2.4 Ecology

2.4.1 Terrestrial Ecology

2.4.1.1 Site Habitats and Communities

The STP site is located within the coastal prairie ecosystem of east Texas, the southernmost tip of the tallgrass prairie system prevalent in the Midwest (Reference 2.4-1). This area is typified by low elevation, generally less than 60 feet above mean sea level (MSL), with open prairie habitat interspersed with creek and river drainages flowing toward the Gulf Coast marshes. The larger drainages often have bottomland forests. Much of the original coastal prairie in Matagorda County has been converted to croplands or is now in pasture. The STP site is immediately west of the Colorado River, approximately 10 miles from the river's confluence with Matagorda Bay. The STP site lies in a largely rural area, with the dominant land use being agricultural fields and pasture.

Current land use at the approximate 12,220-acre STP site is discussed in Section 2.2 and shown in Figure 2.2-1. Approximately 65 acres of the STP site consist of generating facilities, buildings, parking areas, a switchyard, and transmission line corridors associated with STP 1 & 2 (Subsection 2.2.1.1). Based on National Wetland Inventory coverage, there are approximately 7,600 acres of various types of wetlands within the STP boundary. These include 7,068 acres of lake habitat (including the Main Cooling Reservoir [MCR] and Essential Cooling Pond), 369 acres of freshwater emergent wetland, 119 acres of freshwater forested/shrub wetland, 25 acres of freshwater pond, and 10 acres of riverine wetlands. The dominant feature of the STP property is the approximately 7000-acre MCR (Reference 2.4-2), which occupies most of the lower two-thirds of the site.

The STP site landscape can be generally divided into bottomland and upland components (Figure 2.4-1). The bottomlands occupy approximately 1166 acres (9%) and occur along the site boundary with the Colorado River. Once a lush, deciduous forest, this area was historically modified through clearing and herbicide application to promote forage production for livestock. Although large patches of dense trees still exist, particularly near the river, much of the area is now present as pasture with dispersed individual or small patches of trees. Tree species found in the bottomlands include sycamore (*Platanus occidentalis*), pecan (*Carya illinoinensis*), sugarberry (*Celtis laevigata*), cedar elm (*Ulmus carrassifolia*), and red ash (*Fraxinus pennsylvanica*). Depressions and sloughs within the bottomlands receive drainage from the upland portions of the site, providing shallow wetland habitat used by many species of waterbirds and alligators (*Alligator mississippiensis*). One slough draining the uplands feeds the 34-acre Kelly Lake, located northeast of the MCR. Also within the bottomland area is a 133-acre U.S. Army Corps of Engineers (USACE) spoil impoundment that has received spoil from dredging operations on the Colorado River since 1972. Because of the negative impacts of the spoil accumulation on survival of woody vegetation, this activity has resulted in a semi-permanent marsh that provides habitat for waterbirds and other wildlife species (Reference 2.4-2).

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Uplands make up the remaining 90% of the STP site (Figure 2.4-1) and consist of scrubland (primarily sea myrtle, *Baccharis halimifolia*) and upland prairie/abandoned cultivated lands (Reference 2.4-2). There are non-jurisdictional wetlands (pending approval from USACE) and other water bodies, primarily surface water and storm water ditches, within these uplands (Reference 2.4-3). Embedded within the upland component are assorted impoundments and a managed wetland.

The MCR is an approximate 7000-acre impoundment (Figure 2.4-1) that was established on the property by the construction of tall earthen embankments. The reservoir side of this embankment was lined with "soil-cement" to prevent erosion, whereas the exterior was sodded and is maintained by periodic mowing. Approximately seven miles of interior dikes were placed within the MCR (Figure 2.4-1) to enhance circuitous water flow, maximizing cooling. The Essential Cooling Pond is an approximate 47-acre impoundment immediately to the east of STP 1 & 2, and also is surrounded by an earthen embankment that is covered with reinforced concrete and/or soil cement for erosion protection (Reference 2.4-2).

A managed 110-acre shallow wetland area (Texas Prairie Wetlands Project) was built in the northeastern portion of the site adjacent to FM 521 in 1996 to enhance the property for waterbirds (Reference 2.4-4). STPNOC cooperated with Ducks Unlimited, Texas Parks and Wildlife Department (TPWD), U.S. Fish and Wildlife Service (USFWS) and U.S. Department of Agriculture Natural Resources Conservation Service to construct impoundments designed to create foraging habitat for wintering waterfowl, wading birds, and shorebirds. These impoundments are included on the Great Texas Coastal Birding Trail that spans the entire Texas Gulf Coast (Reference 2.4-5).

The proposed 54-acre power block area for STP 3 & 4 consists of industrial land (existing buildings and parking areas), a mowed field, and a large drainage ditch running east-west through the site. The ditch is approximately 8 to 10 feet wide, and approximately 4 to 5 feet deep, although the water is restricted to a more narrow channel (approximately 2 to 4 feet wide) approximately 1 to 2 feet deep. Portions of the ditch margins are mowed to the water level, other portions are vegetated with small shrubs (sea myrtle) and aquatic grasses/rushes. The sites of both the proposed mechanical draft cooling towers (14 acres) and switchyard (15 acres) are relatively open, dominated by bluestem grasses (*Andropogon* spp.), blackberry (Rubus spp.) and sea myrtle, all plants common to disturbed or abandoned agricultural land in this region (Reference 2.4-2). Two construction parking areas (87 total acres) and a construction borrow and spoils area (142 acres) are located to the west and southwest of the proposed STP 3 & 4 power block area on open fields and lowlands. Several non-jurisdictional wetlands (pending approval from USACE) and water bodies exist in these areas (Reference 2.4-3).

Wildlife species found within the STP site are typical of those found in the east Texas coastal prairie system. Mammals include white-tailed deer (*Odocoileus virginianus*), feral pigs (*Sus scrofa*), gray fox (*Urocyon cinereoargenteus*), fox squirrels (*Sciurus niger*), and gray squirrels (*S. carolinensis*) (Reference 2.4-2). Hunting and/or trapping of game animals is not allowed on the STP site. However, contractors are hired to remove feral pigs from the STP site due to their tendency to disturb soils on the reservoir embankment and destroy more preferred habitats.

Species of resident birds at STP include turkey vultures (*Cathartes aura*), black vultures (*Coragyps atratus*), crows (*Corvus* spp.), grackles (*Quiscalus* spp.), cardinals (*Cardinalis cardinalis*), red-winged blackbirds (*Agelaius phoeniceus*), bobwhite quail (*Colinus virginiana*) and mourning doves (*Zenaida macroura*). Wild turkeys (*Meleagris gallopavo*) and ring-necked pheasant (*Phasianus colchicus*) have been observed on the STP site; however, they are thought to be released, pen-reared birds that crossed over to the site. Many different species of wading birds have foraged in STP wetlands including wood storks (*Mycteria americana*), roseate spoonbills (*Ajaia ajaja*), great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), white-faced ibis (*Plegadis chihi*), white ibis (*Eudocimus albus*), and little blue herons (*Egretta caerulea*) (Reference 2.4-2). Other waterbirds using the site included white pelicans, laughing gulls (*Larus atricilla*), cormorants (*Phalacrocorax* spp.), anhingas (*Anhinga anhinga*), and kingfishers (*Ceryle alcyon*). A variety of waterfowl species use STP wetlands, including American coots (*Fulica americana*), teal (*Anas* spp.), and shovellers (*Anas clypeata*) (Reference 2.4-2). Waterfowl observed on the MCR in 1987 included 16 duck species and 3 species of geese (Reference 2.4-6). These observations confirmed that the waterfowl community of the reservoir was shifting from dabbling ducks to diving ducks as a response to initial reservoir filling.

Waterbirds were first observed nesting on the MCR dikes in 1986. The dikes in the MCR have been monitored annually since 2000 for the occurrence of nesting waterbirds as part of the Texas Colonial Waterbird Surveys (Reference 2.4-7). Waterbirds nest on terminal ends of the "Y" dike (see Figure 2.4-1) used to direct water flow in the reservoir. The STP colony has been dominated by nesting laughing gulls (*Larus atricilla*) and gull-billed terns (*Sterna nilotica*), which constitute approximately 53% and 31% of the nesting birds in the STP colony (Table 2.4-1). Lower numbers (with typically <100 nests each) of seven additional bird species nest with them on the reservoir. Matagorda County contains many other water bird colonies (Reference 2.4-7). In 2005, there were five total colonies in Matagorda County containing approximately 11,500 total water bird nests. Total waterbird nests observed in the county during the period from 2000–2004 were even higher, with estimates of approximately 20,000 nests each year.

The east coast of Texas, including Matagorda County and STP, is at the terminus of the Central Flyway migration route, resulting in the occurrence of many different species of avifauna during the fall, winter, and spring months (Reference 2.4-8). Thousands of migrating birds, especially waterfowl, from the cooler regions of the North American continent visit or winter in the coastal zone of Texas. Other migrants traveling to or from Central and South America use this region of Texas as an important stopover point before continuing their travels.

The STP site is part of the Matagorda County – Mad Island Christmas Bird Count (CBC). The Mad Island CBC has been among the top five CBCs nationwide every year since 1993 in regards to total number of species observed (References 2.4-8 and 2.4-9). In 2006, 233 bird species were observed in the 15-mile diameter circle including the STP site (circle center: 28° 40.99'N, 95°58.99'W). Since 2000, the total number of species observed in the circle has ranged from 231–250 avian species. The Great Texas Birding Classic is held annually in mid-April during spring migration along the Texas Gulf Coast. Matagorda County is in the "central coast" region of this Classic, along with 18 other counties to the south and west, including the Corpus Christi area. Classic participants visit the STP site but do not classify their bird sightings as specific to the STP site. In 2006, 190 avian species were observed in the central coast region (Reference 2.4-10).

The USFWS is responsible for designating lands as "critical habitat" for federally listed endangered and threatened species. Such lands are protected to aid the recovery of the species and may require special management activities. No area designated by the USFWS as critical habitat is found within or adjacent to the STP site. The nearest critical habitat is a wintering area for federally threatened piping plovers (*Charadrius melodus*) along Matagorda Bay and Matagorda Peninsula, approximately 7-8 miles south of STP (Reference 2.4-11). Wintering habitat for the endangered whooping crane (*Grus americana*) is located approximately 35 miles southwest of the STP site in Aransas and Calhoun Counties (Reference 2.4-12).

Historically, only two federally listed species have been observed within the STP site boundary (Reference 2.4-2)—the bald eagle (*Haliaeetus leucocephalus*) and the American alligator. The bald eagle was recently delisted under the Endangered Species Act (Reference 2.4-13), but remains listed as threatened by the state of Texas. The bald eagle will remain federally protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Bald eagles are present year-round throughout Texas as spring or fall migrants, breeders, or winter residents. Breeding eagles are primarily found in the eastern half of Texas. Nesting occurs in Matagorda County, with a typical nesting season of October through July. A single nest, first reported in 2004, is located in remote woodlands within the southeastern boundary of the STP site, near the Colorado River. There have been other active nests near the STP site since at least 1992. The productivity (i.e., number of young fledged) of the nest on the STP site and nearby nests has not been reported by state and/or federal agencies. American alligators are listed as threatened by the USFWS due to similarity of appearance to the endangered crocodile (Crocodylus acutus), which is found only in Florida. Alligators have been observed in the MCR and most wetland portions of the STP site.

A more recent visitor to the STP site is the federally threatened brown pelican (*Pelecanus occidentalis*), which nests as close as Matagorda Bay (Reference 2.4-7). This species has been observed at the MCR, where it is visiting presumably to drink fresh water, rest, and/or possibly forage.

Matagorda County has 23 animal species that are either federally or state listed as endangered or threatened, including the bald eagle, brown pelican, and alligator (References 2.4-14 and 2.4-15). It should be noted that information about federally listed species on the state and federal Web sites occasionally differ, with the state including all counties within the historical range of these species and the federal listing including only counties with sightings. As a conservative approach, STPNOC has included species in counties from both listings. Also, STPNOC acknowledges that these listings reflect only recorded or historical occurrences and the possibility exists that other (unrecorded) rare species might occur in this county. STPNOC has initiated consultations with the USFWS, the National Oceanographic and Atmospheric Administration (NOAA), and TPWD regarding endangered and threatened species (References 2.4-16, 2.4-17, and 2.4-18).

Several species listed for Matagorda County have been subject to loss of their specific habitats as humans settled the area and altered the natural landscape to a more open and managed agricultural landscape. Once found throughout eastern Texas, the red wolf's (*Canis rufus*) decline was linked to these land use changes which reduced their more forested habitats and enhanced that of the coyote (*Canis latrans*), resulting in a population overlap. Subsequent interbreeding between the two canine species has effectively resulted in the extirpation of the red wolf from Texas (Reference 2.4-19). The ocelot (*Leopardus pardalis*) was a neotropical cat found in large, dense thickets of thorny shrubs. With the loss of vast areas of this habitat, ocelots are now limited to a few isolated areas in southern Texas (Reference 2.4-20). The Louisiana black bear (*Ursus americanus luteolus*), one of 16 subspecies of American black bear, was once common in the forested area of the eastern region of Texas. Due to hunting and habitat loss, this subspecies was presumed to be extirpated from this area by the 1940s, and any recent sightings are thought to be dispersing juveniles from Louisiana (Reference 2.4-20). The Eskimo curlew (*Numenius borealis*), a victim of over-hunting and the conversion of open and coastal prairie habitats to agriculture, was once an abundant migrant of the Texas prairie. It may now be extinct. The last verified sighting of an Eskimo curlew occurred on the "coast of Texas" in 1987 (Reference 2.4-20). Five species of sea turtles are federally listed for Matagorda County, including: loggerhead sea turtles (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (Eretmochelys imbricate), and the Kemp's ridley sea turtle (*Lepidochelys kempii*). All nest on seaward sandy beaches and thus are not affected by STP, its operation or proposed expansion. Given the changes to habitats in and around the STP site, it is highly unlikely that any of these listed species would be impacted by activities on the STP site.

"Important species" are defined in the Environmental Standard Review Plan for Environmental Reviews for Nuclear Plants (NUREG-1555) (Reference 2.4-21) as those that are federally or state listed as threatened or endangered, proposed for listing as threatened or endangered (see Table 2.4-2), commercially or recreationally valuable, essential to the maintenance or survival of species that are rare or commercially or recreationally valuable, critical to the structure and function of the local terrestrial ecosystem, or that serve as biological indicators. Game species fall within the "commercially or recreationally valuable" species category. The primary game species at the STP site are white-tailed deer, feral pigs, gray squirrel, northern bobwhite, mourning dove, and numerous species of waterfowl (Reference 2.4-2). No travel corridors for game species cross the STP site, with the exception that migratory waterfowl use the MCR and other site impoundments and wetlands during migration.

Important habitats, as defined under NUREG-1555, include wildlife refuges, sanctuaries, or preserves, habitats identified by federal or state agencies as rare or to be protected, wetlands, floodplains, other resources specifically protected by federal or state regulation, or land areas identified as critical habitat for threatened or endangered species. The Texas Prairie Wetland Project in the northeast portion of the site is the closest refuge-like habitat to the proposed construction site, being approximately 200 yards from the new switchyard site. Wetlands exist on the STP site; however, there are no jurisdictional wetlands within the proposed construction and laydown/spoils sites (Reference 2.4-3).

The Mad Island Wildlife Management Area is approximately three miles due south of the STP site and was established to preserve coastal wetland habitat for wintering waterfowl. It is also beneficial to cranes, alligators, and other local wildlife. It occupies 7200 acres of fresh-to-brackish marsh with sparse brush and flat coastal prairie (Reference 2.4-22).

The 7063-acre Clive Runnells Family Mad Island Marsh Preserve is approximately four miles southwest of the STP site and contains both upland prairie and a variety of coastal wetlands (Reference 2.4-8). The preserve, operated by the Runnells family and The Nature Conservancy, is actively managed to enhance ricefields and wetlands for resident and migratory waterbirds.

The Big Boggy National Wildlife Refuge borders Matagorda Bay, approximately nine miles southeast of the STP site. It consists of 5000 acres of rice fields, managed impoundments, and salt marsh habitat, and was established to preserve habitat for neotropical migrating birds in the fall and spring, wintering waterfowl, and other bird life (Reference 2.4-23). Within the refuge, Dressing Point Island is an important bird rookery for many species of waterbirds, including the federally listed brown pelican.

Although the STP site hosts such potential disease vectors as ticks and mosquitoes, no vector-borne diseases have been reported to STPNOC.

2.4.1.2 Transmission Line Corridor Habitats and Communities

STP 3 & 4 will use the existing transmission lines' rights-of-way. The existing transmission lines generally pass through typical habitats associated with the coastal prairie region of east Texas—agricultural fields, pasture/rangeland, and some forests. However, the westward transmission lines reach into the Texas "Hill Country," with different habitats such as Edwards Aquifer springs and karst areas. Land use along the existing transmission line corridors is listed in Table 2.2-4. No areas designated by the USFWS as a "critical habitat" for endangered or threatened species are crossed by these corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas.

Endangered and threatened species known to occur in the counties crossed by existing transmission corridors are listed in Table 2.4-2. The list is based on classifications of the USFWS (Reference 2.4-15) and TPWD (Reference 2.4-14). However, these lists are based on either recorded occurrences or historical ranges of species, and the possibility exists that other protected species might exist in the counties crossed by the existing corridors.

The transmission line rights-of-way are maintained by the transmission service providers that own and operate those transmission lines: CenterPoint Energy (CNP), AEP Texas Central Company (TCC), City of Austin (Austin Energy), and the City Public Service Board of the City of San Antonio, TX (CPS). As discussed in Subsection 2.2.2.2, no additional transmission line rights-of-way are required to support STP 3 & 4.

2.4.2 Aquatic Ecology

The surface water bodies of interest, those that could be potentially affected by construction and operation of STP 3 & 4, include onsite sloughs, drainage areas, wetlands, and impoundments; the lower Colorado River; and Matagorda Bay (see Figures 2.4-1 and 2.4-2). The section that follows describes the aquatic communities of each of these surface water bodies.

2.4.2.1 Aquatic Communities

2.4.2.1.1 Onsite Sloughs, Drainage Areas, Wetlands, and Impoundments

Several sloughs, drainage areas, wetlands, and impoundments occur on or near the site:

- Little Robbins Slough, which drains into a coastal marsh north of Matagorda Bay
- Drainage areas associated with two unnamed sloughs
- Main Cooling Reservoir (7000 acres)
- Essential Cooling Pond (47 acres)
- Kelly Lake (34.4 acres) and the slough that feeds it

Twelve small non-jurisdictional wetlands (pending approval from USACE) occur in the area potentially affected by construction and operation of STP 3 & 4. The wetlands were identified using standard delineation techniques, including hydrology, vegetation, and soil characteristics (Reference 2.4-3). These non-jurisdictional wetlands, which total 3.9 acres, are shown in Figure 2.4-3.

Aquatic species known or expected to use these habitats are described below.

2.4.2.1.1.1 Aquatic Species in Sloughs and Wetlands

The aquatic species that occur in sloughs, drainage areas, and wetlands on the STP site are common and easily located in nearby waters. The construction-phase Final Environmental Statement (FES) (Reference 2.4-24) listed species common in wetlands near the site, including the grass shrimp (Palaemonetes kadiakensis), crayfish (several genera occur in the area) (Reference 2.4-25), blue crab (*Callinectes sapidus*), red shiner (*Cyprinella lutrensis*), mosquitofish (*Gambusia affinis*), silverband shiner (*Notropis shumardi*), sailfin molly (*Poecilia latipinna*), green sunfish (*Lepomis cyanellus*), warmouth (*Lepomis gulosus*), bluegill (*Lepomis macrochirus*), white crappie (*Pomoxis annularis*), tidewater silverside (*Menidia peninsulae*), striped mullet (*Mugil cephalus*), and several species of killifish (Family *Cyprinodontidae*, likely *Lucania* sp. and *Fundulus* spp.). Most of these common species tend

to be tolerant of salinity and temperature fluctuations, and are ubiquitous in coastal wetlands along the Gulf Coast.

In addition to the crustaceans mentioned above, important aquatic invertebrate species in the wetlands are the juvenile stages of flying insects. Although the wetland areas themselves are considered a sensitive and valuable resource, the particular wetlands that would be impacted on the STP site are not substantively distinguishable from other wetlands in the vicinity. The FES (Reference 2.4-24) indicated that the rerouting of Little Robbins Slough would cause declines in several insect populations, including midges, beetles, mayflies, biting midges, dragonflies, and damselflies; potential impacts were considered acceptable because these ubiquitous species readily recolonize available surface waters, and so would not be lost to the area.

As part of the review of the original license application for STP 1 & 2, the USFWS provided a Section 7 consultation, under the Endangered Species Act Amendments of 1978 (PL 95-632) stating that no endangered or threatened aquatic species occurred near the site (Reference 2.4-26). No endangered or threatened species, nor critical habitat for such species, were observed during an ecological survey of the site conducted in 2007 (Reference 2.4-3).

In May 2007, STPNOC commissioned a rapid bioassessment of the 1500-meter-long drainage ditch that crosses the area slated for construction (Reference 2.4-63). The bioassessment was intended to characterize the water quality and fish community of the ditch before its relocation, supporting the assessment of construction impacts. Fish collections from the STP site ditch system were dominated by mosquitofish, sunfish (largemouth bass [*Micropterus salmoides*] and three common *Lepomids*), sailfin molly, and sheepshead minnow (*Cyprinodon variegatus*). No rare or unusual species were collected. Most of the species collected are tolerant of salinity and temperature fluctuations, and are common to ubiquitous in coastal wetlands along the Gulf Coast.

2.4.2.1.1.2 Aquatic Species in the MCR and Essential Cooling Pond

Records of fish caught in the MCR provide a partial list of species that occur in the reservoir. In a September 1994 catch-and-release fishing tournament for employees, the most commonly caught species were redfish (red drum [*Sciaenops ocellatus*]) and catfish (presumably blue catfish (*Ictalurus furcatus*), but tournament records did not differentiate among catfish species); other species landed included black drum (*Pogonias cromis*), common carp (*Cyprinus carpio*), and largemouth bass. One specimen each of gar (*Lepisosteus osseus*), croaker (*Micropogon undulates*), and Southern flounder (*Paralichthys lethostigma*) was reported.

Fish species other than those caught during the tournament occur in the MCR. Some species, such as striped mullet, do not readily take lures and are difficult to catch using traditional hook-and-line methods. Other species, such as sheepshead minnow and naked goby (*Gobiosoma bosc*), are below the size normally targeted by anglers. Invertebrates such as blue crab may also occur in the reservoir. STPNOC is currently undertaking a study to characterize the relative abundance of fish species in the MCR.

A 2002 survey of the Essential Cooling Pond yielded two fish species—the sailfin molly and the sheepshead minnow (Reference 2.4-27). Both of these species likely occur in the onsite wetlands and sloughs as well. Both sailfin molly and sheepshead minnow are known to tolerate high temperatures, wide salinity ranges, and low dissolved oxygen levels. Both are ubiquitous in south Atlantic Coast and Gulf Coast estuaries.

2.4.2.1.2 Colorado River

The Colorado River rises in Dawson County in the High Plains of west Texas, flows southeastward across the Rolling Plains and Edwards Plateau, turns eastward and then southeastward to cross portions of the Blackland Prairie and Post Oak Savannah, finally moving across the Gulf Coast Prairie and Marshes of Wharton and Matagorda Counties to empty into Matagorda Bay (Figure 2.4-2). The largest river entirely within the state of Texas, the Colorado River, is 862 miles long and has a drainage area of approximately 42,000 square miles (Reference 2.4-28). Major tributaries, from upstream to downstream, are the Concho River, Pecan Bayou, San Saba River, Llano River, and Pedernales River.

The lower Colorado River has been described as "a coastal plains run of immense natural scenery and little development" (Reference 2.4-29). It is a popular destination for paddlers, fishermen, and birdwatchers. Most adjoining land is privately owned, and access is limited, but plenty of sand and gravel bar islands, as well as riverbanks, can be found for camping or overnight trips. The river is "wide, deep, and slow-moving," with "plenty of water for recreational use at all times" (Reference 2.4-30). Fishermen pursue largemouth bass, sunfish, and several species of catfish in the stretch of the river between Bay City and Matagorda Bay Discharge at a gauging station near Bay City, approximately 20 miles upstream from STP, ranged from 375 cubic feet per second (cfs; lowest annual daily mean) to 14,270 cfs (highest annual daily mean) over water years 1948–2004 and averaged (annual daily mean) 2,628 cfs (Reference 2.4-31). Flows tend to be highest in late spring-early summer and lowest in late summer and early fall.

The Colorado River is tidally influenced in the vicinity of the STP site, which is at river mile 14.6, upstream from Matagorda Bay. The tidal influence extends as far as 32 miles upstream of Matagorda Bay under conditions of low flow (Reference 2.4-2). The extent of tidal influence depends on tidal amplitude at the mouth of the river and the freshwater flow in the river. Tidal elevations are influenced by wind conditions. In general, the heights of both high and low tides are increased by onshore winds and decreased by offshore winds (Reference 2.4-2).

Salt water may move as far as 24 miles upstream of Matagorda Bay, along the bottom of the Colorado River (Reference 2.4-2). Salinities less than 0.5 parts per thousand (ppt) are generally regarded as limnetic or "fresh," while salinities greater than 0.5 ppt are generally regarded as indicative of brackish water. Salinities in the vicinity of STP are generally near fresh, ranging up to 8 ppt in most years. During drought periods, when freshwater flows are substantially reduced, salinities can get higher, falling into the 8 to 20 ppt range.

In 1973, as part of the preoperational monitoring of the Colorado River, Houston Lighting & Power Company (HL&P) (Reference 2.4-2) measured salinities at a series of stations up- and downstream of the STP site. Salinities upstream of the plant and in the vicinity of the plant were always low, characteristic of fresh water. Salinities at a station immediately downstream of the plant were always low at surface, but were brackish (15.2 ppt) at the bottom in June, indicative of a salt wedge moving upstream almost to the STP site.

The Lower Colorado River Authority (LCRA) maintains a network of gauges that monitor water quality and meteorological conditions throughout the lower Colorado River watershed, including a station at Selkirk Island, in the general vicinity of the STP blowdown pipeline. From 1997 through 2006, salinities ranged from "under scale" (fresh) to 19 ppt (Reference 2.4-30). In some years, such as 1997, all samples were classified as "fresh." In most years, however, salinities ranged from under-scale/fresh to 5 ppt, with highest values in summer and early fall. In the year 2000, however, all samples were brackish, with salinities ranging from 2.3 ppt to 19 ppt (Reference 2.4-32). Flows were high in 1997, with 4,570,000 acre feet (approximately 6300 cubic feet per second) of water flowing into Matagorda Bay from the Colorado River basin, whereas 2000 was a low-flow year, with 718,000 acre feet (approximately 1000 cubic feet per second) flowing into Matagorda Bay (Reference 2.4-32).

2.4.2.1.2.1 Aquatic Communities of the Colorado River

The composition of the aquatic community of the lower Colorado River in the area of the STP site is directly influenced by salinity gradients in the river, which are in turn affected by precipitation and freshwater inflows from upstream in the Colorado River basin. As freshwater flows increase and salinities decrease, the riverine freshwater fish community from upriver locations displaces the estuarine species, which move further downstream. During low-flow periods (droughts), the salinity increases and more marine and estuarine species move into the lower river.

The construction-phase Environmental Report (ER) (Reference 2.4-2) for STP 1& 2 contains detailed descriptions of the aquatic communities of the lower Colorado River and Matagorda Bay, which are summarized in the construction-phase FES (Reference 2.4-24). Because much of the monitoring took place during a wet period (1973–1974) when the Colorado River was running high and fresh, the NRC required HL&P to conduct additional surveys. Additional studies of the lower Colorado River were subsequently conducted in 1975–1976 ("Phase 1") and 1983–1984 ("Phase 2"). These studies are summarized in the operations-phase FES (Reference 2.4-26).

Phytoplankton

The lower Colorado River and an adjacent stretch of the Intracoastal Waterway were surveyed for phytoplankton in the summer of 1973. A total of 216 taxa representing 94 genera and five major divisions were collected. Although several groups were abundant, phytoplankton samples were typically dominated by diatoms and green algae. Blue-green "algae" (now commonly referred to as cyanobacteria) and dinoflagellates were common in July surface-water samples, but diatoms were more numerous in bottom-water samples (Reference 2.4-2). The 1974 ER notes, on page 2.7-12, that the lower Colorado River appears to provide a "relatively stable environment which allows development of a moderately diverse plankton flora." The 1974 ER also observes that stressful conditions (i.e., high-water temperatures) appeared to

produce increases in numbers of "opportunistic" groups such as Cryptomonads and blue-green algae (cyanobacteria). Blue-green algae, in particular, are often associated with degraded water quality, specifically with nutrient enrichment and eutrophication.

Zooplankton

A total of 144 zooplankton species were collected in 1973 (Reference 2.4-2). Most of these were protozoans (65 species) and rotifers (52 species). In addition, 11 copepod species and 6 cladoceran species were collected. Zooplankton community structure was strongly related to salinity. During periods of low river flow and strong incoming tides, species diversity increased at upstream stations. At these times, species normally associated with brackish waters were carried further upstream than normal with the tidal pulse and were able to survive because of higher salinities (Reference 2.4-2).

Benthos

Studies of the Colorado River in the vicinity of the STP site in the 1960s, before construction of STP 1 & 2, had found the area to be "a stressful environment" for benthic organisms, with a low number of benthic organisms and low species diversity (Reference 2.4-2). These studies showed the number of taxa and the number of individuals to decrease from the mouth of the river upstream, with lowest diversity and numbers in the area of the STP site, which is the transition zone from fresh to brackish (Reference 2.4-2).

Studies of benthos in 1973 also indicated "a general sparsity of species with number of taxa and mean number of organisms per square meter increasing toward the Gulf as salinity increased" (Reference 2.4-2). Aquatic insects and oligochaetes were common at upstream study stations, in the vicinity of the STP site, but were uncommon at downriver stations closer to Matagorda Bay. Conversely, polychaetes dominated collections from downstream study sites and were largely absent at upstream sites (Reference 2.4-2). This is as would be expected because aquatic insects and oligochaetes are normally associated with fresh waters, while polychaetes are normally associated with estuarine and marine waters.

Ichthyoplankton

The Matagorda Bay estuary is a nursery area for many Gulf of Mexico fish species. STP biologists collected 59 fish taxa in surveys of ichthyoplankton conducted in 1973 (Reference 2.4-2). As was the case with benthic organisms, densities and diversity increased from upstream to downstream sampling stations. Upriver stations (1, 2, and 3) in the vicinity of STP contributed less than one percent of the total catch of eggs and larvae (Reference 2.4-24). Densities of eggs and larvae were highest in fall and spring. Recreationally and commercially important species and groups in collections included croakers, menhaden (*Brevoortia patronus*), shad (*Alosa* spp.), sardines, anchovies (*Anchoa* spp.), blue and channel catfish (*Ictalurus punctatus*), seatrout (*Cynoscion* spp.), drums, flounders (*Paralichthys* spp.), and soles (Fam. *Pleuronectidae*) (Reference 2.4-24).

Juvenile and Adult Fish

Baseline data on fishes of the lower Colorado River was collected in 1973 and 1974. Fish were collected using gill nets, seines, and trawl nets. Ninety-one marine, estuarine, and freshwater fish species were captured over a 12-month period (Reference 2.4-24, Appendix B, Table B.7). Marine and estuarine species regarded as commercially important, recreationally important, or important as forage included Gulf menhaden, bay anchovy, spotted and sand seatrout (*Cynoscion nebulosus* and *C. arenarius*), spot (*Lutjanus* spp.), Atlantic croaker, red and black drum (*Sciaenops ocellatus* and *Pogonias cromis*), and southern flounder (Reference 2.4-24, Appendix B, Table B.7). Important freshwater species included blue and channel catfish, smallmouth buffalo (*Ictiobus bubalus*), and several sunfish (*Lepomis*) species.

River flow, through its influence on upstream movement of the salt wedge, appeared to be the most important factor in determining abundance and distribution of fish at the Colorado River sampling stations (Reference 2.4-24). During periods of high flow, relatively few fish were caught, and most of these were freshwater species. Low river flow allowed the salt water to move further upstream, bringing along marine and estuarine fishes, which dominated collections at these times. Periods of low flow, therefore, corresponded with largest catches of fish. Midriver and downriver stations generally produced more species and greater numbers of fish than upriver stations, because young-of-the-year (of estuarine species) tended to be concentrated in these areas rather than further upstream (Reference 2.4-24). Station 2, at the site of the future the STP site makeup intake structure, generally produced the smallest catches in terms of number and biomass.

Additional fish studies were conducted over the 1975–1976 and 1983–1984 periods to "further refine the assessment of impact potentials" (Reference 2.4-26). Earlier surveys and studies had been conducted during a period of unusually heavy rainfall and freshwater flows, casting some doubt on the usefulness of the studies. The 1975–1976 and 1983–1984 studies are discussed in Section 5.3.1, as they relate more to impingement and entrainment impacts than to the general ecology of the Colorado River.

2.4.2.1.3 Matagorda Bay

The Colorado River flows into Matagorda Bay approximately 10 miles downriver of the STP site. Matagorda Bay is the third largest estuarine system in Texas, after the Laguna Madre Bay and Galveston Bay systems (Reference 2.4-34). Freshwater input to Matagorda Bay comes primarily from the Colorado and Lavaca Rivers, but numerous smaller streams also contribute. The average daily inflow from all sources is approximately 5300 cfs (Reference 2.4-34). It is relatively shallow, with an average depth of about two meters (6.5 feet). The average salinity is approximately 19 ppt.

The Matagorda Bay system (the Bay) encompasses a number of smaller embayments: East Matagorda Bay, Karankawa Bay, Tres Palacios Bay/Turtle Bay, and Lavaca Bay. The Bay has a surface area of 422 square miles (Reference 2.4-34). Matagorda Bay is separated from the Gulf of Mexico by the Matagorda Peninsula, with most water exchange occurring through five tidal inlets.

The Matagorda Bay estuary supports marine and estuarine fishery species of economic importance, including Gulf menhaden, bay anchovy, sheepshead (*Archosargus probatocephalus*), Atlantic croaker, sand and spotted seatrout, black drum, and red drum. Seagrass beds line the northern shores of Matagorda Peninsula and Matagorda Island, and the eastern shore of Matagorda Bay, providing essential forage and cover for juvenile fish of recreational importance (Reference 2.4-35). The dominant species is shoalgrass (*Halodule beaudettii*), with healthy stands of widgeon-grass (*Ruppia maritima*) and turtlegrass (*Thalassia testudinum*). In 1999, approximately 3830 acres of seagrasses were estimated to grow in Matagorda and East Matagorda Bays (Reference 2.4-35).

Juveniles and adult marine fish forage in the tidal salt marsh habitat in Matagorda Bay. The decaying leaves of marsh plants, and the organic waste produced by fishes and invertebrates, provides a nutritional base for the complex food web that supports recreationally and commercially important fisheries (Reference 2.4-36). The commercial shrimp industry is Texas' most valuable commercial fishery with ex-vessel shrimp landings during 2000 valued in excess of $230 million (Reference 2.4-37).

In the northern and eastern sections of the Bays, oyster (*Crassostrea virginica*) reefs provide additional forage and shelter. Oyster reefs increase the habitat value for finfishes substantially by providing structural complexity, attachment sites for invertebrate prey species, crevices for spawning and rearing fry, shelter from predators, and other services. In the early 20th century, Matagorda Bay produced about half of the oysters in Texas (Reference 2.4-36). An accidental hydrologic alteration in the late 1920s degraded conditions for oysters as well as other estuarine-dependent organisms. Oyster production was further restricted by excessive removal of shell substrate, saltwater intrusion via the Matagorda Ship Channel and the Gulf Intercoastal Waterway, and the explosion of oyster parasites and predators (Reference 2.4-36). In 1992, a project to restore the original function of Matagorda Bay was undertaken. The Colorado River was rerouted back into the Matagorda Bay so that freshwater flows of water and sediment would once again pour into the Bay and nourish the tidal marshes (Reference 2.4-38). The project was considered a success, and oyster production has increased since then (Reference 2.4-36).

In the open-water habitats of Matagorda Bay, invertebrates thrive in silty substrates. Plankton blooms support a complex benthic invertebrate food web that includes filter feeders, deposit feeders, scavengers, and mobile predators (including polychaete worms, mollusks, crabs, and shrimp). Crabs and shrimp prey upon the polychaetes and mollusks. Roving schools of spotted sea trout, redfish, and flounder forage heavily in these open areas. Matagorda Bay is second only to Galveston Bay in commercial fisheries value in Texas.

The relative abundance of important fish and shellfish in various salinity zones in the Matagorda Bay estuary is summarized in Table 2.4-3 (based on data in Reference 2.4-39). The importance of this profile is that the salinity of the water at the STP site will determine to a large extent the composition and life stages of species present in the area. Regardless of which species or life stages are in the estuary at a given time, high freshwater flows tend to keep many of them from moving up the river as far as the STP site. Conversely, low river flows, and the concomitant saltwater intrusion, allow greater movement of estuarine and marine species upriver.

Long-term catch data in Matagorda Bay shows that populations of most commercial, recreational, and forage species have either remained stable or increased over the past two decades since STP 1 & 2 became operational. Selected analytical studies are summarized briefly below:

- Wilbur, D. H. and R. Bass. 1998. "Effect of the Colorado River Diversion on Matagorda Bay Epifauna." Estuarine, Coastal, and Shelf Science, Volume 47(3):309-318.

- Martinez-Andrade, Campbell and Fuls. 2005. Trends in Relative Abundance and Size of Selected Finfishes and Shellfishes Along the Texas Coast: November 1975 – December 2003. Texas Parks and Wildlife Management Data Series No. 232.

- Lower Colorado River Authority (LCRA), Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife, and Texas Water Development Board. Matagorda Bay Freshwater Inflow Needs Study (FINS). August 2006.

The USACE diverted the lower Colorado River into the eastern arm of Matagorda Bay in 1991 to create habitat, increase nutrients and moderate salinity; the overall goal was to improve fisheries productivity. Wilbur and Bass (Reference 2.4-38) evaluated several long-term data sets that included fisheries abundance in various parts of the bay before and after the diversion. The expectation was that the diversion would be shown to have had a significant positive effect on at least some important species such as white shrimp, brown shrimp, blue crab, croaker, anchovy, or menhaden. However, none of the data sets indicated significant shifts in species abundance, despite substantial habitat changes, such as the growth of a deltaic marsh at the end of the diversion cut. This study points out that, relative to other Gulf of Mexico estuaries, the Colorado River has a small average discharge (76.5 m^3/s) compared with the size of Matagorda Bay (1070 km); in fact, when the flow is less than 14 m^3/s (500 cfs) at the Wharton gauge, the Colorado River does not discharge at all. The authors noted that there were no diversion-related differences in abundance for any important species monitored by the TPWD, and that blue crab and shrimp landings “did not exhibit any unusual deviations from historical interannual variability.”

Texas Wildlife and Parks Coastal Fisheries Division samples the nine major bay systems in Texas to monitor relative abundances of fishes and shellfishes (Reference 2.4-40). Their samples are independent of fisheries pressures, which can skew data away from representing ecologically relevant abundances. Trends in relative abundance of important species in East Matagorda Bay, Matagorda Bay, and the entire Texas coast are presented in Table 2.4-4 for several sample types: (1) gill nets in spring, (2) gill nets in fall, (3) bag seines, and (4) trawls.

The data clearly shows that populations of fishes and shellfishes in the Matagorda Bay estuary, and, by extension, the tidal reaches of the lower Colorado River, have either remained stable or increased since 1985. This pattern holds even for species that have experienced a decline statewide, such as blue crab and white shrimp. Based on the data available, all Texas bays experienced below-average catch rates of shrimp in 2005; the small size of the shrimp was also of concern. Matagorda Bay experienced one of the lowest catch-per-unit effort as compared to the 1986 through 2005 historical averages. Small shrimp predominated in all Texas bays. The dominant size category in San Antonio and Galveston Bays was 81–100; all other Texas bays had 100+ counts per pound shrimp (Reference 2.4-41).

A cooperative group of several Texas government agencies prepared an independent analysis of the long-term fisheries-independent data collected by the TPWD in Matagorda and East Matagorda Bays (Reference 2.4-33). The study concluded that the current health and productivity of Matagorda Bay is generally good, and gave as evidence the approximately $63 million that Matagorda Bay generates annually in commercial seafood harvests, and the $115 million annually the Bay contributes to the sport fishing industry (Reference 2.4-31). The current freshwater inflows have helped maintain the health and productivity of the bay, although the study acknowledges that a host of complex factors that are not yet fully understood interact to affect the overall productivity of the bay.

An LCRA study conducted in 2006 provides a summary of the economic value of the ecological services provided by Matagorda Bay, with particular reference to its role as habitat for estuarine-dependent fish and shellfish. For example, commercial fishermen in Texas landed an estimated 95.2 million pounds of fish, shrimp, crabs and oysters in 1999. Shrimp are the most valuable resource along the Texas coast, accounting for 81% of the harvest and 88% of the dockside value in 1999 (Reference 2.4-33). Commercial shrimpers in the Matagorda Bay system landed one-fourth of the total shrimp catch from all Texas bays, representing 27% of the dockside value, on average, from 1995 to 1999 (total dockside value was $219 million in 1999 dollars). As reported in the LCRA study, a Texas A&M University study in 1995 estimated that the Matagorda estuary contributed 1,847 jobs and $71.86 million to commercial fishing (gulf and bay). Since the study was published, both landings and economic impact have increased.

2.4.2.2 Important Species of Lower Colorado River and Matagorda Bay

NOAA's Estuarine Living Marine Resources program was developed to provide a consistent database of the distribution, abundance, and life history characteristics of important fishes and invertebrates in U.S. estuaries (Reference 2.4-42). Four criteria were used to select the 44 species included in the Gulf of Mexico database: (1) commercial value, (2) recreational value, (3) indicator of environmental stress, and (4) ecological value (References 2.4-39, 2.4-42, and 2.4-43). These criteria are similar to those used to identify "important species" in NUREG-1555.

Various surveys and programs in Texas have focused on different subsets of the species considered important by Nelson and Monaco (Reference 2.4-39) and Patillo et al. (Reference 2.4-43), as shown in Table 2.4-4. The TPWD identified principal fisheries species in Matagorda Bay (Reference 2.4-38). In a recent summary of recreationally important fishes, Green and Campbell (Reference 2.4-44) of TPWD found that three species stand out as prime targets of anglers. The FESs for STP 1 & 2 (References 2.4-24 and 2.4-26) name important species, as well. For this ER, professional judgment based on the preponderance of evidence served as the basis for selecting important species potentially affected by plant operations.

Nelson (Reference 2.4-39) presented data on the salinity preferences of various life stages of important fish and shellfish in Matagorda Bay and associated tidal rivers, including the lower Colorado River. Although a multitude of interacting environmental variables influence the distribution and abundance of estuarine species, it is well documented that salinity is a major controlling factor, particularly during spawning and early life stages. With the exception of sessile organisms such as oysters, most adult fish and shellfish (nekton) do not stay in the Bay, but move throughout the estuary in response to salinity gradients. A well-known example is the movement of estuarine or marine fishes upriver during low flow periods when a saltwater wedge penetrates well into the river. During such time, the salinity differential at the bottom and top of the river can be substantial. Along with the saline wedge come the planktonic larvae of fish and shellfish, which are generally carried passively along in the water column. The result of these hydrodynamic movements is that while the location in space cannot always be predicted for estuarine organisms, the location with respect to salinity gradient is better known.

2.4.2.3 Other Important Species

In addition to identifying commercially and recreationally important species, applicants for construction and operating licenses must consider impacts to rare species (Reference 2.4-21). Rare species include species listed by the USFWS or the National Marine Fisheries Service (NMFS) as threatened or endangered, species proposed for listing by these agencies, species that are candidates for listing by these agencies, and species that are listed as threatened or endangered by the state in which the proposed facilities are located. Although diadromous (migratory) fish are not one of the groups designated by the NRC as "important," migratory fish should also be considered.

2.4.2.3.1 Rare/Sensitive Species

Construction and operation of STP 3 & 4 could potentially impact populations of important aquatic species in the lower Colorado River. STPNOC withdraws water from the Colorado River approximately 14.6 river miles upstream from Matagorda Bay, in Matagorda County. Consequently, STPNOC searched TPWD's "Rare, Threatened, and Endangered Species of Texas" database for aquatic-sensitive species in Matagorda County. Sensitive species in this context are (1) state or federally listed species, (2) species that are candidates for federal listing, and (3) species proposed for listing by the USFWS. No sensitive aquatic species (as defined in the previous sentence) are on the Matagorda County list (Reference 2.4-14). The TPWD list for Matagorda County shows only one fish, the American eel (*Anguilla rostrata*), which is discussed below in the subsection on diadromous species.

As discussed previously, HL&P conducted surveys of lower Colorado River benthic macroinvertebrates and fish in the 1970s and 1980s. Survey results were reported in the ER (Reference 2.4-2), FES-CP (Reference 2.4-24), and FES-Operations (Reference 2.4-26). The ER stated that no (aquatic) species listed as rare or endangered were known to occur in the STP study area. The FES-CP (Reference 2.4-24) was more specific, asserting that "No fishes listed as threatened by the United States Department of Interior Fish and Wildlife Service or the Endangered Species Committee of the American Fisheries Society was collected during the applicant's baseline surveys." The FES-Operations (Reference 2.4-26) reported that NRC staff had submitted a formal request for information on threatened or endangered species in the vicinity of the STP site and that the USFWS responded on May 30, 1985 that no threatened or endangered aquatic species occurred near the site.

A single blue sucker (*Cycleptus elongates*) was captured in a gill net at a Colorado River sampling station 1.5 miles upstream of the STP site by biologists conducting preoperational surveys of the lower Colorado River in 1973 (Reference 2.4-2). The blue sucker is currently listed as Threatened by TPWD (Reference 2.4-45), but was not listed by the state at the time of capture. This species, which is found in large, unpolluted rivers with strong currents and firm (often gravel or rock) substrates (Reference 2.4-46 and Reference 2.4-47), is known to occur in small numbers in segments of the Colorado River well upstream of the plant (Reference 2.4-48).

2.4.2.3.1.1 Diadromous Species

Based on a literature review and surveys conducted by HL&P in the 1970s and 1980s, no anadromous fishes ascend the Colorado River to spawn upstream or downstream of the STP site. There are relatively few true anadromous species (e.g., Gulf sturgeon [*Acipenser oxyrinchus desotoi*], Alabama shad [*Alosa alabamae*] , and striped bass [*Morone saxatilis*]) in the Gulf of Mexico, and these species spawn in rivers flowing into the Gulf of Mexico further east, in Louisiana, Mississippi, Alabama, and Florida (Reference 2.4-49). One migratory fish species, the American eel, does ascend Gulf Coast streams in Texas, including the Colorado River.

The American eel occurs in rivers and streams along the east coast of the U.S. from Maine to Florida, and along the Gulf Coast from Florida to Texas (Reference 2.4-50). The American eel is catadromous, growing to sexual maturity in fresh water and migrating hundreds of miles into the Atlantic Ocean (the Sargasso Sea) to spawn. Eggs spawned in the Sargasso Sea drift westward and northward with ocean currents and develop into larvae, then nektonic glass eels, which swim west across the Continental Shelf and enter Atlantic Coast and Gulf Coast estuaries, where they darken and become elvers (at about 65 mm in length). At about 100 mm, elvers become fully-pigmented juvenile (yellow) eels. Males, which tend to remain in estuarine areas, grow rapidly and mature into adults at age 3–10 (Reference 2.4-51). Females tend to move inland, into tidal freshwater rivers and upriver tributaries, where they mature into adults at age 4–18. Adults leave estuaries and coastal rivers to migrate to the Sargasso Sea, and do not return to fresh water after spawning. They may live to be 20–25 years old.

Small numbers of eel larvae are carried by winds and currents from the Atlantic Ocean into the Gulf of Mexico, almost certainly via the Yucatan Strait. From the Gulf of Mexico they "wander" into Gulf Coast and Central American estuaries and rivers (Reference 2.4-52). American eels are uncommon in Texas. In 30 years of sampling coastal waters, the Coastal Fisheries Division of TPWD encountered only seven eels, in Matagorda/San Antonio Bays and Corpus Christi Bay (three in 1984, one in 1986, one in 1988, two in 2001). The Inland Fisheries Division of TPWD encountered only 15 eels in 20 years of sampling in freshwater reservoirs and streams (two in the 1980s, ten in 1990, and three in 2003–2004) (Reference 2.4-53). LCRA biologists have collected eels as far upstream in the Colorado River as Altair, Texas, despite the fact that there is a 15–20-foot-tall dam (built to store water for irrigation and prevent salt water from moving upstream) two miles south of the State Highway 35 Bridge.

American eel numbers along the Atlantic coast were relatively stable through the 1970s. Fisheries managers and commercial fishermen noticed a decline in numbers of eels ascending coastal streams in the 1980s and 1990s, a decline described by Haro et al., (Reference 2.4-54). Responding to concerns of state and federal agency biologists, in April 2000, the Atlantic States Marine Fisheries Commission issued an Interstate Fishery Plan for American eel that summarized and synthesized information on the population decline and proposed a range of measures that would ensure the species' recovery and continued viability. These included monitoring and research to fill gaps in the existing data, improved reporting of catch data, and commercial and recreational fishing regulations in states where none were in place.

In response to a petition received in November 2004, on July 6, 2005, the USFWS announced in a 90-day Finding that it was initiating a status review to determine if listing the American eel was warranted (Federal Register/Volume 70/No. 128/July 6, 2005). The discussion of population status indicated that population declines have been most dramatic in Canada and New England and that populations may be stable in the southeastern United States. On February 2, 2007, USFWS published its Findings on a Petition to List the American eel (72 FR 4967), summarized as follows: "After a thorough review of all available scientific information, we find that listing the American eel as either threatened or endangered is not warranted at this time."

2.4.2.3.1.2 Nuisance Species

NUREG-1555 (Reference 2.4-21) suggests that an applicant's ER include information on the presence of nuisance species, such as *Corbicula* sp. or *Mytilus* sp. on site or in the vicinity of the plant that could create biofouling problems in the cooling water system or cause "other significant problems."

The Asiatic clam, *Corbicula fluminea*, is a problematic invasive mollusk from southeastern Asia. It is a small bivalve that is typically found at high densities and has a relatively high growth rate (Reference 2.4-55). Because of its tolerance of a wide variety of aquatic conditions and its high reproductive rate, it has developed into a pest that clogs ditches and interferes with pipes and heat exchangers of power plants. The first reported collection of *Corbicula* in Texas occurred in the Neches River in 1958 (Reference 2.4-56). *Corbicula* were next discovered near El Paso, in 1964, suggesting that the species was invading Texas from both east and west. It was first documented in the Colorado River in the 1970s. A number of specimens were discovered in the MCR in 1981 (Reference 2.4-26). Routine biofouling inspections conducted since initial operation have not identified any corbicula in STP 1 & 2 plant systems. Additional specimens were collected in the Colorado River drainage between the STP site and Bay City in the mid-1980s (Reference 2.4-57). By 2005, *Corbicula* had been reported from 162 lotic and 174 lentic water bodies in Texas.

Hydrilla (*Hydrilla verticillata*), a nonnative plant (from Asia), has been found in 100 water bodies in Texas (Reference 2.4-58). It is a fast-growing nuisance plant that quickly establishes itself and produces dense mats of vegetation that can clog pipes and ditches and otherwise restrict water flow (Reference 2.4-59). It was first recorded in Texas in 1969, and was subsequently found in the mid-1980s at Lake Fayette, a power plant cooling reservoir on the Colorado River (Reference 2.4-58 and 2.4-60). In the 1990s, it was discovered in two more Colorado River impoundments—Lake Bastrop and Lake Austin. There is a concern that hydrilla will eventually spread downstream and restrict flow in the irrigation canals used by rice growers in Matagorda, Colorado, and Wharton Counties. As of 2003, no rooted Hydrilla had been found in the Colorado River downstream of the Austin-area impoundments (Reference 2.4-60). LCRA scientists and volunteers continue to monitor the lower reaches of the river, looking for evidence of infestation.

2.4.2.4 Habitat Importance

Many marine fish and estuarine fishes that are federally managed by the Gulf of Mexico Fishery Management Council (GMFMC), NOAA, and NMFS rely on coastal bays and tidal rivers during part of their lives. The tidally influenced sections of the Colorado River and its tributaries, as well as Matagorda Bay and East Matagorda Bay, have been designated essential fish habitat, which is defined as those waters and substrate necessary to fish or shellfish for spawning, breeding, feeding, or growth to maturity (Reference 2.4-61). Discussion of essential fish habitat is in §600.10 of the regulations implementing the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297). The GMFMC and NMFS are responsible for designating essential fish habitat for each life stage of federally managed marine fish species.

The generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC (Reference 2.4-61) proscribe essential fish habitat for federally managed species, including shrimp, red drum, reef fish, and coastal migratory pelagic species. Habitats in the lower Colorado River near the STP site include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, and seagrasses. Managed species that are considered important with respect to this ER include brown shrimp, white shrimp, and red drum. Essential fish habitat has been designated for all life stages (egg, larvae, post-larvae, juvenile, and adult) of these species.

Categories of essential fish habitat in the lower Colorado River and Matagorda Bay that could be impacted by the project include estuarine water column, estuarine mud, and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, and seagrasses. Detailed information on essential fish habitat is provided in the 1998 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC (Reference 2.4-61).

In addition to providing essential fish habitat for the federally managed species listed above, the Matagorda Bay estuary provides nursery and rearing habitat for other important estuarine species (listed in Tables 2.4-3 and 2.4-4), as well as for non-harvested forage species that support the harvested species.

Each estuary along the Gulf of Mexico coast has a particular species assemblage (Reference 2.4-39). The relative significance of important aquatic species in a regional context can be described in a variety of ways, such as the monetary value or poundage of commercial catches, or the recreational value of certain species in a given bay. In some cases, critical habitat for an endangered species may occur in one estuary but not another. That is not the case for Matagorda Bay. None of the important species considered in this ER are endemic to Matagorda Bay, nor does critical habitat occur in Matagorda Bay. All of the species listed as common to abundant in Table 2.4-3 are also found in Galveston Bay to the north of Matagorda Bay. The NRC (Reference 2.4-26) concluded that (1) the lower Colorado River was not a unique nursery area for estuarine-marine organisms, and (2) species expected to be most affected by operations at STP (e.g., Gulf menhaden, croaker, bay anchovy, striped mullet) were ubiquitous and abundant along the Texas and Gulf coasts.

2.4.2.5 Preexisting Environmental Stresses

Estuaries are, by definition, variable habitats; upstream floods can lower salinities to near zero; long-term droughts can allow salt water to move many miles inland. While freshwater organisms are sometimes washed by floods into unsuitable areas where they perish, estuarine animals tolerate a wide range of conditions, often moving along with the mass of water that best suits them. The lower Colorado River experiences periods of flooding as well as low flow resulting from drought or water management practices (Reference 2.4-33). Whether these events are called "stresses" depends entirely on the organism in question.

The species defined as "important" in this ER are generally tolerant of a wide range of flows and salinities (Reference 2.4-39). Data since 1985 shows that populations of most estuarine species have either held steady or increased in Matagorda Bay. No dramatic local declines or extirpations have been reported; commercial and recreational fishing has been good. Water quality is generally good in the lower Colorado River and Matagorda Bay.

The TCEQ is required, under Section 303(d) of the Clean Water Act, to identify waterbodies for which effluent limitations are not stringent enough to satisfy water quality standards (Reference 2.4-62). Every two years, in even-numbered years, TCEQ publishes a "Texas Water Quality Inventory and 303(d) List" that identifies streams and impoundments that are impaired for one or more pollutants and therefore do not meet one or more water quality standards. Segment 1401 of the Colorado River (Tidal), to which the MCR occasionally discharges, did not appear on the 2004 list of impaired waters. Segment 1401 does appear on the 2006 list, however, as not meeting the state water quality standard for bacteria (Reference 2.4-62). The bacterium *Enterococcus*, which is found in the intestinal tracts of humans and farm animals, was present in unacceptably high concentrations. TCEQ reported that a "non-point source – Agriculture" was the source of the impairment (Reference 2.4-62).

2.4.2.6 Aquatic Resources Along Transmission Corridors

As discussed in Subsection 2.4.1, existing transmission lines pass through typical habitats associated with the coastal prairie region of east Texas: agricultural fields, forests, and pasture/rangeland. However, the westward lines reach into the Texas "Hill Country," with different habitats such as Edwards Aquifer springs and karst areas. No areas designated by the USFWS as "critical habitat" for endangered or threatened aquatic species are crossed by these corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas.

Endangered and threatened aquatic species known to occur in the counties crossed by existing transmission corridors are listed in Table 2.4-2. These lists are based on either recorded occurrences or historical ranges of species. The possibility exists that other protected species might exist in the counties crossed by the existing corridors. As discussed in Subsection 2.2.2, there are no new transmission line rights-of-way for STP 3 & 4.

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Table 2.4-1 Waterbird Species Observed Nesting on the MCR Interior Dikes at STP During Texas Colonial Waterbird Surveys [1]

Common Name	Scientific Name	Nests per Species per Year					
		2005	2004	2003	2002	2001	2000
Laughing gull	*Larus atricilla*	769	759	685	733	1,127	787
Gull-billed tern	*Sterna nilotica*	423	438	184	424	744	650
Caspian tern	*Sterna caspia*	21	17	59	69	34	0
Forster's tern	*Sterna forsteri*	18	2	60	68	226	116
Black-necked stilt	*Himantopus mexicanus*	17	1	0	0	0	0
Black skimmer	*Rhynchips niger*	15	56	142	94	73	6
Least tern	*Sterna antillarum*	9	66	44	17	71	35
Royal tern	*Sterna maxima*	0	0	0	0	0	30
Killdeer	*Charadrius vociferous*	0	0	0	0	0	3
Total Nesting Birds		1,272	1,339	1,174	1,405	2,275	1,627

[1] Source: Reference 2.4-7

Table 2.4-2 Protected Species in Texas Counties Containing the STP Site and Transmission Lines

Common Name	Scientific Name	Federal Status [1]	State Status [1]	STP Site [2]	Transmission -Line Counties [2]
Birds					
Texas Botteri's sparrow	*Aimophila botterii texana*	-	T	-	Y
White-tailed hawk	*Buteo albicaudatus*	-	T	Y	Y
Zone-tailed hawk	*Buteo albonotatus*	-	T	-	Y
Piping plover	*Charadrius melodus*	LT	T	Y	Y
Golden-cheeked warbler	*Dendroica chrysoparia*	LE	E	-	Y
Reddish egret	*Egretta rufescens*	-	T	Y	Y
Peregrine falcon	*Falco peregrinus anatum*	DL	T	Y	Y
Arctic peregrine falcon	*Falco peregrinus tundrius*	DL	T	Y	Y
Whooping Crane	*Grus Americana*	LE	E	Y	Y
Bald eagle	*Haliaeetus leucocephalus*	DL	T	Y	Y
Wood stork	*Mycteria americana*	-	T	Y	Y
Eskimo Curlew	*Numenius borealis*	LE	E	Y	Y
Brown pelican	*Pelecanus occidentalis*	LT	E	Y	Y
White-faced ibis	*Plegadis chihi*	-	T	Y	Y
Interior least tern	*Sterna antillarum anthalassos*	LE	E	-	Y
Sooty tern	*Sterna fuscata*	-	T	Y	Y
Attwater's prairie chicken	*Tympanuchus cupido attwateri*	LE	E	-	Y
Black-capped vireo	*Vireo atricapilla*	LE	E	-	Y
Mammals					
Red wolf	*Canis rufus*	LE	E	-	Y
Gulf coast jaguarundi	*Herpailurus yaguarondi cacominth*	LE	E	-	Y
Southern yellow bat	*Lasiurus ega*	-	T	-	Y
Ocelot	*Leopardus pardalis*	LE	E	Y	Y
White-nosed coati	*Nasura narica*	-	T	-	Y
Manatee	*Trichechus manatus*	LE	E	-	Y
Black bear	*Ursus americanus*	SAT	T	-	Y
Louisiana black bear	*Ursus americanus luteolus*	T	T	Y	Y

Table 2.4-2 Protected Species in Texas Counties Containing the STP Site and Transmission Lines (Continued)

Common Name	Scientific Name	Federal Status [1]	State Status [1]	STP Site [2]	Transmission -Line Counties [2]
Reptiles					
American alligator	*Alligator mississippiensis*	DM, SAT	-	Y	Y
Loggerhead sea turtle	*Caretta caretta*	LT	T	Y	Y
Texas scarlett snake	*Cemaphora coccinea linerii*	-	T	Y	Y
Green sea turtle	*Chelonia mydas*	E	T	Y	Y
Timber/canebreak rattlesnake	*Crotalus horridus*	-	T	Y	Y
Leatherback sea turtle	*Dermochelys coriacea*	E	E	Y	Y
Indigo snake	*Drymarchon corais*	-	T	-	Y
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E	Y	Y
Texas tortoise	*Gopherus berlandieri*	-	T	-	Y
Cagle's map turtle	*Graptemys caglei*	-	T	-	Y
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E	Y	Y
Smooth green snake	*Liochlorophis vernalis*	-	T	Y	-
Texas horned lizard	*Phrynosoma cornutum*	-	T	-	Y
Alligator snapping turtle	*Macrochelys temmenckii*	-	T	-	Y
Amphibians					
Houston toad	*Bufo houstonensis*	LE	E	-	Y
Cascade Caverns salamander	*Eurycea latitans complex*	-	T	-	Y
Comal blind salamander	*Eurycea tridentifera*	-	T	-	Y
Sheep frog	*Hypopachus variolosus*	-	T	-	Y
Black-spotted newt	*Notophthalmus meridionalis*	-	T	-	Y
South Texas siren (large form)	*Siren spp.*	-	T	-	Y
Fish					
Blue sucker	*Cycleptus elongatus*	-	T	-	Y
Fountain darter	*Etheostoma fonticola*	LE	E	-	Y
Opossum pipefish	*Microphis brachyurus*	-	T	-	Y
Sharpnose shiner	*Notropis oxyrhynchus*	C	-	-	Y
Widemouth blindcat	*Satan eurystomus*	-	T	-	Y

Table 2.4-2 Protected Species in Texas Counties Containing the STP Site and Transmission Lines (Continued)

Common Name	Scientific Name	Federal Status [1]	State Status [1]	STP Site [2]	Transmission -Line Counties [2]
Toothless blindcat	*Trogloglanis pattersoni*	-	T	-	Y
Crustaceans					
Peck's Cave amphipod	*Stygobromus pecki*	LE	E	-	Y
Insects					
Helotes mold beetle	*Batrisodes venyivi*	LE	-	-	Y
Comal Springs riffle beetle	*Heterelmis comalensis*	LE	-	-	Y
A ground beetle	*Rhadine exilis*	LE	-	-	Y
A ground beetle	*Rhadine infernalis*	LE	-	-	Y
Comal Springs dryopid beetle	*Stygoparnus comalensis*	LE	-	-	Y
Arachnids					
Robber Baron Cave meshweaver	*Circurina baronia*	LE	-	-	Y
Madla Cave meshweaver	*Cicurina madla*	LE	-	-	Y
Braken Bat Cave meshweaver	*Cicurina venii*	LE	-	-	Y
Government Canyon Bat Cave meshweaver	*Cicurina vespera*	LE	-	-	Y
Government Canyon Bat Cave spider	*Neoleptoneta microps*	LE	-	-	Y
Cokendolpher Cave harvestweaver	*Texella cokendolpheri*	LE	-	-	Y
Plants					
South Texas ambrosia	*Ambrosia cheiranthifolia*	LE	E	-	Y
Black lace cactus	*Echinocereus reichenbachii var. albertii*	LE	E	-	Y
Navasota ladies'-tresses	*Spiranthes parkseii*	LE	E	-	Y

[1] LE/E = Endangered; T = Threatened; C = Candidate; - = Not listed; DL = delisted taxon, recovered, being monitored for first five years post delisting; SAE/T = listed due to similarity to endangered/threatened species.

[2] Listed in the county containing the plant site (Matagorda County) and/or the counties containing the existing transmission lines (Y=Yes, - = no reported occurrence).

Sources of county occurrences: References 2.4-14 and 2.4-15.

Table 2.4-3 Relative Abundance of Life Stages of Important Estuarine Organisms in Matagorda Bay

		Relative Abundance in Salinity Zones		
Species	**Life Stage**	**Tidal Fresh (<0.5 ppt)**	**Mixing (0.5–25 ppt)**	**Seawater (>25 ppt)**
American Oyster *Crassostrea virginica*	Adult	Rare	Common	Rare
	Spawning adults		Common	
	Juveniles	Rare	Common	Rare
	Larvae	Rare	Common	Rare
	Eggs		Common	
Brown shrimp *Farfantepenaeus aztecus*	Adult		Common	Highly Abundant
	Spawning adults			
	Juveniles	Common	Highly Abundant	Common
	Larvae	Common	Highly Abundant	Highly Abundant
	Eggs			
White shrimp *Penaeus setiferus*	Adult	Rare	Abundant	Common
	Spawning adults			
	Juveniles	Highly Abundant	Abundant	Common
	Larvae	Highly Abundant	Highly Abundant	Highly Abundant
	Eggs			
Blue crab *Callinectes sapidus*	Adult	Common	Abundant	Common
	Spawning adults	Common	Rare	
	Juveniles	Common	Abundant	Common
	Larvae	Highly Abundant	Abundant	Common
	Eggs		Rare	Common
Gulf menhaden *Brevoortia patronus*	Adult		Abundant	Highly Abundant
	Spawning adults			
	Juveniles	Highly Abundant	Highly Abundant	Highly Abundant
	Larvae			
	Eggs			
Bay anchovy *Anchoa mitchelli*	Adult	Abundant	Highly Abundant	Common
	Spawning adults	Common	Highly Abundant	Common
	Juveniles	Abundant	Abundant	Common
	Larvae	Abundant	Common	Common
	Eggs	Common	Common	Common

Table 2.4-3 Relative Abundance of Life Stages of Important Estuarine Organisms in Matagorda Bay (Continued)

		Relative Abundance in Salinity Zones		
Species	**Life Stage**	**Tidal Fresh (<0.5 ppt)**	**Mixing (0.5–25 ppt)**	**Seawater (>25 ppt)**
Sheepshead *Archosargus probatocephalus*	Adult	Common	Abundant	Abundant
	Spawning adults			
	Juveniles	Common	Abundant	Common
	Larvae			
	Eggs			
Sand seatrout *Cynoscion arenarius*	Adult		Common	Common
	Spawning adults			
	Juveniles	Common	Common	Common
	Larvae			
	Eggs			
Spotted seatrout *Cynoscion nebulosus*	Adult	Rare	Common	Common
	Spawning adults		Common	Common
	Juveniles	Rare	Common	Common
	Larvae		Common	Common
	Eggs		Common	Common
Atlantic croaker *Micropogonias undulatus*	Adult	Abundant	Abundant	Abundant
	Spawning adults			
	Juveniles	Abundant	Highly Abundant	Abundant
	Larvae			
	Eggs			
Black drum *Pogonias cromis*	Adult		Common	Common
	Spawning adults			Common
	Juveniles	Common	Common	Common
	Larvae			Common
	Eggs			Common
Red drum *Sciaenops ocellatus*	Adult	Rare	Rare	Common
	Spawning adults			Common
	Juveniles	Common	Common	Common
	Larvae			Common
	Eggs			Common

Table 2.4-3 Relative Abundance of Life Stages of Important Estuarine Organisms in Matagorda Bay (Continued)

		Relative Abundance in Salinity Zones		
Species	**Life Stage**	**Tidal Fresh (<0.5 ppt)**	**Mixing (0.5–25 ppt)**	**Seawater (>25 ppt)**
Striped mullet *Mugil cephalus*	Adult	Common	Abundant	Abundant
	Spawning adults			Abundant
	Juveniles	Abundant	Abundant	Abundant
	Larvae			Abundant
	Eggs			Abundant
Southern flounder *Paralichthys lethostigma*	Adult	Common	Abundant	Common
	Spawning adults			
	Juveniles	Common	Common	Common
	Larvae			
	Eggs			

Source: Reference 2.4-39

Notes:
Rare = Present but not frequently encountered

Common = Frequently encountered but not in large numbers; does not imply a uniform distribution throughout the salinity zone

Abundant Highly = Often encountered in substantial numbers relative to other species

Abundant = Numerically dominant relative to other species

Blank cell = Absent

Table 2.4-4 Relative Abundance of Important Estuarine Organisms in Matagorda Bay 1985–2003

	Gear Type	East Matagorda Bay [1]	Matagorda Bay [1]	Coastwide [2]
Brown shrimp *Farfantepenaeus aztecus*	Gill net – spring	ND	ND	ND
	Gill net – fall	ND	ND	ND
	Bag seine	+	=	+
	Trawl	=	=	+
White shrimp *Penaeus setiferus*	Gill net – spring	ND	ND	ND
	Gill net – fall	ND	ND	ND
	Bag seine	=	=	-
	Trawl	+	=	–
Blue crab *Callinectes sapidus*	Gill net – spring	=	=	–
	Gill net – fall	=	=	–
	Bag seine	=	–	–
	Trawl	–	=	–
Gulf menhaden *Brevoortia patronus*	Gill net – spring	=	=	ND
	Gill net – fall	=	=	ND
	Bag seine	=	=	ND
	Trawl	=	=	ND
Bay anchovy *Anchoa mitchelli*	Gill net – spring	ND	ND	ND
	Gill net – fall	ND	ND	ND
	Bag seine	ND	ND	ND
	Trawl	ND	ND	ND
Sheepshead *Archosargus probatocephalus*	Gill net – spring	=	+	–
	Gill net – fall	=	=	–
	Bag seine	=	=	ND
	Trawl	=	=	ND
Sand seatrout *Cynoscion arenarius*	Gill net – spring	ND	ND	ND
	Gill net – fall	ND	ND	ND
	Bag seine	=	=	ND
	Trawl	=	=	ND

Table 2.4-4 Relative Abundance of Important Estuarine Organisms in Matagorda Bay 1985–2003 (Continued)

	Gear Type	East Matagorda Bay [1]	Matagorda Bay [1]	Coastwide [2]
Spotted seatrout *Cynoscion nebulosus*	Gill net – spring	=	+	+
	Gill net – fall	=	=	+
	Bag seine	=	=	–
	Trawl	=	=	ND
Atlantic croaker Micropogonias undulatus	Gill net – spring	=	=	–
	Gill net – fall	=	=	+
	Bag seine	=	–	–
	Trawl	+	=	+
Black drum Pogonias cromis	Gill net – spring	+	+	+
	Gill net – fall	=	+	+
	Bag seine	=	=	+
	Trawl	+	=	ND
Red drum Sciaenops ocellatus	Gill net – spring	+	+	+
	Gill net – fall	=	=	+
	Bag seine	=	=	–
	Trawl	=	=	ND
Striped mullet Mugil cephalus	Gill net – spring	=	=	ND
	Gill net – fall	=	=	ND
	Bag seine	=	=	ND
	Trawl	=	=	ND
Southern flounder Paralichthys lethostigma	Gill net – spring	=	=	–
	Gill net – fall	=	=	–
	Bag seine	=	–	ND
	Trawl	=	=	ND
Total Finfishes **[3]**	Gill net – spring	+	+	+
	Gill net – fall		–	–
	Bag seine	=	=	ND
	Trawl	=	=	ND
American Oyster **[4]**	Spat	=		+
	Small	+		+
	Market size	+		+

Source: (Reference 2.4-40)

[1] Trends for East Matagorda Bay and Matagorda Bay were estimated by inspection of annual catch data from 1985 to 2003. No statistical analysis was used or implied.

[2] Coastwide trends were described in the report based on all data since inception of the study, which varied by gear type and species. The earliest data was collected in 1975.

[3] Total includes some species not represented in this table.

[4] Oyster data was not reported for East Matagorda Bay separately.

Relative Abundance Indicators:

+ = Annual catch increased from 1985 to 2003

- = Annual catch decreased from 1985 to 2003

= = Annual catch showed no marked change from 1985 to 2003, either due to relatively steady catches or to large variations with no apparent pattern

ND = no data

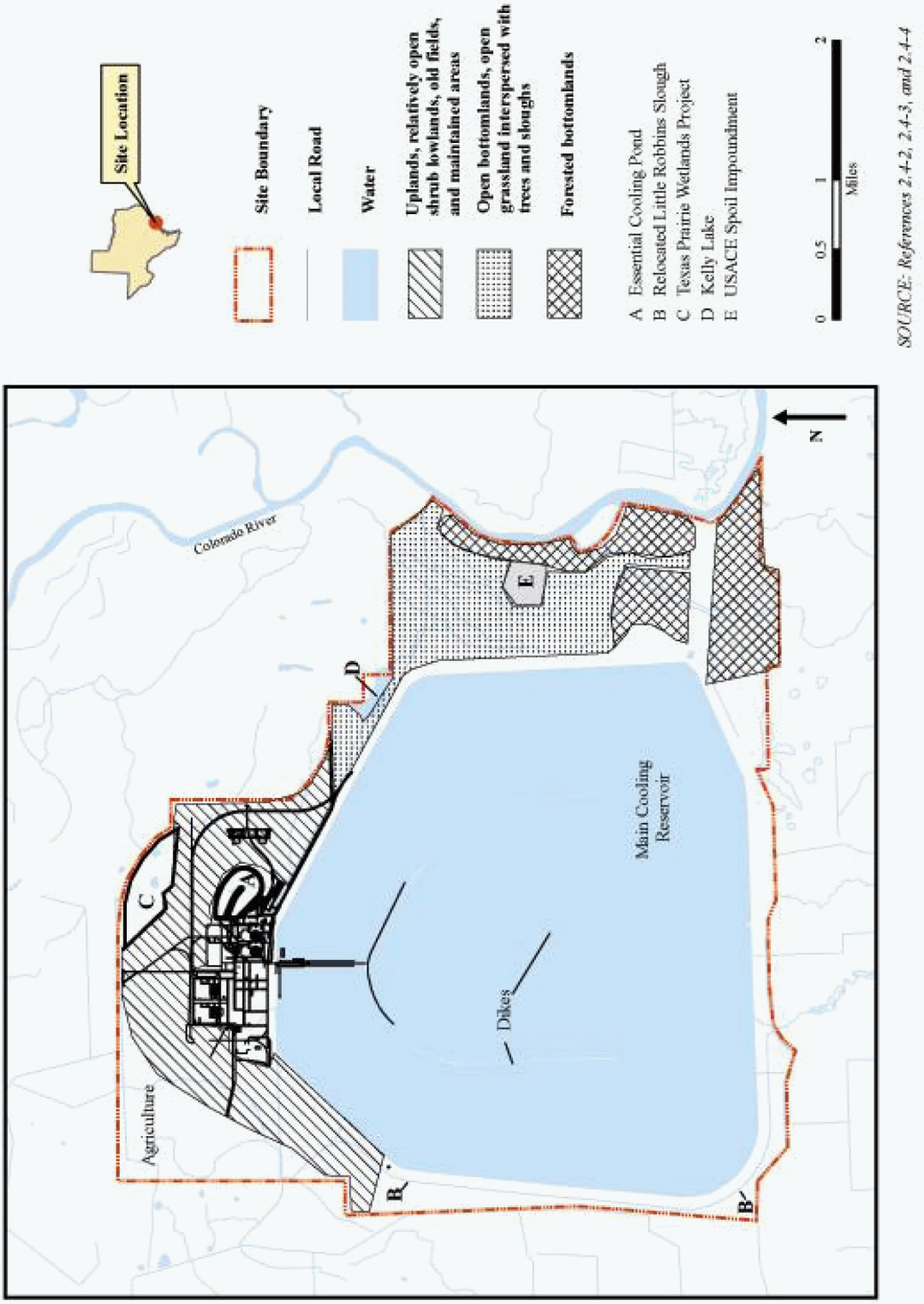
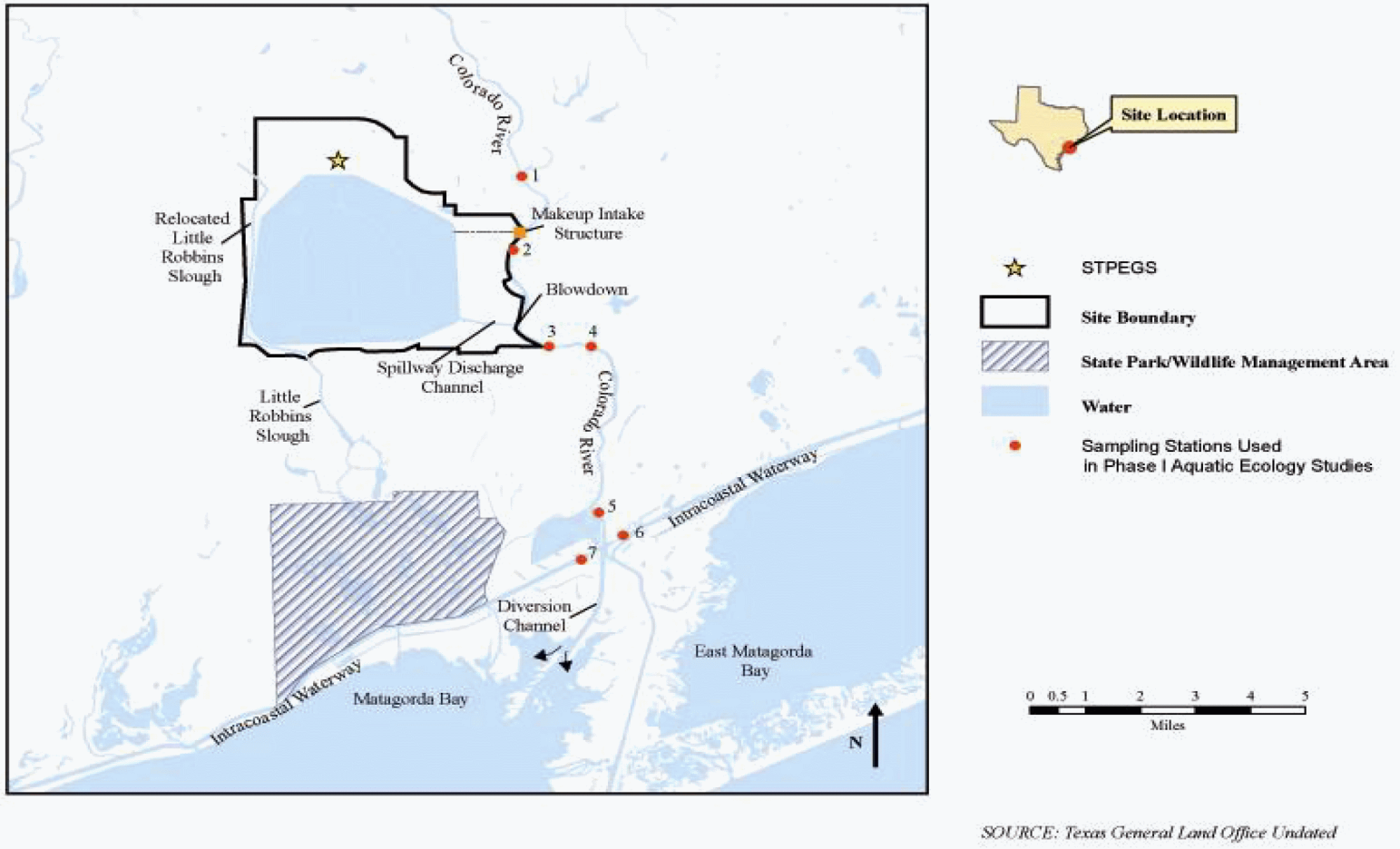


Figure 2.4-1 Landscape Features and Habitat Types of the STP



SOURCE: Texas General Land Office Undated

Figure 2.4-2 Major Water Bodies in STP Vicinity

Figure 2.4-2 Major Water Bodies in STP Vicinity

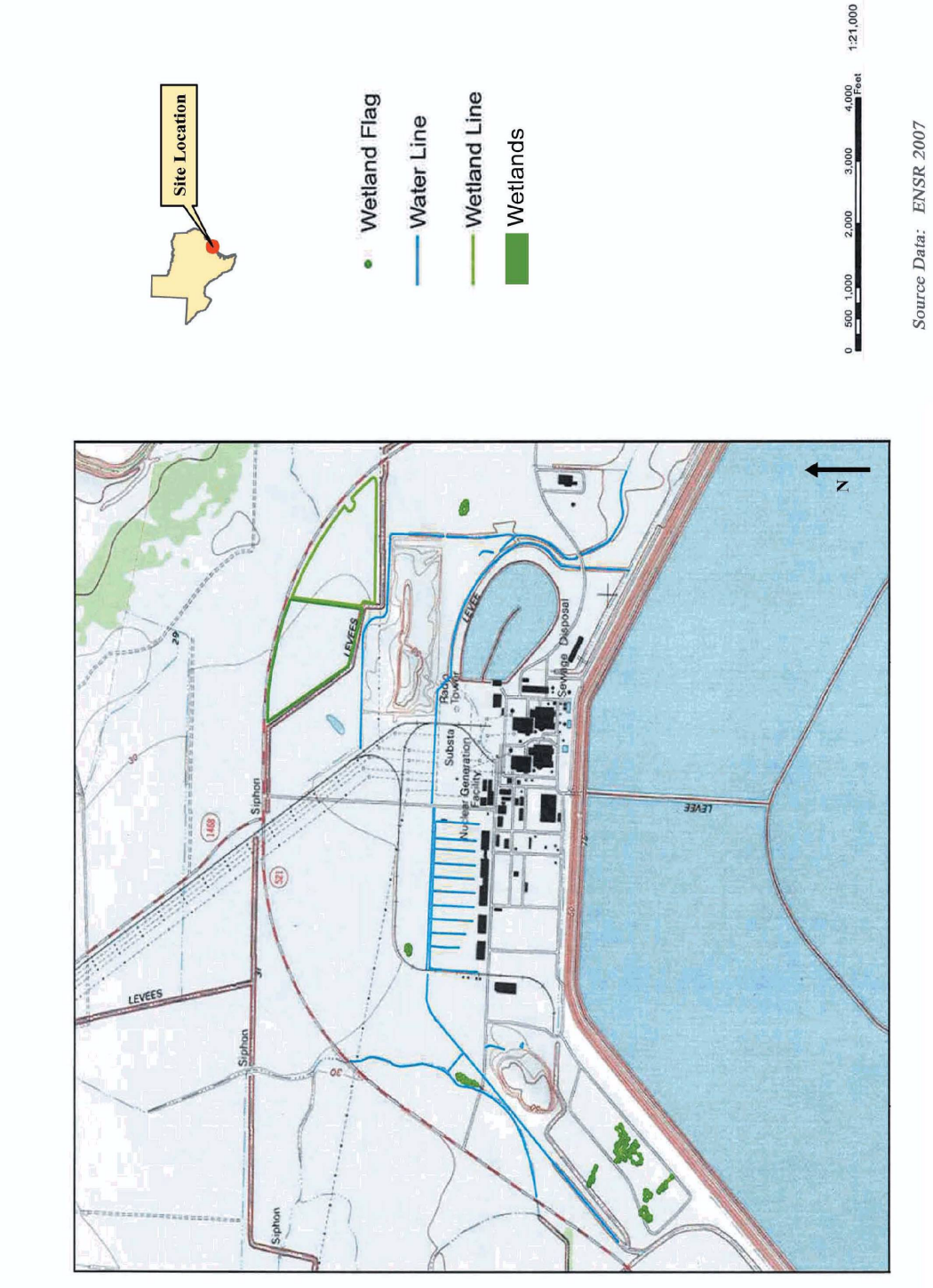


Figure 2.4-3 Wetlands Identified in 2006 Survey