Salt Bayou at J.D. Murphree WMA, Jefferson County. Source: Big Hill Bayou DOQ, 1996.

1.13.4 Taylor Bayou

Taylor Bayou is formed at the confluence of its north and south forks in central Jefferson County and flows eastward to the Gulf Intracoastal Waterway (GIWW). Taylor Bayou is the major drainage for Jefferson County. The bayou and the riparian woodlands that border the stream, represent an isolated sliver of the Big Thicket that extends toward the coast (TPWD 1999). Taylor Bayou and its forks were channelized in the early 1900's to provide deep draft channels to Beaumont and Port Arthur. The bayou and its forks are bordered by extensive palustrine wetlands, although much of these habitats have been fragmented and altered for farming activities (USFWS 2005). The ecologically significant stream segment is from the confluence with the GIWW upstream to and including the north and south forks and Mayhaw Bayou in Jefferson County.

- **Riparian conservation area-** fringed by the 24,366-acre J.D. Murphree Wildlife Management Area.

1.13.5 Texas Bayou

Texas Bayou begins in southeast Jefferson County and flows eastward about four miles before emptying into Sabine Pass and ultimately the Gulf of Mexico. The bayou meanders through banks lined with extensive cordgrass (*Spartina* sp.). The bayou is entirely contained within the Texas Point National Wildlife Refuge (NWR), which encompasses almost 9,000 acres of estuarine-tidal saltmarsh with some wooded uplands and prairie ridges (Moulton and Jacob 2000, USFWS 2004b). The refuge provides habitat for wintering and migrating waterfowl, alligators and coastal marsh animals, and also functions as a nursery area for commercially and recreationally important finfish and shellfish (USFWS 2004b). The ecologically significant stream segment is from the confluence with the Gulf Intracoastal Waterway (GIWW) upstream to its headwaters in Jefferson County.

- **Riparian conservation area-** fringed by the 8,900-acre Texas Point NWR.

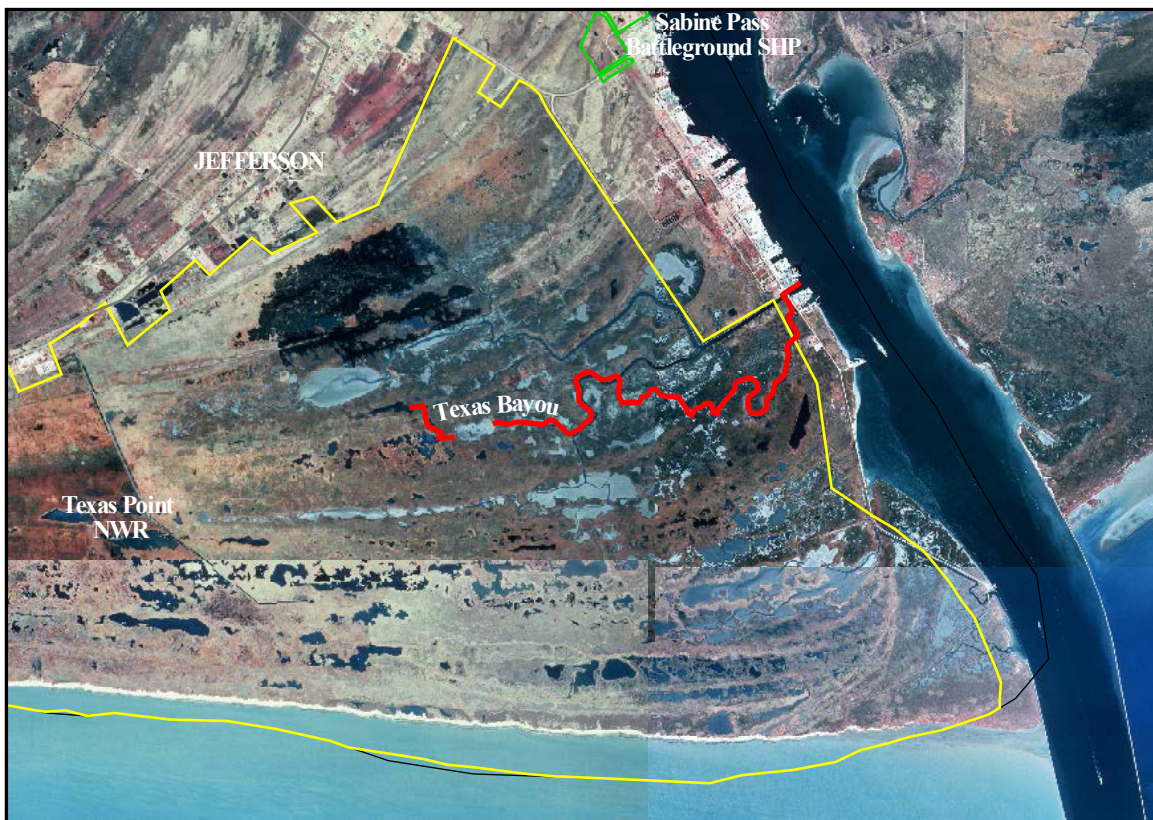


Figure 58. Texas Bayou within Texas Point National NWR, Jefferson County. Source: Texas Point and Sabine Pass DOQs, 1995.

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1.15 APPENDIX A: 31 TAC § 357.8 ECOLOGICALLY UNIQUE RIVER AND STREAM SEGMENTS

(a) Regional water planning groups may include in adopted regional water plans recommendations for all or parts of river and stream segments of unique ecological value located within the regional water planning area by preparing a recommendation package consisting of a physical description giving the location of the stream segment, maps, and photographs of the stream segment and a site characterization of the stream segment documented by supporting literature and data. The recommendation package shall address each of the criteria for designation of river and stream segments of ecological value found in subsection (b) of this section. The regional water planning group shall forward the recommendation package to the Texas Parks and Wildlife Department and allow the Texas Parks and Wildlife Department 30 days for its written evaluation of the recommendation. The adopted regional water plan shall include, if available, Texas Parks and Wildlife Department's written evaluation of each river and stream segment recommended as a river or stream segment of unique ecological value.

(b) A regional water planning group may recommend a river or stream segment as being of unique ecological value based upon the following criteria:

- (1) **biological function**--stream segments which display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats;*
- (2) **hydrologic function**--stream segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge;*
- (3) **riparian conservation areas**--stream segments which are fringed by significant areas in public ownership including state and federal refuges, wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes, or stream segments which are fringed by other areas managed for conservation purposes under a governmentally approved conservation plan;*
- (4) **high water quality/exceptional aquatic life/high aesthetic value**--stream segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality; or*
- (5) **threatened or endangered species/unique communities**--sites along streams where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species, and sites along streams significant due to the presence of unique, exemplary, or unusually extensive natural communities.*

1.16 APPENDIX B: NATIONAL RIVERS INVENTORY SUMMARY

In 1968 Congress passed the Wild and Scenic Rivers Act, which called for the identification of potential wild, scenic, and recreational river areas of the nation. The Act declared that the established national policy of dams and other construction on appropriate sections of river should be complimented by a policy to preserve other sections of rivers in their free-flowing condition to “protect water quality and to fulfill other vital national conservation purposes.” Designation as a Wild and Scenic River does not halt development and use of a river, but is meant to preserve the character of a river. Thus, uses compatible with the management goals of a particular river are allowed as long as it does not curtail its free-flowing nature or damage the outstanding natural resources upon which its designation was based. Section 5 (d) of the Wild and Scenic Rivers Act calls for the creation of a list of potential national wild, scenic, and recreational river areas for use in future water planning and development.

The Nationwide Rivers Inventory (NRI), in partial fulfillment of section 5 (d), is maintained by the National Park Service (NPS) as a national listing of river segments potentially eligible for protection under the Wild and Scenic Rivers Act of 1968.

The NRI is a listing of free-flowing river segments in the United States that are believed to possess one or more “outstandingly remarkable” natural or cultural values. It provides the location of free-flowing, relatively undisturbed stream segments as well as a description of the “outstandingly remarkable” features associated with its designation. These values are thought to be of more than local or regional significance, thus affording these river segments a certain amount of protection from federal actions that would adversely affect one or more of the NRI segments. For groups concerned with ecosystem management or river assessments, the NRI serves as a source of information on nearby naturally-functioning river systems for reference while performing monitoring or restoration activities.

A river segment must be free-flowing and possess one or more Outstandingly Remarkable Value (ORV) to be listed on the NRI. In order to be deemed outstandingly remarkable, the value must be a unique, rare, or exemplary feature that is significant at a comparative scale. The scale for comparison may be regional or national and the range of resources considered should be directly river-related. Evaluating a river for inclusion on the NRI consists of an examination of the rivers hydrology, man-made alterations, and an inventory of its natural, cultural, and recreational resources. The criteria for evaluation may be modified to serve as a meaningful basis for comparison within the state, physiographic province, ecoregion, or other defined area. The following criteria for assessing ORVs was offered to aid federal agencies in assessing river segments:

- 1.) **Scenery (S):** The landscape elements of landform, vegetation, water, color, and related factors result in notable or exemplary visual features and/or attractions. When analyzing scenic values, additional factors -- such as seasonal variations in vegetation, scale of cultural modifications, and the length of time negative intrusions are viewed -- may be considered. Scenery and visual attractions may be highly diverse over the majority of the river or river segment.
- 2.) **Recreation (R):** Recreational opportunities are, or have the potential to be, popular enough to attract visitors from throughout or beyond the region of comparison or are unique or rare within the region. Visitors are willing to travel long distances to use the river resources for recreational purposes.

River-related opportunities could include, but are not limited to, sightseeing, wildlife observation, camping, photography, hiking, fishing and boating.

- Interpretive opportunities may be exceptional and attract, or have the potential to attract, visitors from outside the region of comparison.
- The river may provide, or have the potential to provide, settings for national or regional usage or competitive events.

3.) **Geology (G):** The river, or the area within the river corridor, contains one or more example of a geologic feature, process or phenomenon that is unique or rare within the region of comparison. The feature(s) may be in an unusually active stage of development, represent a "textbook" example, and/or represent a unique or rare combination of geologic features (erosional, volcanic, glacial, or other geologic structures).

4.) **Fish (F):** Fish values may be judged on the relative merits of either fish populations, habitat, or a combination of these river-related conditions.

- **Populations:** The river is nationally or regionally an important producer of resident and/or anadromous fish species. Of particular significance is the presence of wild stocks and/or federal or state listed (or candidate) threatened, endangered or sensitive species. Diversity of species is an important consideration and could, in itself, lead to a determination of "outstandingly remarkable."
- **Habitat:** The river provides exceptionally high quality habitat for fish species indigenous to the region of comparison. Of particular significance is habitat for wild stocks and/or federal or state listed (or candidate) threatened, endangered or sensitive species. Diversity of habitats is an important consideration and could, in itself, lead to a determination of "outstandingly remarkable."

5.) **Wildlife (W):** Wildlife values may be judged on the relative merits of either terrestrial or aquatic wildlife populations or habitat or a combination of these conditions.

- **Populations:** The river, or area within the river corridor, contains nationally or regionally important populations of indigenous wildlife species. Of particular significance are species considered to be unique, and/or populations of federal or state listed (or candidate) threatened, endangered or sensitive species. Diversity of species is an important consideration and could, in itself, lead to a determination of "outstandingly remarkable."
- **Habitat:** The river, or area within the river corridor, provides exceptionally high quality habitat for wildlife of national or regional significance, and/or may provide unique habitat or a critical link in habitat conditions for federal or state listed (or candidate) threatened, endangered or sensitive species. Contiguous habitat conditions are

such that the biological needs of the species are met. Diversity of habitats is an important consideration and could, in itself, lead to a determination of "outstandingly remarkable."

- 6.) **Prehistory (P):** The river, or area within the river corridor, contains a site(s) where there is evidence of occupation or use by Native Americans. Sites must have unique or rare characteristics or exceptional human interest value(s). Sites may have national or regional importance for interpreting prehistory; may be rare and represent an area where a culture or cultural period was first identified and described; may have been used concurrently by two or more cultural groups; and/or may have been used by cultural groups for rare sacred purposes. Many such sites are listed on the National Register of Historic Places, which is administered by the NPS.
- 7.) **History (H):** The river or area within the river corridor contains a site(s) or feature(s) associated with a significant event, an important person, or a cultural activity of the past that was rare or one-of-a-kind in the region. Many such sites are listed on the National Register of Historic Places. A historic site(s) and/or features(s) is 50 years old or older in most cases.
- 8.) **Other Values (O):** While no specific national evaluation guidelines have been developed for the "other similar values" category, assessments of additional river-related values consistent with the foregoing guidance may be developed -- including, but not limited to, hydrology, paleontology and botany resources.

Twenty river or stream segments in Texas were included on the final Nationwide Rivers Inventory in August of 1982. Of these, four segments are included within the Region I Regional Water Planning Area. Stream segments within the Region I Regional Water Planning Area included on the NRI are listed below:

- 1). Neches River- A 180-mile section from the north end of B.A. Steinhagen Reservoir upstream to Lake Palestine was listed on the NRI in 1982 for outstandingly remarkable Scenic, Recreation, Fish, and Wildlife values. The following description was offered by the NPS: This segment provides habitat for the Red-Cockaded Woodpecker and American Alligator, and wintering grounds for the Bald Eagle, federally listed endangered species. It partially forms the boundaries of the Davey Crockett and Angelina National Forests and is recommended for inclusion in the proposed state rivers system. This segment has good water quality; heavy rainfall and numerous tributaries provide sufficient water for recreation use. The segment flows through gently rolling hills covered with pine and hardwood forests, with trees forming a canopy over the river. The river receives significant recreation use by canoeist and fishermen. The upper reaches contain the Big Slough area, which is designated a loop canoe trail by the Forest Service and is considered a wilderness-type area. It is an area of a wide variety of vegetative types, and is highly scenic. Below Big Slough, the river is very remote and extremely scenic with forests of cypress, oak, sweetgum and pine. It is an important recreation area, and a quality recreation waterway. Public boat ramps, Forest

Service campgrounds and numerous sandbars are available for recreation use. Swimming conditions are ideal at sandy beaches.

- 2). Neches River- A 60-mile stretch from the confluence of Pine Island Bayou just north of Beaumont upstream to B.A. Steinhagen Reservoir was listed on the NRI in 1982 for outstandingly remarkable Scenic, Recreation, Wildlife, and Other values. The following description was offered by the NPS: This segment provides habitat for the Red Wolf, Red-Cockaded Woodpecker and American Alligator, and wintering grounds for the Bald Eagle, federally listed endangered species. The river flows through the Big Thicket National Preserve which is characterized as a transitional zone between the arid southwest and the tropical coastal marsh, and the central prairie and eastern woodlands. It has been called the ecological crossroads of North America and this unique transitional characteristic, combined with 60" of annual rainfall, provides a rich habitat for plant and animal life. It also offers vast and varied recreation and education opportunities. There are over 300 bird species, 40 wild orchid species and 9 carnivorous plant species. This segment is one of the more popular and scenic waterways in the state. Overall scenic beauty is outstanding, with thickly forested banks of pine, hardwoods, stately bald cypress and water tupelo. Water quality is good, and heavy rainfall and numerous tributaries provide sufficient water for a quality recreation experience. Public boat ramps are available and large sandbars are used for camping and day use. The southern reaches contain a maze of sloughs and swamps. The middle reaches contain hardwoods and are laced with sloughs. Jack Gore Baygall is an important natural feature, a wild, swampy area. The entire river is ideal for swimming at sandy beaches and provides good catfish fishing. It is a year-round mecca for recreationists and nature lovers.
- 3). Sabine River- A 110-mile section from the I-10 crossing above Sabine Lake upstream to Toledo Bend Reservoir was listed on the NRI in 1982 for outstandingly remarkable Scenic, Recreation, and Wildlife values. The following description was offered by the NPS: Federally listed endangered species occurring in the area are: Red Wolf, Bald Eagle, Red-Cockaded Woodpecker, American Alligator and Arctic Perigrine Falcon migration corridor. Recommended for inclusion in proposed Texas Natural Rivers System. River maintains larger flow of water due to heavy rainfall and numerous tributaries and springs, with long isolated stretches. Forested, gently rolling hills in area. Banks are heavily vegetated with stately cypress trees and other hardwoods. River is popular for float trips. Swampy terrain provides habitat for a wide variety of wildlife. Fine white sand bars utilized for camping and day use.
- 4). Sabine River- A 50-miles section from the headwater of Toledo Bend Reservoir upstream to town of Easton was listed on NRI in 1982 for outstandingly remarkable Scenic, Wildlife, and Historic values. The following description was offered by the NPS: The Red-Cockaded Woodpecker and the American Alligator, federally listed endangered species, inhabit the area. Part of a segment of the Sabine River recommended for inclusion in a proposes state system in 1973. This segment is characterized by: (1) a low gradient streambed with associated marshes, sloughs, bayous, oxbows and backwaters;

(2) a near total lack of riffle rapid and waterfall areas; (3) a broad, deeply cut channel; (4) a diverse mixture of bottomland hardwood forests, pine ecosystems and wetland habitats with all stages of the hydric-xeric successional continuum being well represented; (5) diverse plant and animal assemblages; (6) archaeological and historical sites of potential importance; (7) a minimum of human development within sight of the river; and (8) outstanding scenic qualities. At least 7 Natural Areas are present, including "Woodland Cathedral", a natural oxbow lake amphitheater containing a nearly pristine oak-cypress-sweetgum forest, which is being leased by the Nature Conservancy. A number of state listed threatened/endangered species potentially occur in the corridor.

1.17 APPENDIX C FISHES COLLECTED FROM STREAMS IN REGION I
(ALPHABETICAL BY STREAM NAME)

Fishes collected from Alabama Creek

| Scientific Name | Common Name |
|-------------------------------------|-------------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Centrarchus macropterus</i> | Flier |
| <i>Cypinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis symmetricus</i> | Bantam sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Notemigonus crysoleucas</i> | Golden shiner |
| <i>Notropis atherinoides</i> | Emerald shiner |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Notropis vollucellus</i> | Mimic shiner* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Pylodictis olivaris</i> | Flathead catfish |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Austin Branch

| Scientific Name | Common Name |
|-------------------------------------|-------------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Centrarchus macropterus</i> | Flier |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma histrio</i> | Harlequin darter |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Ichthyomyzon gagei</i> | Southern brook lamprey* |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Lythrurus umbratilis</i> | Redfin shiner |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Notropis atrocaudalis</i> | Blacktail shiner |
| <i>Notropis buchanani</i> | Ghost shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis volucellus</i> | Mimic shiner* |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |
| <i>Semotilus atromaculatus</i> | Creek chub |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Beech Creek

| Scientific Name | Common Name |
|-------------------------------------|-------------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Elassoma zonatum</i> | Banded pygmy sunfish |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma gracile</i> | Slough darter |
| <i>Etheostoma proeliare</i> | Cypress darter* |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Labidesthes sicculus</i> | Brook silverside* |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Lythrurus umbratilis</i> | Redfin shiner |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Notropis chalybaeus</i> | Ironcolor shiner* |
| <i>Noturus gyrinus</i> | Tadpole madtom* |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Percina sciera</i> | Dusky darter* |

sources:

Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

Bayer, C.W., J.R. Davis, S.R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. Texas aquatic ecoregion project: an assessment of least disturbed streams (draft). Texas Water Commission, Austin, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Big Cypress Creek

| Scientific Name | Common Name |
|--------------------------------|-----------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Elassoma zonatum</i> | Banded pygmy sunfish |
| <i>Etheostma gracile</i> | Slough darter |
| <i>Etheostoma asprigene</i> | Mud darter |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Hybognathus hayi</i> | Cypress minnow |
| <i>Labidesthes sicculus</i> | Brook silverside* |
| <i>Lepisosteus oculatus</i> | Spotted gar |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis symmetricus</i> | Bantam sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Notemigonus crysoleucas</i> | Golden shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Noturus gyrinus</i> | Tadpole madtom* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Pomoxis nigromaculatus</i> | Black crappie |

sources:

Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

Bayer, C.W., J.R. Davis, S.R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. Texas aquatic ecoregion project: an assessment of least disturbed streams (draft). Texas Water Commission, Austin, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Big Sandy Creek

| Scientific Name | Common Name |
|--------------------------------|--------------------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Ammocrypta clara</i> | Western sand darter |
| <i>Ammocrypta vivix</i> | Scaly sand darter |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Ichthyomyzon gagei</i> | Southern brook lamprey* |
| <i>Ictalurus punctatus</i> | Channel catfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Menidia beryllina</i> | Inland silverside |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Hybopsis amnis</i> | Pallid shiner |
| <i>Notropis volucellus</i> | Mimic shiner* |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |

source: Moring, J.B. 2003. Baseline assessment of fish communities, benthic macroinvertebrate communities, and stream habitat and land use, Big Thicket National Preserve, Texas, 1999-2001. United States Geological Survey, Water Resources Investigations Report 03-4270, Austin, Texas

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Camp Creek

| Scientific Name | Common Name |
|-------------------------------------|--------------------------------|
| <i>Ameiurus melas</i> | Black bullhead |
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Centrarchus macropterus</i> | Flier |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Erimyzon oblongus</i> | Creek chubsucker |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma proliare</i> | Cypress darter* |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosis</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Notemigonus chryoleucas</i> | Golden shiner |
| <i>Notropis atherinoides</i> | Emerald shiner |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Semotilus atromaculatus</i> | Creek chub |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Catfish Creek

| Scientific Name | Common Name |
|-------------------------------------|-----------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma gracile</i> | Slough darter |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Ictalurus punctatus</i> | Channel catfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus sp.</i> | Black bass |
| <i>Minytrema melanops</i> | Spotted sucker |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |
| <i>Pomoxis nigromaculatus</i> | Black crappie |
| <i>Pylodictus olivarius</i> | Flathead catfish |

sources:

Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

Bayer, C.W., J.R. Davis, S.R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. Texas aquatic ecoregion project: an assessment of least disturbed streams (draft). Texas Water Commission, Austin, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Cochino Bayou

| Scientific Name | Common Name |
|-------------------------------------|-------------------------|
| <i>Ameiurus melas</i> | Black bullhead |
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma gracile</i> | Slough darter |
| <i>Etheostoma proliare</i> | Cypress darter* |
| <i>Etheostoma whipplei</i> | Redfin darter |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Readear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis symmetricus</i> | Bantam sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Minytrema melanops</i> | Spotted sucker |
| <i>Moxostoma poeciliurum</i> | Blacktail redhorse |
| <i>Notemigonus chrysoleucas</i> | Golden shiner |
| <i>Notropis atherinoides</i> | Emerald shiner |
| <i>Notropis atrocaudalis</i> | Blacktail shiner |
| <i>Notropis sabiniae</i> | Sabine shiner |

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Cochino Bayou (continued)

| Scientific Name | Common Name |
|----------------------------|------------------|
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis umbratilis</i> | Redfin shiner |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Percina sciera</i> | Dusky darter* |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Hackberry Creek

| Scientific Name | Common Name |
|-------------------------------------|--------------------------------|
| <i>Ameiurus melas</i> | Black bullhead |
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Erimyzon oblongus</i> | Creek chubsucker |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulud olivaceous</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Notemigonus chrysoleucas</i> | Golden shiner |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Notropis umbratilis</i> | Redfin shiner |
| <i>Notropis texanus</i> | Weed shiner |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Hager Creek

| Scientific Name | Common Name |
|-------------------------------------|--------------------------------|
| <i>Ameiurus melas</i> | Black bullhead |
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Centrarchus macropterus</i> | Flier |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Notemigonus chrysoleucas</i> | Golden shiner |
| <i>Notropis atherinoides</i> | Emerald shiner |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Opsopoedodus emiliae</i> | Pugnose minnow |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Percina sciera</i> | Dusky darter* |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Hickory Creek

| Scientific Name | Common Name |
|-------------------------------------|-------------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis symmetricus</i> | Bantam sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Minytrema melanops</i> | Spotted sucker |
| <i>Moxostoma poeciliurum</i> | Blacktail redhorse |
| <i>Notemigonus chrysoleucas</i> | Golden shiner |
| <i>Notropis atherinoides</i> | Emerald shiner |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis vollucellus</i> | Mimic shiner* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Phenacobius mirabilis</i> | Suckermouth minnow |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Hillebrandt Bayou

| Scientific Name | Common Name |
|--------------------------------|----------------------|
| <i>Astyanax mexicanus</i> | Mexican tetra |
| <i>Aplodinotus grunniens</i> | Freshwater drum |
| <i>Cyprinodon variegatus</i> | Sheepshead minnow |
| <i>Cyprinus carpio</i> | Common carp |
| <i>Dorosoma cepedianum</i> | Gizzard shad |
| <i>Dorosoma petenense</i> | Threadfin shad |
| <i>Fundulus chrysotus</i> | Golden topminnow |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Gambusia geiseri</i> | Largespring gambusia |
| <i>Ictalurus furcatus</i> | Blue catfish |
| <i>Ictalurus punctatus</i> | Channel catfish |
| <i>Ictiobus bubalus</i> | Smallmouth buffalo |
| <i>Lepisosteus oculatus</i> | Spotted gar |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lucania parva</i> | Rainwater killifish |
| <i>Menidia beryllina</i> | Tidewater silverside |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Morone mississippiensis</i> | Yellow bass |
| <i>Mugil cephalus</i> | Striped mullet |
| <i>Notropis emiliae</i> | Pugnose minnow |
| <i>Poecilia latipinna</i> | Sailfin molly |
| <i>Pomoxis annularis</i> | White crappie |

source: Linam, G.W. and L.J. Kleinsasser. 1987. Fisheries use attainability study for Hillebrandt Bayou. River Studies Report No. 1. Texas Parks and Wildlife Department, Austin, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Irons Bayou

| Scientific Name | Common Name |
|-------------------------------|-------------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma gracile</i> | Slough darter |
| <i>Etheostoma radiosum</i> | Orangebelly darter* |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Opsopoedodus emiliae</i> | Pugnose minnow |
| <i>Noturus gyrinus</i> | Tadpole madtom* |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |

source: Bayer, C.W., J.R. Davis, S.R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. Texas aquatic ecoregion project: an assessment of least disturbed streams (draft). Texas Water Commission, Austin, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Little Pine Island Bayou

| Scientific Name | Common Name |
|-------------------------------------|-----------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Aplodinotus grunniens</i> | Freshwater drum |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Dorosoma cepedianum</i> | Gizzard shad |
| <i>Dorosoma petenense</i> | Threadfin shad |
| <i>Elassoma zonatum</i> | Banded pygmy sunfish |
| <i>Elops saurus</i> | Ladyfish |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma proeliare</i> | Cypress darter* |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Ictalurus furcatus</i> | Blue catfish |
| <i>Ictalurus punctatus</i> | Channel catfish |
| <i>Ictiobus bubalus</i> | Smallmouth buffalo |
| <i>Labidesthes sicculus</i> | Brook silverside* |
| <i>Lepisosteus oculatus</i> | Spotted gar |
| <i>Lepisosteus osseus</i> | Longnose gar |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Menidia beryllina</i> | Inland silverside |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Mugil caphalus</i> | Striped mullet |
| <i>Notemigonus chrysoleucas</i> | Golden shiner |
| <i>Hybopsis amnis</i> | Pallid shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis volucellus</i> | Mimic shiner* |

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Little Pine Island Bayou (continued)

| Scientific Name | Common Name |
|-------------------------------|-------------------------|
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |
| <i>Poxomis annularis</i> | White crappie |
| <i>Poxomis nigromaculatus</i> | Black crappie |
| <i>Pylodictus olivaris</i> | Flathead catfish |

source: Moring, J.B. 2003. Baseline assessment of fish communities, benthic macroinvertebrate communities, and stream habitat and land use, Big Thicket National Preserve, Texas, 1999-2001. United States Geological Survey, Water Resources Investigations Report 03-4270, Austin, Texas

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Lynch Creek

| Scientific Name | Common Name |
|---------------------------------|-----------------------------|
| <i>Ameiurus melas</i> | Black bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Centrarchus macropterus</i> | Flier |
| <i>Elassoma zonatum</i> | Banded pygmy sunfish |
| <i>Erimyzon oblongus</i> | Creek chubsucker |
| <i>Erimyzon sucetta</i> | Lake chubsucker |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma proliere</i> | Slough darter |
| <i>Etheostoma vivax</i> | Scaly sand darter |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Notemigonus chrysoleucas</i> | Golden shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis umbratilis</i> | Redfin shiner |
| <i>Notropis vollucellus</i> | Mimic shiner* |
| <i>Phenacobius mirabilis</i> | Suckermouth minnow |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Menard Creek

| Scientific Name | Common Name |
|-------------------------------------|--------------------------------|
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Cyprinus carpio</i> | Common carp |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Ictalurus punctatus</i> | Channel catfish |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Noturus gyrinus</i> | Tadpole madtom* |
| <i>Percina sciera</i> | Dusky darter* |

source: Moring, J.B. 2003. Baseline assessment of fish communities, benthic macroinvertebrate communities, and stream habitat and land use, Big Thicket National Preserve, Texas, 1999-2001. United States Geological Survey, Water Resources Investigations Report 03-4270, Austin, Texas

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Neches River

| Scientific Name | Common Name |
|--------------------------------|----------------------------|
| <i>Ammocrypta vivix</i> | Scaly sand darter |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Aplodinotus grunniens</i> | Freshwater drum |
| <i>Carpiodes carpio</i> | River carpsucker |
| <i>Cycleptus elongatus</i> | Blue sucker* |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Dorosoma cepedianum</i> | Gizzard shad |
| <i>Dorosoma petenense</i> | Threadfin shad |
| <i>Elops saurus</i> | Ladyfish |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Hybognathus nuchalis</i> | Mississippi silvery minnow |
| <i>Ichthyomyzon castaneus</i> | Chestnut lamprey* |
| <i>Ichthyomyzon gagei</i> | Southern brook lamprey* |
| <i>Ictalurus furcatus</i> | Blue catfish |
| <i>Ictalurus punctatus</i> | Channel catfish |
| <i>Ictiobus bubalus</i> | Smallmouth buffalo |
| <i>Lepisosteus oculatus</i> | Spotted gar |
| <i>Lepisosteus osseus</i> | Longnose gar |
| <i>Lepisosteus spatula</i> | Alligator gar |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Menidia beryllina</i> | Inland silverside |
| <i>Micropterus coosae</i> | Redeye bass |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Morone chrysops</i> | White bass |
| <i>Morone saxatilis</i> | Striped bass |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Mugil cephalus</i> | Striped mullet |
| <i>Hybopsis amnis</i> | Pallid shiner |

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Neches River (continued)

| Scientific Name | Common Name |
|-------------------------------|----------------------------|
| <i>Notropis atherinoides</i> | Emerald shiner |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis volucellus</i> | Mimic shiner* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |
| <i>Poxomis annularis</i> | White crappie |
| <i>Poxomis nigromaculatus</i> | Black crappie |
| <i>Pylodictus olivaris</i> | Flathead catfish |
| <i>Strongylura marina</i> | Atlantic needlefish |

source: Moring, J.B. 2003. Baseline assessment of fish communities, benthic macroinvertebrate communities, and stream habitat and land use, Big Thicket National Preserve, Texas, 1999-2001. United States Geological Survey, Water Resources Investigations Report 03-4270, Austin, Texas

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Pine Island Bayou Watershed

| Scientific Name | Common Name |
|-------------------------------------|-----------------------------------|
| <i>Ameiurus melas</i> | Black bullhead |
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Amia calva</i> | Bowfin |
| <i>Ammocrypta clara</i> | Western sand darter |
| <i>Ammocrypta vivix</i> | Scaly sand darter |
| <i>Anchoa mitchelli</i> | Bay anchovy |
| <i>Angiulla rostrata</i> | American eel |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Aplodinotus grunniens</i> | Freshwater drum |
| <i>Carpiodes carpio</i> | River carpsucker |
| <i>Centrarchus macropterus</i> | Flier |
| <i>Cycleptus elongatus</i> | Blue sucker* |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Cyprinus carpio</i> | Common carp |
| <i>Dorosoma cepedianum</i> | Gizzard shad |
| <i>Dorosoma petenense</i> | Threadfin shad |
| <i>Elassoma zonatum</i> | Banded pygmy sunfish |
| <i>Erimyzon oblongus</i> | Creek chubsucker |
| <i>Erimyzon sucetta</i> | Lake chubsucker |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma asprigene</i> | Mud darter |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma gracile</i> | Slough darter |
| <i>Etheostoma histrio</i> | Harlequin darter |
| <i>Etheostoma parvipinne</i> | Goldstripe darter* |
| <i>Etheostoma proeliare</i> | Cypress darter* |
| <i>Etheostoma whipplei</i> | Redfin darter |
| <i>Fundulus blairae</i> | Blair's topminnow |
| <i>Fundulus chrysotus</i> | Golden topminnow |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Hybognathus nuchalis</i> | Mississippi silvery minnow |
| <i>Ichthyomyzon castaneus</i> | Chestnut lamprey* |

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Pine Island Bayou Watershed (continued)

| Scientific Name | Common Name |
|---------------------------------|-------------------------|
| <i>Ichthyomyzon gagei</i> | Southern brook lamprey* |
| <i>Ictalurus furcatus</i> | Blue catfish |
| <i>Ictalurus punctatus</i> | Channel catfish |
| <i>Ictiobus bubalus</i> | Smallmouth buffalo |
| <i>Ictiobus cyprinellus</i> | Bigmouth buffalo |
| <i>Ictiobus niger</i> | Black buffalo |
| <i>Labidesthes sicculus</i> | Brook silverside* |
| <i>Lepisosteus oculatus</i> | Spotted gar |
| <i>Lepisosteus osseus</i> | Longnose gar |
| <i>Lepisosteus spatula</i> | Alligator gar |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis symmetricus</i> | Bantam sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Lythrurus umbratilis</i> | Redfin shiner |
| <i>Macrohybopsis aestivalis</i> | Speckled chub |
| <i>Menidia beryllina</i> | Inland silverside |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Minytrema melanops</i> | Spotted sucker |
| <i>Morone chrysops</i> | White bass |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Mugil cephalus</i> | Striped mullet |
| <i>Myrophis punctatus</i> | Speckled worm eel |
| <i>Notemigonus crysoleucas</i> | Golden shiner |
| <i>Hybopsis amnis</i> | Pallid shiner |
| <i>Notropis atherinoides</i> | Emerald shiner |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Notropis buchmanii</i> | Ghost shiner |

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Pine Island Bayou Watershed (continued)

| Scientific Name | Common Name |
|--------------------------------|----------------------|
| <i>Notropis emiliae</i> | Pugnose minnow |
| <i>Notropis fumeus</i> | Ribbon shiner |
| <i>Notropis sabiniae</i> | Sabine shiner |
| <i>Notropis shumardi</i> | Silverband shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis volucellus</i> | Mimic shiner* |
| <i>Noturus gyrinus</i> | Tadpole madtom* |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Percina macrolepida</i> | Big scaled logperch* |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Percina shumardi</i> | River darter |
| <i>Phenacobius mirabilis</i> | Suckermouth minnow |
| <i>Pimephales vigilax</i> | Bullhead minnow |
| <i>Poxomis annularis</i> | White crappie |
| <i>Poxomis nigromaculatus</i> | Black crappie |
| <i>Pylodictus olivaris</i> | Flathead catfish |
| <i>Semotilus atromaculatus</i> | Creek chub |
| <i>Trinectes maculatus</i> | Hogchoker |

sources:

Halstead, B.G. 1981. Pine Island Bayou Watershed, Texas: A planning-aid report submitted to U.S. Army Corps of Engineers Galveston District. U.S. Fish and Wildlife Service, Galveston, TX.

Linam, G.W. and L.J. Kleinsasser. 1987b. Fisheries use attainability study for Pine Island Bayou. River Studies Report No. 6. Texas Parks and Wildlife Department, Austin, Texas.

* denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Piney Creek

| Scientific Name | Common Name |
|-------------------------------------|----------------------------|
| <i>Amerius natalis</i> | Yellow bullhead |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Centrarchus macropterus</i> | Flier |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Elassoma zonatum</i> | Banded pygmy sunfish |
| <i>Erimyzon oblongus</i> | Creek chubsucker |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma gracile</i> | Slough darter |
| <i>Etheostoma histrio</i> | Harlequin darter |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Hybognathus nuchalis</i> | Mississippi silvery minnow |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Minytrema melanops</i> | Spotted sucker |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Notemigonus chrysoleucas</i> | Golden shiner |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Notropis texanus</i> | Weed shiner |

*denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Piney Creek (continued)

| Scientific Name | Common Name |
|---------------------------|-----------------|
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |

sources:

Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

Bayer, C.W., J.R. Davis, S.R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. Texas aquatic ecoregion project: an assessment of least disturbed streams (draft). Texas Water Commission, Austin, Texas.

***denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.**

Fishes collected from Sandy Creek (Houston Co.)

| Scientific Name | Common Name |
|-------------------------------------|-------------------------|
| <i>Ameiurus melas</i> | Black bullhead |
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Erimyzon oblongus</i> | Creek chubsucker |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma gracile</i> | Slough darter |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis microphus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis sp.</i> | Juvenile sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Notemigonus chryoleucas</i> | Golden shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Semotilus atromaculatus</i> | Creek chub |

source: Kelly, J.P. 1995. An ichthyological survey of ten streams in the Davy Crockett National Forest, Texas. Masters Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

*denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Turkey Creek

| Scientific Name | Common Name |
|-------------------------------------|-------------------------|
| <i>Ammocrypta vivix</i> | Scaly sand darter |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Ichthyomyzon gagei</i> | Southern brook lamprey* |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Minytrema melanops</i> | Spotted sucker |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Mugil cephalus</i> | Striped mullet |
| <i>Notropis atrocaudalis</i> | Blackspot shiner |
| <i>Notropis volucellus</i> | Mimic shiner* |
| <i>Noturus gyrinus</i> | Tadpole madtom* |
| <i>Noturus nocturnus</i> | Freckled madtom* |
| <i>Percina macrolepida</i> | Bigscale logperch* |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |
| <i>Pylodictus olivaris</i> | Flathead catfish |

source: Moring, J.B. 2003. Baseline assessment of fish communities, benthic macroinvertebrate communities, and stream habitat and land use, Big Thicket National Preserve, Texas, 1999-2001. United States Geological Survey, Water Resources Investigations Report 03-4270, Austin, Texas

*denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Village Creek

| Scientific Name | Common Name |
|-------------------------------------|----------------------------|
| <i>Ammocrypta clara</i> | Western sand darter |
| <i>Ammocrypta vivix</i> | Scaly sand darter |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Aplodinotus grunniens</i> | Freshwater drum |
| <i>Carpoides carpio</i> | River carpsucker |
| <i>Ctenopharyngodon idella</i> | Grass carp |
| <i>Cyprinella lutrensis</i> | Red shiner |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Dorosoma cepedianum</i> | Gizzard shad |
| <i>Esox americanus vermiculatus</i> | Grass pickerel |
| <i>Etheostoma gracile</i> | Slough darter |
| <i>Fundulus chrysotus</i> | Golden topminnow |
| <i>Fundulus notatus</i> | Blackstripe topminnow |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Hybognathus nuchalis</i> | Mississippi silvery minnow |
| <i>Ichthyomyzon gagei</i> | Southern brook lamprey* |
| <i>Ictalurus punctatus</i> | Channel catfish |
| <i>Ictiobus bubalus</i> | Smallmouth buffalo |
| <i>Labidesthes sicculus</i> | Brook silverside* |
| <i>Lepisosteus oculatus</i> | Spotted gar |
| <i>Lepisosteus spatula</i> | Alligator gar |
| <i>Lepomis auritus</i> | Redbreast sunfish |
| <i>Lepomis cyanellus</i> | Green sunfish |
| <i>Lepomis gulosus</i> | Warmouth |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis marginatus</i> | Dollar sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lepomis punctatus</i> | Spotted sunfish |
| <i>Lepomis symmetricus</i> | Bantam sunfish |
| <i>Menidia beryllina</i> | Inland silverside |
| <i>Micropterus coosae</i> | Redeye bass |
| <i>Micropterus punctulatus</i> | Spotted bass |

*denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from Village Creek (continued)

| Scientific Name | Common Name |
|------------------------------|--------------------|
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Minytrema melanops</i> | Spotted sucker |
| <i>Morone saxatilis</i> | Striped bass |
| <i>Moxostoma poecilurum</i> | Blacktail redhorse |
| <i>Mugil cephalus</i> | Striped mullet |
| <i>Notropis amabilis</i> | Texas shiner |
| <i>Notropis atherinoides</i> | Emerald shiner |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis volucellus</i> | Mimic shiner* |
| <i>Noturus gyrinus</i> | Tadpole madtom* |
| <i>Opsopoeodus emiliae</i> | Pugnose minnow |
| <i>Percina sciera</i> | Dusky darter* |
| <i>Pimephales vigilax</i> | Bullhead minnow |
| <i>Pomoxis annularis</i> | White crappie |
| <i>Pylodictus olivaris</i> | Flathead catfish |

source: Moring, J.B. 2003. Baseline assessment of fish communities, benthic macroinvertebrate communities, and stream habitat and land use, Big Thicket National Preserve, Texas, 1999-2001. United States Geological Survey, Water Resources Investigations Report 03-4270, Austin, Texas

*denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.

Fishes collected from White Oak Creek

| Scientific Name | Common Name |
|--------------------------------|----------------------------|
| <i>Ameiurus natalis</i> | Yellow bullhead |
| <i>Ammocrypta vivax</i> | Scaly sand darter |
| <i>Aphredoderus sayanus</i> | Pirate perch |
| <i>Cyprinella venusta</i> | Blacktail shiner |
| <i>Elassoma zonatum</i> | Banded pygmy sunfish |
| <i>Etheostoma chlorosomum</i> | Bluntnose darter |
| <i>Etheostoma parvipinne</i> | Goldstripe darter* |
| <i>Fundulus olivaceus</i> | Blackspotted topminnow* |
| <i>Gambusia affinis</i> | Western mosquitofish |
| <i>Hybognathus nuchalis</i> | Mississippi silvery minnow |
| <i>Lepomis macrochirus</i> | Bluegill sunfish |
| <i>Lepomis megalotis</i> | Longear sunfish |
| <i>Lepomis microlophus</i> | Redear sunfish |
| <i>Lythrurus fumeus</i> | Ribbon shiner |
| <i>Micropterus punctulatus</i> | Spotted bass |
| <i>Micropterus salmoides</i> | Largemouth bass |
| <i>Notropis texanus</i> | Weed shiner |
| <i>Notropis volucellus</i> | Mimic shiner* |
| <i>Percina sciera</i> | Dusky darter* |

source: Bayer, C.W., J.R. Davis, S.R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. Texas aquatic ecoregion project: an assessment of least disturbed streams (draft). Texas Water Commission, Austin, Texas.

*denotes intolerant taxa. Intolerant species are typically the first species to disappear following a disturbance.