2.4S.1 Hydrolflogic Description

The following site-specific supplement addresses COL License Information Item 2.13.

2.4S.1.1 Site and Facilities

The STP 3 & 4 site is located in Matagorda County, Texas near the west bank of the Colorado River, opposite river mile 14.6. It is approximately 12 miles south-southwest of Bay City, Texas, and 8 miles north-northwest of Matagorda, Texas (Figure 2.4S.1-1). The surface elevation of the site ranges from about El. 32 to 34 ft mean sea level (MSL), which is equivalent to National Geodetic Vertical Datum of 1929 (NGVD 29), at the north boundary to between El. 15 ft to 20 ft MSL at the south boundary.

Figure 2.4S.1-2 shows the topography and hydrologic features within about 3 miles from the site based on digital data from the U.S. Geological Survey (USGS). Figure 2.4S.1-3 shows the existing (pre-development) topography of the site in more detail based on data from a recent aerial survey. Figure 2.4S.1-3 also shows various external plant structures and components. The proposed site layout and drainage system after the construction of Unit 3 & 4 is discussed in Subsection 2.4S.2. The post-development topography and major drainage features of the site are presented in Figure 2.4S.2-4.

A major feature of the site is the Main Cooling Reservoir (MCR), which is formed by a 12.4-mile-long earthfill embankment constructed above the natural ground surface. The MCR has a surface area of 7000 acres with a normal maximum operating level of El. 49 ft MSL. The MCR is not a safety-related facility. Makeup water to the MCR is supplied from the Colorado River and pumped into the MCR intermittently throughout the year via the Reservoir Makeup Pumping Facility (RMPF). A smaller separate cooling pond, referred to as the Essential Cooling Pond (ECP), serves as the ultimate heat sink for STP 1 & 2. The surface area of the ECP is 46 acres. (Reference 2.4S.1-1)

STP 3 & 4 utilizes safety-related Ultimate Heat Sinks (UHS) to remove heat load from the Reactor Service Water (RSW) system during normal, safe shutdown and the design basis accident. The UHS basin is sized for a water volume adequate for 30 days of cooling with no makeup water under the design basis accident. A UHS basin and its pump house are dedicated to each unit. Each unit has a counterflow mechanically induced draft cooling tower with six cooling tower cells, of which two cells are dedicated to each of the three RSW divisions to remove heat from their respective RCW/RSW division.The primary source of makeup water to the UHS cooling towers are site wells with the MCR as the backup source.

The critical safety-related flood levels resulting from a postulated instantaneous breach of the MCR embankment are discussed in Subsection 2.4S.4. Calculations show a maximum flood water level at the safety-related facilities, including the power block and the UHSs, to be El. 38.8 ft MSL. The Design-Basis Flood (DBF) elevation is conservatively established as 40.0 ft MSL. Specific elevations of safety-related structures and plant flood protection measures are discussed in Subsections 2.4S.2 and 2.4S.10.

2.4S.1.2 Hydrosphere

Plant interfaces with hydrosphere include the use of the MCR for nonsafety-related normal plant cooling, and the use of groundwater to supply the safety-related UHS cooling water and potable water. Makeup water for the MCR is withdrawn from the Colorado River adjacent to the site. The UHS cooling tower basin is sized to maintain a water inventory adequate for 30 days of cooling under the design basis accident with no makeup and blowdown. As discussed in Subsection 9.2.5, the UHS is designed to meet the dependability requirements, and the affected units can be safely shut down without relying on the availability of groundwater.

The conceptual model of the site hydrology presented in this section, including surface water and groundwater, is well supported by site data and is expected to realistically represent hydrologic conditions at the site. All site-related seismic and non-seismic information have been taken into account as they related to the hydrologic description.

2.4S.1.2.1 Surface Water

2.4S.1.2.1.1 Colorado River Basin

General Description

The Colorado River Basin extends across the middle of Texas, from the southeastern portion of New Mexico to Matagorda Bay at the Gulf of Mexico. The total drainage area of the Colorado River is 42,318 sq. miles, 11,403 sq. miles of which is considered non-contributory to the river water supply. The Lower Colorado River Basin is the part of the river system from Lake O.H. Ivie to the Gulf Coast (Figure 2.4S.1-4) and comprises approximately 22,682 sq. miles of drainage area (Reference 2.4S.1-2). The Upper Colorado River Basin has a drainage area of approximately 19,636 sq. miles. There are six major tributaries with drainage areas greater than 1000 sq. miles that contribute to the Colorado River: Beals Creek and Concho River in the upper Colorado River Basin and San Saba, Llano, Pedernales Rivers, and Pecan Bayou in the lower Colorado River Basin. All six major tributaries, and approximately 90% of the entire contributing drainage for the river, occur upstream of Mansfield Dam near Austin. Downstream of Austin, there are only two tributaries with drainage areas greater than 200 sq. miles: Barton Creek and Onion Creek in Travis County (Reference 2.4S.1-3).

The Colorado Basin lies within the warm-temperate/subtropical zone, and its subtropical climate is typified by dry winters and humid summers. Spring and fall are both wet seasons in this region with rainfall peaks in May and September. The spring rains are produced by convective thunderstorms, which result in high intensity, short duration precipitation events with rapid runoff. The fall rains are primarily governed by tropical storms and hurricanes that originate in the Caribbean Sea or the Gulf of Mexico. These rains pose flooding risks to the Gulf Coast from Louisiana to Mexico. The spatial rainfall distribution in this region varies from an annual amount of 44 inches at the coast to 24 inches in the northwestern portion of the region (Reference 2.4S.1-3).

The Colorado River Basin is located in a semi-arid region; its hydrologic characteristics are closely linked to the weather in this area, which has been described as a "continuous drought periodically interrupted by floods" (Reference 2.4S.1-4).

Stream flow gauging data collected in the Colorado River since the early 1900s show that there has been a major drought in almost every decade of the twentieth century. Major droughts in the basin cause stock ponds and small reservoirs to go dry and large reservoirs, such as Lake Travis, formed by Mansfield Dam, to significantly drop their storage levels, even to one third of their storage capacity. During the 30-year period from 1941 to 1970, there have been three major statewide droughts, from 1947 to 1948, from 1950 to 1957, and from 1960 to 1967. The most severe of these droughts occurred from 1950 to 1957, when 94 percent of the counties in the state were declared disaster areas (Reference 2.4S.1-4). The discussion about maintaining sufficient water supply to STP 3 & 4 during severe drought conditions is presented in Subsection 2.4S.11. With support of water management plan between the Lower Colorado River Authority (LCRA) and STP, the MCR is capable of supplying the existing STP 1 & 2 and STP 3 & 4 units during low flow conditions in the Colorado River. Since the primary source of makeup water to the UHS cooling tower basin for STP 3 & 4 is onsite groundwater wells, the low water considerations does not affect the dependability of the source of makeup water for the UHS, and the deep aquifer has sufficient capacity to supply makeup water to the UHS basin as documented in Subsection 2.4S.12.

A drought cycle is often followed by one or more flooding events. Due to very limited vegetative cover, rocky terrain, and steep channels, runoff in the Upper Colorado River is high and rapid, producing fast moving and high-peak floods. The terrain in the Lower Colorado River basin is flatter with greater vegetative cover and wider floodplains, which reduces the velocity of floods. The Hill Country watershed of the Lower Colorado River has been characterized as "Flash Flood Alley," meaning that the lower Colorado River Basin is one of the regions most prone to flash flood damage. There are two major phenomena that contribute to the high flooding potential in this region. First, thin soils and steep slopes in the upper Colorado River Basin promote rapid runoff from the watershed during heavy rain events. Second, the large and relatively steep drainage area of the Hill Country can receive runoff from hundreds of miles away, transforming heavy rains into flood waters with destructive potential. More than 80 floods have been recorded in this region since the mid-1800s. During these events, water levels exceeded the river flood stage and inundated dry lands. The most intense localized flash flood in the Lower Colorado region in recent history occurred on May 24, 1981 in Austin (Reference 2.4S.1-3).

Major reservoirs in the Colorado River Basin with storage capacity greater than 10,000 acre-feet are summarized in Table 2.4S.1-1 (Reference 2.4S.1-5), which are sorted in order of descending storage capacity. The locations of some major dams are shown in Figure 2.4S.1-5. Because of the high risk of flooding in the Lower Colorado River basin, a system of dams and lakes has been developed along the river primarily to manage floodwaters, but also to conserve and convey water supplies. The Lower Colorado River Authority (LCRA) operates six dams on the Lower Colorado River: Buchanan, Inks, Wirtz, Starcke, Mansfield, and Tom Miller (Figure 2.4S.1-6). These

dams form the six Highland Lakes: Buchanan, Inks, LBJ, Marble Falls, Travis, and Austin (Reference 2.4S.1-6).

Buchanan Dam and Mansfield Dam are the two major dams on the Lower Colorado River that may influence conditions at STP site 3 & 4. Mansfield Dam, forming Lake Travis, is located approximately 28 miles upstream from Austin. Mansfield Dam is the largest reservoir and the most downstream existing major control structure on the Colorado River (Reference 2.4S.1-6). Buchanan Dam is another large dam on the main stream of the Colorado River. Its primary purpose is water supply and generation of hydroelectric power. Table 2.4S.1-2 gives the pertinent characteristics of these two major dams and Figure 2.4S.1-7 gives the area-capacity curves of Lake Travis and Lake Buchanan. The characteristics of these two dams are also used in the dam break analysis presented in Subsection 2.4S.4.

The seismic design criteria for these two dams are not readily available. The dam break analysis presented in Subsection 2.4S.4 is performed under very conservative assumptions. Specifically, all dams on the Colorado River and its tributaries upstream of Buchanan Dam (with top-of-dam capacity over 5000 AF) would fail in such a manner that their flood flow, expressed in terms of their respective top-of-dam storage volumes, would arrive at Lake Buchanan at approximately the same time, triggering the failure of Buchanan Dam. The dam break flood flow from Buchanan Dam would then propagate downstream to Lake Travis, overtopping Mansfield Dam and causing it to fail. Further, the dam failures were postulated to occur coincidentally with a 2-year design wind event and a Standard Project Flood (SPF) event, more severe than a 500-year flood or a one-half probable maximum flood (PMF) dams as required by ANSI/ANS-2.8.

In accordance with the spillway design criteria for dams as defined in Rule 299.14 Title 30 of the Texas Administrative Code (Reference 2.4S.1-14), large dams with high hazard potential, such as Buchanan and Mansfield Dams, were either designed or have been upgraded to accommodate and sustain their respective Probable Maximum Flood (PMF). With the completion of Simon Freese Dam in 1989, normal flows and flood flows in the Colorado River upstream of Mansfield Dam are regulated by 27 major reservoirs, including Lake Travis (Reference 2.4S.1-5).

Even though there are several dams upstream of Mansfield Dam, Mansfield Dam provides most of the floodwater storage capacity. The other dams pass floodwaters downstream to Lake Travis, where the water is stored in a flood pool until it can be released safely downstream. Tom Miller Dam at Austin is downstream of Lake Travis. It impounds a portion of the Colorado River known as Lake Austin; however, because of the small storage capacity of its reservoir, it affords no major control of flood flows. Lake Travis and Lake Buchanan also serve as water supply reservoirs. Lake Travis has a water supply storage capacity of approximately 1,132,400 acre-feet and Lake Buchanan has a water supply storage capacity of approximately 875,000 acre-feet. With a combined capacity of about 2 million acre-feet, the two lakes store water for communities, industry and aquatic life along the river, as well as supply irrigation water for the agricultural industry near the Gulf Coast (Reference 2.4S.1-7).

The Colorado River near the Site

For large peak flows the attenuation of peak discharges downstream from the City of Columbus (see Figure 2.4S.1-8) becomes more pronounced than for smaller flows. This phenomenon is explained by a comparison of the floodplain and river valley complex of the areas above and below Columbus. Above Columbus, the width of the floodplain varies from about 2.5 to 5.5 miles. The slope of the floodplain in the direction normal to the channel varies from about 5 ft/mile to 12 ft/mile. Also, the floodplain is in a well-defined valley, which provides relatively little storage of storm runoff, especially during floods of greater magnitudes. Below Columbus, the floodplain width varies from 4 to 8 miles, and its side slopes average between 0.5 ft/mile and 1.5 ft/mile. In this area, no discernible valley exists, and the floodwaters can spill over beyond the basin divide causing interbasin spillage. Thus, this part of the basin provides significant flood peak attenuation. (References 2.4S.1-1 and 2.4S.1-8)

Table 2.4S.1-3 gives pertinent data of seven stream-flow gauging stations downstream of Mansfield Dam, including the mean, highest and lowest average annual flow for the period of record. The locations of these gauges are shown on Figure 2.4S.1-8 (Reference 2.4S.1-8). The streamflow gauging station nearest to the STP 3 & 4 site is located approximately 16 miles upstream of the STP site and about 2.8 miles west of Bay City, at river mile 32.5 on the Colorado River. Records of stage at this station have been collected since the installment of the gauge in April 1948 till present. Based on the historical data, for the water years 1948 to 2004, the highest annual stream flow at this station is 14,270 cfs (cubic feet per second), the lowest annual flow is 375 cfs, and the mean annual flow is about 2628 cfs.

Figure 2.4S.1-9 shows the flood inundated areas delineated by the Federal Emergency Management Agency (FEMA) in the area near the site of STP 3 & 4. The map shows different flood prone areas indicated as zones A, B, and C for flood insurance purposes. Zone A indicates areas of special flood hazard; zone B includes areas of moderate flood hazards, and zone C areas of minimal flood hazards. The site of STP 3 & 4 is located in Zone C, suggesting minimal flooding possibility.

2.4S.1.2.1.2 Little Robbins Slough

Little Robbins Slough (see Figure 2.4S.1-2) is a significant hydrologic feature near the STP site. It is an intermittent stream located nine miles northwest of Matagorda in southwestern Matagorda County and runs south for 6.5 miles to the point where it joins Robbins Slough, a brackish marsh, which meanders four more miles to the Gulf Intracoastal Waterway (Reference 2.4S.1-9). During the construction of the main cooling reservoir (MCR) for STP 1 & 2, the water course of Little Robbins Slough within the STP site was relocated to a channel on the west side of the west embankment of the reservoir and rejoined its natural course about one mile east of the southwest corner of the MCR. Therefore, flooding in Little Robbins Slough has no adverse effects on STP 3 & 4.

2.4S.1.2.1.3 Adjacent Drainage Basins

To the west of the Colorado River in the coastal area is the Colorado-Lavaca River Basin, as shown on Figure 2.4S.1-10. This basin includes the Tres Palacios Creek, which is not tributary to either of those rivers. The Colorado-Lavaca River Basin drains into Tres Palacios Bay, north of Matagorda Bay. In the event of interbasin spillage, flood waters from the Colorado River Basin flow into Caney Creek near Wharton, as in the case of the 1913 flood, or into the San Bernard River Basin on the east edge of the Colorado River Basin (Reference 2.4S.1-10), or into the Colorado-Lavaca River Basin on the west.

2.4S.1.2.1.4 Shore Regions

The STP 3 & 4 site is located 10.5 miles inland from Matagorda Bay and 16.9 miles inland from the Gulf of Mexico. It is approximately 75 miles from the Continental Shelf. The shoreline of Matagorda Peninsula along the Gulf of Mexico changes constantly, retreating landward or advancing seaward as the result of a combination of hydrologic and meteorological processes, climatic factors as well as engineering activities.

Matagorda Peninsula is a classic microtidal, wave-dominated coast with a mean diurnal tide range of approximately 2.1 ft. An evaluation of 20 years of data shows that "the mean significant wave height (Hs) at a location 40 km southeast of the Colorado River Entrance in 26 m water depth is 1.0 m, with a mean peak wave period (Tp) of 5.7 s. […] The hindcast data show that mean Hs varies from 0.8 m in August to 1.1 m from November through March and 1.2 m in April" (Reference 2.4S.1-11). This shore region is also greatly affected by waves generated by tropical storms and hurricanes.

The hydrologic features of the shore region are also altered by a series of engineering modifications. After the removal of a log jam on the Colorado River in 1929, a channel was dredged across the peninsula to allow the river to directly discharge to the Gulf of Mexico in 1936. Beginning in 1990s, the U.S. Army Corps of Engineers (USCOE) constructed jetties on each side of the river entrance and dredged an entrance channel. In 1993, USCOE constructed a diversion channel that directs the flow of the Colorado River into Matagorda Bay. The former river channel is now a navigation channel connected to the Intra Coastal Waterway (Reference 2.4S.1-11).

Studies conducted recently to calculate the average annual rate of shoreline changes show that the shoreline segment of Matagorda Peninsula 1.6 mile southwest of the Colorado River is retreating at a rate of 1.6 to 6.4 ft/yr. The shoreline from this point up north to the mouth of the Colorado River displays long-term advance. This is partly related to three factors: sediment load from the river, sand bypassing across the entrance jetties, and wave sheltering by the jetties. The shoreline northeast of the Colorado River is relatively stable and shows slight long-term advance in an area 8 miles to the northeast of the river mouth. (Reference 2.4S.1-11)

The historical hydrometeorological events were presented in Subsection 2.4S.5. Historical records show that about 33 hurricanes have impacted the Texas Coast from 1900 to 2005. A frequency analysis of hurricanes occurring between 1900 and 2005 along the Gulf Coast of Texas indicated that hurricanes can be expected to impact the

Texas Coast about once every three years. Based on the hydrometeorological conditions along the Texas Coast, Subsection 2.4S.5 develops the hydrometeorological design basis for considering potential hazards to the safety-related facilities due to the effects of probable maximum surge and seiche. The results show that the probable maximum surge and seiche flooding level should be 30.5 cm below site grade. Minimum grade for STP 3& 4 is defined as no less than 32 feet mean sea level.

2.4S.1.2.1.5 Surface Water Use

Beginning January 5, 2002, 14 counties within the Lower Colorado River Basin, including Matagorda County where the STP site is located, were designated by Texas Water Development Board (TWDB) as the Lower Colorado Water Planning Region (LCWPR) for the purpose of regional water resource management. LCWPR is also known as Region K (Figure 2.4S.1-11). Sources of water supply in this region include 10 aquifer systems and 6 river and coastal basins. The Colorado River makes up the single largest source of surface water for this region with large volumes of water available from both run-of-river diversion rights and water stored in reservoirs. The total annual water supply in the LCWPR is estimated to be nearly 1.3 million acre-feet, of which over 73 percent is from surface water sources. (Reference 2.4S.1-12)

The Water Rights Database maintained by the Texas Commission on Environmental Quality (TCEQ) was used to identify surface water users whose intake could be adversely affected by the accidental release of contaminants from the STP site (Reference 2.4S.1-13). This database contains data for all active and inactive surface water right permits and water supply contracts. The active surface water users in Matagorda County are presented in Table 2.4S.1-4. The information includes the owner, water use types, annual water withdrawal amounts, surface water sources and corresponding river basins. As shown in the table, the major surface water user upstream of the STP site is the Lower Colorado River Authority (LCRA). The LCRA is one of the two entities designated by LCWPR as “wholesale water providers.” Together with the other wholesale water provider, city of Austin, they supply a significant amount of water for municipal and/or manufacturing use for the Lower Colorado Region. Because the major diversion points on the river by LCRA are located upstream of the STP site, surface water users served by LCRA are not likely to be affected by the accidental releases from the STP site. There are no known river water users downstream of the STP site.

The location of most of the surface water users given in Table 2.4S.1-4 is shown in Figure 2.4S.1-12. The users shown in this Figure are identified by the number given in the first column of Table 2.4S.1-4. Some of the users listed in Table 2.4S.1-4 are not shown in Figure 2.4S.1-12 because information on their location is not readily available. Also for some users the location shown in Figure 2.4S.1-12 is that of the actual water intake or water use, while for other users the location given is that of their mailing address. Figure 2.4S.1-12 shows the location of the STP 1 & 2 makeup water intake (point #4 in Figure 2.4S.1-12).

The plant water demands for STP Units 3 & 4 are located in Table 3.3-1 of the Environmental Report. The total surface water demand for STP Units 3 & 4 is given by Stream 3, Total Required River Water to MCR. The plant requires surface water consumption only for MCR makeup.

2.4S.1.2.1.6 Data

Detailed descriptions of relevant spatial and temporal datasets in support of conclusions regarding safety of the plant are presented in corresponding subsections of this application. These datasets are all collected, maintained and distributed by Federal and State agencies. For example, the stream flow data of the Colorado River used in Subsection 2.4S.11 come from USGS; the water temperature records presented in Subsection 2.4S.7 are provided by LCRA; and the historical hydrometeorological data used in Subsection 2.4S.5 are from National Oceanic & Atmospheric Administration (NOAA).

2.4S.1.2.2 Groundwater

The local and regional groundwater characteristics are described in Subsection 2.4S.12. A detailed list of current groundwater users, groundwater well locations, and the withdrawal rates in the vicinity of the STP 3 & 4 site is presented in Subsection 2.4S.12.2.

The plant water demands for STP Units 3 & 4 are located in Table 3.3-1 of the Environmental Report. The total ground (well) water demand for STP Units 3 & 4 is given by Stream 2, Plant Well Water Demand. The plant requires well water makeup for Power Plant Makeup/Use, UHS System Makeup, and Potable Water.

2.4S.1.3 References

2.4S.1-1 "STPEGS Updated Final Safety Analysis Report, Units 1 & 2," Revision 13.

2.4S.1-2 "Report 04-6: Arc Hydro Developments for the Lower Colorado River Basin," Daniel R. Obenour and Dr. David R. Maidment, Centers for Research In Water Resources Online, University of Texas at Austin, May 2004. Available at http://www.crwr.utexas.edu/online.shtml, accessed on April 24, 2007.

2.4S.1-3 "The 2005 Initially Prepared Regional Water Plans (for the 2006 Adopted Regional Water Plans) for Lower Colorado Planning Region (Region K)," Chapter 1, Texas Water Development Board (TWDB). Available at http://www.twdb.state.tx.us/rwpg/main-docs/IPP-index.htm, accessed on April 5, 2007.

2.4S.1-4 "Colorado River Flood Guide," Lower Colorado River Authority (LCRA), Austin, TX, January 2003.

2.4S.1-5 "National Inventory of Dams," U.S. Army Corps of Engineers. Available at http://crunch.tec.army.mil/nidpublic/webpages/nid.cfm, website accessed on April 11, 2007.

2.4S.1-6 Website on dams, lakes and structures designed for flood management, water supply, hydroelectricity, Lower Colorado River Authority. Available at http://www.lcra.org/water/dams.html, website accessed on April 5, 2007.

2.4S.1-7 Website on managing the region's water supply, Lower Colorado River Authority. Available at http://www.lcra.org/water/supply.html, accessed on May 15, 2007.

2.4S.1-8 "Water Resources Data, Texas, Water Year 2004," Volume 4, Colorado River basin, Lavaca River basin, and intervening coastal basins, Long, Susan C. Aragon, Reece, Brian D., Eames, Deanna R., U.S. Geological Survey. Available at http://pubs.usgs.gov/wdr/2004/WDR-TX-04-4/index.html, accessed on April 10, 2007.

2.4S.1-9 "Handbook of Texas Online, Under the World." Available at http://www.tsha.utexas.edu/handbook/online/articles/LL/rhl8.html, accessed May 15, 2007.

2.4S.1-10 Friend of River San Bernard website, San Bernard River basin. Available at http://www.sanbernardriver.com/sanbernard/index.htm, accessed on June 27, 2007.

2.4S.1-11 "Texas Shoreline Change Project – Gulf of Mexico Shoreline Change from the Brazos River to Pass Cavallo," James C. Gibeaut et al., Bureau of Economic Geology, The University of Texas, October 2000.

2.4S.1-12 Texas Water Development Board (TWDB) website, 2006 Adopted Regional Water Plans for Lower Colorado Planning Region (Region K). Available at http://www.twdb.state.tx.us/RWPG/main-docs/2006RWPindex.asp, accessed on April 15, 2007.

2.4S.1-13 Texas Commission on Environmental Quality, Water Rights Database and Related Files. Available at http://www.tceq.state.tx.us/permitting/water_supply/ water_rights/wr_databases. html, accessed on April 9, 2007.

2.4S.1-14 "Texas Administrative Code – Title 30, Part 1, Chapter 299," Office of the Secretary of State of Texas, provisions adopted to be effective May 13, 1986 (11 TexReg 1978).

2.4S.1-15 River Basin Map of Texas, 1996, Bureau of Economy Geology, The University of Texas at Austin, Austin , Texas 78713-8924.

Table 2.4S.1-1 Major Dams in the Colorado River Basin

	Dam Name	NID ID	River	Maximum Height ft	Maximum Storage acre-ft	Drainage Area sq mi	Surface Area acre	Year Completed	Dam Type	Dam Purposes	Hazard	County	Owner Type	Owner Name	Longitude degrees	Latitude degrees
1	Mansfield Dam (Marshall Ford Dam)	TX01087	Colorado River	278	3,223,000	38,130	18,929	1942	REPGER	IH	H	Travis	L	Lower Colorado River Authority	-97.9067	30.3917
2	Simon Freese Dam (Stacy Dam)	TX06386	Colorado River	148	1,235,813	18.4	19,149	1989	RECN	R	H	Coleman	L	Colorado River Municipal Water District	-99.6683	31.4967
3	Twin Buttes	TX00022	Middle And South Concho Rivers	134	1,087,530	2,472	32,660	1962	RE	ICR	H	Tom Green	F	DOI BR	-100.5333	31.3767
4	Buchanan Dam	TX00989	Colorado River	146	982,000	50.1	23,060	1937	PGRE	IH	H	Burnet	L	Lower Colorado River Authority	-98.4183	30.7517
5	Robert Lee Dam	TX03517	Colorado River	140	810,000	4,140	18,000	1969	RE	R	H	Coke	L	Colorado River Municipal Water District	-100.515	31.895
6	OC Fisher Dam (San Angelo Dam)	TX00012	Concho River	128	696,300	1,511	3,854	1952	RE	R	H	Tom Green	F	Corps Of Engineers SWF	-100.4833	31.4667
7	Lake Brownwood Dam	TX02789	Pecan Bayou	120	448,200	2.4	7,300	1933	RE	R	H	Brown	L	Brown County WID No 1	-99.0017	31.8383
8	Lake J B Thomas Dam (Colorado River Dam)	TX04138	Colorado River	105	360,000	3,524	7,820	1952	RE	R	H	Scurry	L	Colorado River Municipal Water District	-101.135	32.5833
9	Alvin Wirtz Dam	TX00986	Colorado River	118	227,000	37.8	6,375	1951	RE	HR	H	Burnet	L	Lower Colorado River Authority	-98.3383	30.555
10	Brady Dam	TX01659	Brady Creek	104	212,400	513	2,020	1963	RE	R	H	McCulloch	L	City Of Brady	-99.3917	31.14
11	Natural Dam Salt Lake	TX06028	Sulphur Springs Draw	47	207,265	556	3,710	1989	RE	CP	H	Howard	L	Colorado River Municipal Water District	-101.625	32.2183
12	Coleman Dam	TX02152	Jim Ned Creek	92	91,680	299	1,886	1966	RE	R	H	Coleman	L	City Of Coleman	-99.465	32.03
13	Champion Creek Dam	TX01691	Champion Creek	120	90,200	164	1,560	1959	RE	R	L	Mitchell	U	TU Electric	-100.86	32.2817
14	Cedar Creek Dam	TX04380	Cedar Creek	106	88,628	6.3	2,400	1977	RE	C	H	Fayette	L	Lower Colorado River Authority	-96.7367	29.915
15	Oak Creek Dam	TX03516	Oak Creek	95	79,336	244	2,375	1950	RE	C	H	Coke	L	City Of Sweetwater	-100.2667	32.04
16	Tom Miller Dam	TX01086	Colorado River	85	73,100	26,124	1,830	1939	CNPG	HR	H	Travis	L	City Of Austin	-97.7867	30.295
17	Colorado City Dam (Morgan Creek Dam)	TX01693	Morgan Creek	85	70,700	322	1,610	1949	RE	R	L	Mitchell	U	TU Electric	-100.9167	32.3183

Table 2.4S.1-1 Major Dams in the Colorado River Basin (Continued)

	Dam Name	NID ID	River	Maximum Height	Maximum Storage	Drainage Area	Surface Area	Year Completed	Dam Type	Dam Purposes	Hazard	County	Owner Type	Owner Name	Longitude	Latitude
				ft	acre-ft	sq mi	acre								degrees	degrees
18	Roy Inks Dam	TX00988	Colorado River	96	63,500	32,076	803	1938	PG	HR	H	Burnet	L	Lower Colorado River Authority	-98.385	30.73
19	Mitchell County Dam	TX06420	Beals Creek	70	50,241	15.3	1,603	1991	REOT	T	S	Mitchell	L	Colorado River Municipal Water District	-101.105	32.24
20	Hords Creek Dam	TX00006	Hords Creek	91	49,290	48	510	1948	RE	R	H	Coleman	F	Corps Of Engineers SWF	-99.5667	31.85
21	Decker Creek Dam	TX01089	Decker Creek	83	45,200	9.3	1,269	1967	RE	R	H	Travis	L	City Of Austin	-97.5967	30.285
22	Nasworthy Dam	TX03139	South Concho River	47	42,500	3,833	-	1930	RE	R	H	Tom Green	L	City Of San Angelo	-100.4783	31.3883
23	Ballinger Municipal Lake Dam (Lake Moonen Dam)	TX05952	Valley Creek	76	34,353	-	560	1985	RE	R	H	Runnels	L	City of Ballinger	-100.0433	31.73
24	Elm Creek Dam	TX05776	Elm Creek	57	33,500	65.5	643	1983	RE	R	H	Runnels	L	City of Winters	-99.8683	31.9383
25	Sulphur Springs Draw Dam	TX06482	Sulphur Springs Draw	33	20,692	258	970	1993	RE	T	S	Martin	L	Colorado River Municipal Water District	-101.7486	32.3217
26	Bastrop Dam	TX02718	Spicer Creek	80	16,962	8.7	244	1964	RE	R	H	Bastrop	L	Lower Colorado River Authority	-97.2917	30.155
27	Upper Pecan Bayou WS SCS Site 17 Dam (Lake Clyde Dam)	TX02940	North Prong Pecan Bayou	63	16,550	38	449	1970	RE	C	S	Callahan	L	Callahan Divide SWCD	-99.47	32.3133
28	Brady Creek WS SCS Site 17 Dam	TX01677	South Brady Creek	50	13,511	28.8	76	1962	RE	C	L	McCulloch	L	McCulloch SWCD	-99.5967	31.1467
29	Brady Creek WS SCS Site 28 Dam	TX01626	Fitzgerald Creek	42	13,042	21.88	67	1957	RE	C	L	Concho	L	Concho SWCD	-99.88	31.1486
30	Brady Creek WS SCS Site 31 Dam	TX01625	Brady Creek	50	11,155	22.5	-	1958	RE	C	L	Concho	L	Concho SWCD	-99.975	31.1683

Table 2.4S.1-1 Major Dams in the Colorado River Basin (Continued)

Notes:

Dam Type (in the order of importance)		Dam Purposes		Owner Type
RE - Earth		I - Irrigation		F - Federal
ER - Rockfill		H - Hydroelectric		S - State
PG - Gravity		C - Flood Control and Storm Water Management		L - Local Government
CB - Buttress		N - Navigation		U - Public Utility
VA - Arch		S - Water Supply		P - Private
MV - Multi-Arch		R - Recreation		
CN - Concrete		P - Fire Protection, Stock, Or Small Farm Pond		
MS - Masonry		F - Fish and Wildlife Pond		
ST - Stone		D - Debris Control		
TC - Timber Crib		T - Tailings		
OT - Other		O – Other		

Downstream Hazard Potential		
Potential hazard to the downstream area resulting from failure or misoperation of the dam or facilities:		
L - Low	**S - Significant**	**H - High**
Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.	Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.	Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary)

Source: Reference 2.4S.1-5

Table 2.4S.1-2 Pertinent Characteristics for Two Major Dams in the Colorado River

Characteristics	Mansfield Dam	Buchanan Dam
General description		
Dam Type	Concrete gravity with embankment wing dams & saddle dikes	Multiple Concrete Arch, gated and gravity section
Watercourse	Colorado River, TX	Colorado River, TX
Reservoir	Lake Travis	Lake Buchanan
Ownership	Lower Colorado River Authority	Lower Colorado River Authority
Dimensions		
Structural Height (ft)	278	145.5
Crest Length (ft)	7,089.4	10,987.6
Top Width (ft)	30	Varies, with the maximum at 33.8 ft
Hydraulics and Hydrology		
Drainage Area (sq. mile)	38,130 [1]	31,250 [1]
Surface Area of the Reservoir (acre)	18,622	22,335
Elevation when full	El. 681 ft MSL	El. 1,020.35 ft MSL
Top of Dam	El. 750 ft MSL	El. 1,025.35
Total Storage (acre-feet)	1,131,650 at El. 681 ft	875,566 at El. 1,020.35 ft
Spillway Elevation	El. 714 ft MSL	Section 1 & 2 (near north end and center): El. 1005.5 ft MSL with 30 gates, each 33 ft x 15.5 ft Section 3 (near the Powerhouse): El. 995.5 ft MSL with 7 gates, each 40 ft x 25.5 ft Section 4 (far north end): El. 1020.5 ft MSL
Historic High (ft)	El. 710.4 ft MSL on Dec. 25, 1991	El. 1,021.4 ft MSL on Dec. 20, 1991

Table 2.4S.1-2 Pertinent Characteristics for Two Major Dams in the Colorado River (Continued)

Characteristics	Mansfield Dam	Buchanan Dam
Hydraulics and Hydrology		
Historic Low (ft)	El. 614.2 ft MSL on Aug. 14, 1951	El. 983.7 ft MSL on Sep. 9, 1952
Normal Operating Range (ft)	at or below El. 681 ft MSL	May to October: at or below El. 1,018 ft MSL November to April: at or below El. 1,020.35 ft MSL
Discharge capacity (cfs)	121,080 cfs 24 floodgates @ 4,770 cfs each 3 turbines @ 2,200 cfs each	355,000 cfs 7 large floodgates @ 19,000 cfs each 30 small floodgates @ 7,250 cfs each 3 turbines @ 1,500 cfs each

Source: Reference 2.4S.1-6

[1] Including about 11,900 sq. miles non-contributory area

Table 2.4S.1-3 Streamflow Gauge Stations Downstream of Mansfield Dam

Gauge No.	Gauge Name	Location (river mile)	Longitude	Latitude	County	Drainage Area (square mile) [1]	Period of Record From Year	Years of Record [2]	Historical Annual Flow Rate (cfs)		
									Highest	Lowest	Mean
08158000	Austin	290.3	97.694	30.244	Travis	39,009	1898	106	7,535	590	2,168
08159200	Bastrop	236.6	97.319	30.104	Bastrop	39,979	1960	44	9,073	828	2,227
08159500	Smithville	212.1	97.161	30.013	Bastrop	40,371	1930	74	6,780	794	2,654
08160400	LaGrange	177	96.904	29.912	Fayette	40,874	1988	16	9,913	930	2,662
08161000	Columbus	135.1	96.537	29.706	Colorado	41,640	1916	88	10,810	653	3,100
08162000	Wharton	66.6	96.104	29.309	Wharton	42,003	1939	65	11,120	615	2,740
08162500	Bay City	32.5	96.012	28.974	Matagorda	42,240	1948	56	14,270	375	2,628

Source: Reference 2.4S.1-8

[1] All drainage areas include 11,403 square miles of probably noncontributing area

[2] All gauges listed in the table are currently active, and “years of record” is counted from the beginning year up to the water year of 2004

Table 2.4S.1-4 Active Surface Water Users in Matagorda County

#	WR Type	WR Issue Date	Owner Name or Site Name	Owner Type	Amount	Type of	Area	Reservoir Capacity	Basin	River/Stream
					acre-ft/yr	Use	acres	acre-ft		
1	6	6-28-1989	Lower Colorado River Authority (Gulf Coast Water Division)	Organization	2,142,180	5	-	1,560	Colorado	Colorado River
2	6	6-28-1989	Lower Colorado River Authority (Gulf Coast Water Division)	Organization	262,500	3	50,000	383	Colorado	Colorado River
3	6	6-28-1989	STP Nuclear Operating Company Agent et al	Others	102,000	2	-	-	Colorado	Colorado River
4	6	6-28-1989	STP Nuclear Operating Company Agent	Organization	80,125 [1]	2	-	202,988	Colorado	Colorado River
5	6	1-20-1987	Farmers Canal Company	Organization	20,615	3	15,000	457.3	Colorado-Lavaca	Tres Palacios et al
6	9	6-3-1988	Celanese Ltd	Organization	3,222	2	-	-	Colorado	Colorado River
7	1	4-25-2001	Herff Cornelius	Individual	2,400	3	400	404[2]	Brazos-Colorado	Live Oak Bayou
8	6	2-7-1985	O B Stanley	Individual	2,339	3	481	-	Brazos-Colorado	Peyton Crk
9	6	1-20-1987	South Texas Land Ltd Partner	Organization	1,500	3	600	271	Colorado-Lavaca	Moccasin Crk
10	1	4-29-1985	Don A Culwell et al	Others	1,500	2	-	79	Colorado-Lavaca	Buttermilk Slough
11	1	4-29-1983	John Schmermund	Individual	1,500	3	375	-	Colorado-Lavaca	E Carancahua Crk
12	1	9-14-1982	The Minze Land Investments Lp	Organization	1,000	3	500	3	Brazos-Colorado	Hardeman Slough
13	6	2-7-1985	Russell & Juanita Matthes	Individual	880	3	472	6	Brazos-Colorado	Live Oak Slough
14	6	2-7-1985	Hudgins Division Of HD Hudgins	Individual	800	3	400	190	Brazos-Colorado	Caney Crk
15	1	4-29-1985	Don A Culwell et al	Others	750	2	-	31	Colorado-Lavaca	Buttermilk Slough
16	6	8-26-1988	Crouch Family Limited Partnership Llp	Organization	728	3	-	-	Colorado	Blue Crk
17	6	2-7-1985	E Cross Cattle Co. Inc.	Organization	668	3	334	-	Brazos-Colorado	Peyton Crk
18	6	2-7-1985	E Cross Cattle Co. Inc.	Organization	600	3	300	-	Brazos-Colorado	Peyton Crk
19	6	2-7-1985	E Cross Cattle Co. Inc.	Organization	592	3	296	-	Brazos-Colorado	Peyton Crk
20	6	2-7-1985	John A. Huebner Jr et al	Others	550	3	500	2	Brazos-Colorado	Dry Crk
21	1	4-4-1983	Futuro Farms Inc	Organization	450	3	90	10	Brazos-Colorado	Big Boggy Crk
22	6	2-7-1985	Francis I Savage	Individual	411	3	84.4	-	Brazos-Colorado	Peyton Crk
23	6	1-20-1987	Lawrence J Peterson & Wife	Individual	400	3	200	-	Colorado-Lavaca	Tres Palacios
24	6	1-20-1987	Max Cornelius Johnson et al	Others	400	3	200	400	Colorado-Lavaca	Tres Palacios
25	1	12-23-1986	Matagorda Bay Aquaculture Inc.	Organization	316	2	-	50	Colorado-Lavaca	Tres Palacios
26	6	1-20-1987	Louis F Harper	Individual	301	3	301	-	Colorado-Lavaca	Ducrow
27	1	2-22-1993	Matagorda Co Drainage Dist #1	Organization	260	8	-	-	Brazos-Colorado	Cottonwood Crk
28	6	2-7-1985	John A. Huebner Jr et al	Others	250	3	-	-	Brazos-Colorado	Dry Crk
29	1	6-24-1983	Runnels Pasture Company Ltd	Organization	219	3	150	-	Brazos-Colorado	Caney Crk
30	6	1-20-1987	Farmers Canal Company	Organization	120	3	60	-	Colorado-Lavaca	Tres Palacios
32	1	2-16-1982	Linda C Moore	Individual	90	3	90	4.2	Brazos-Colorado	Caney Crk
33	1	3-5-1981	Lillian G Zernicek	Individual	80	3	40	-	Brazos-Colorado	Big Boggy Crk
34	6	2-7-1985	Johnny Wayne & Vicki L Jones	Individual	78	3	-	-	Brazos-Colorado	Caney Crk

Table 2.4S.1-4 Active Surface Water Users in Matagorda County (Continued)

#	WR Type	WR Issue Date	Owner Name or Site Name	Owner Type	Amount acre-ft/yr	Type of Use	Area acres	Reservoir Capacity acre-ft	Basin	River/Stream
35	6	2-7-1985	Michael J Pruett	Individual	44	3	44.5	-	Brazos-Colorado	Caney Crk
36	6	2-7-1985	Samantha Annette Hudgins	Individual	41	3	40.5	-	Brazos-Colorado	Caney Crk
37	6	2-7-1985	D R Alford	Organization	40	3	40	-	Brazos-Colorado	Caney Crk
38	1	4-29-1983	Betty Gene Mcaferty et al	Others	35	3	35	-	Brazos-Colorado	Caney Crk
39	6	2-7-1985	Donald R & Janice M Kopnicky	Individual	30	3	15	-	Brazos-Colorado	Cottonwood Crk
40	6	2-7-1985	Timothy R Blaylock & Wife	Individual	26	3	17	-	Brazos-Colorado	Caney Crk
41	1	6-20-1984	Julia Holub et al	Others	25	3	60	-	Brazos-Colorado	Hardeman Slough
42	6	2-7-1985	Michael D Stone	Individual	24	3	47.8	-	Brazos-Colorado	Caney Crk
43	6	2-7-1985	Estate Of P J Reeves Jr	Estate or Trust	20	3	60	-	Brazos-Colorado	Caney Crk
44	6	2-7-1985	John S Runnells III (Ashwood Farms)	Individual	17	3	26	-	Brazos-Colorado	Caney Crk
45	6	1-20-1987	Mrs Glen Hutson et al	Others	7	3	3	-	Colorado-Lavaca	Cash's
46	6	2-7-1985	Ben H Towler Jr	Individual	6	3	12.2	-	Brazos-Colorado	Caney Crk
47	6	2-7-1985	Johnny Wayne & Vicki L Jones	Individual	2	3	40	-	Brazos-Colorado	Caney Crk
48	6	6-28-1989	Nrg Texas Lp (South Texas Project (HLP))	Organization	-	2	-	-	Colorado	Colorado River
49	1	6-5-1998	Texas Brine Co Llc	Organization	-	2	-	-	Colorado	Colorado River
50	1	4-29-1985	Don A Culwell et al	Others	-	7	-	82	Colorado-Lavaca	Buttermilk Slough
51	1	4-4-1983	G P Hardy III	Individual	-	3	-	-	Brazos-Colorado	Big Boggy Crk

Source: Reference 2.4S.1-13

[1] This number represents the consumptive amount

[2] This includes on-channel reservoir capacity = 360 acre-feet, and off-channel capacity = 44 acre-feet

Water Right Type:
1 = Application/Permit
6 = Certificate of Adjudication
9 = Contract/Contractual Permit/Agreement

Use of the water right:
1 = Municipal/Domestic
2 = Industrial
3 = Irrigation
4 = Mining
5 = Hydroelectric
6 = Navigation
7 = Recreation
8 = Other
9 = Recharge
11 = Domestic & Livestock Only
13 = Storage

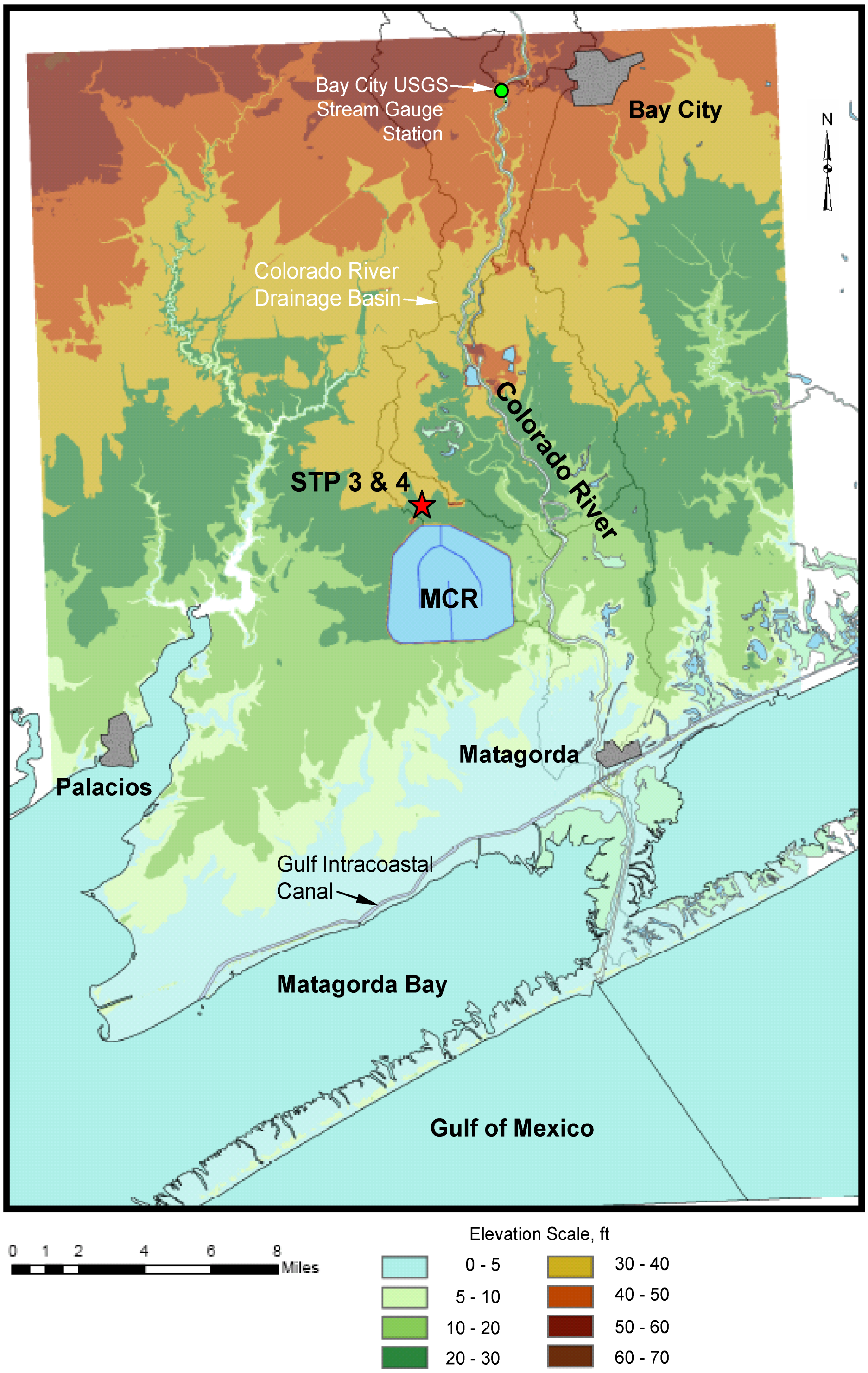

Figure 2.4S.1-1 Site Map of the General Area of STP 3 & 4

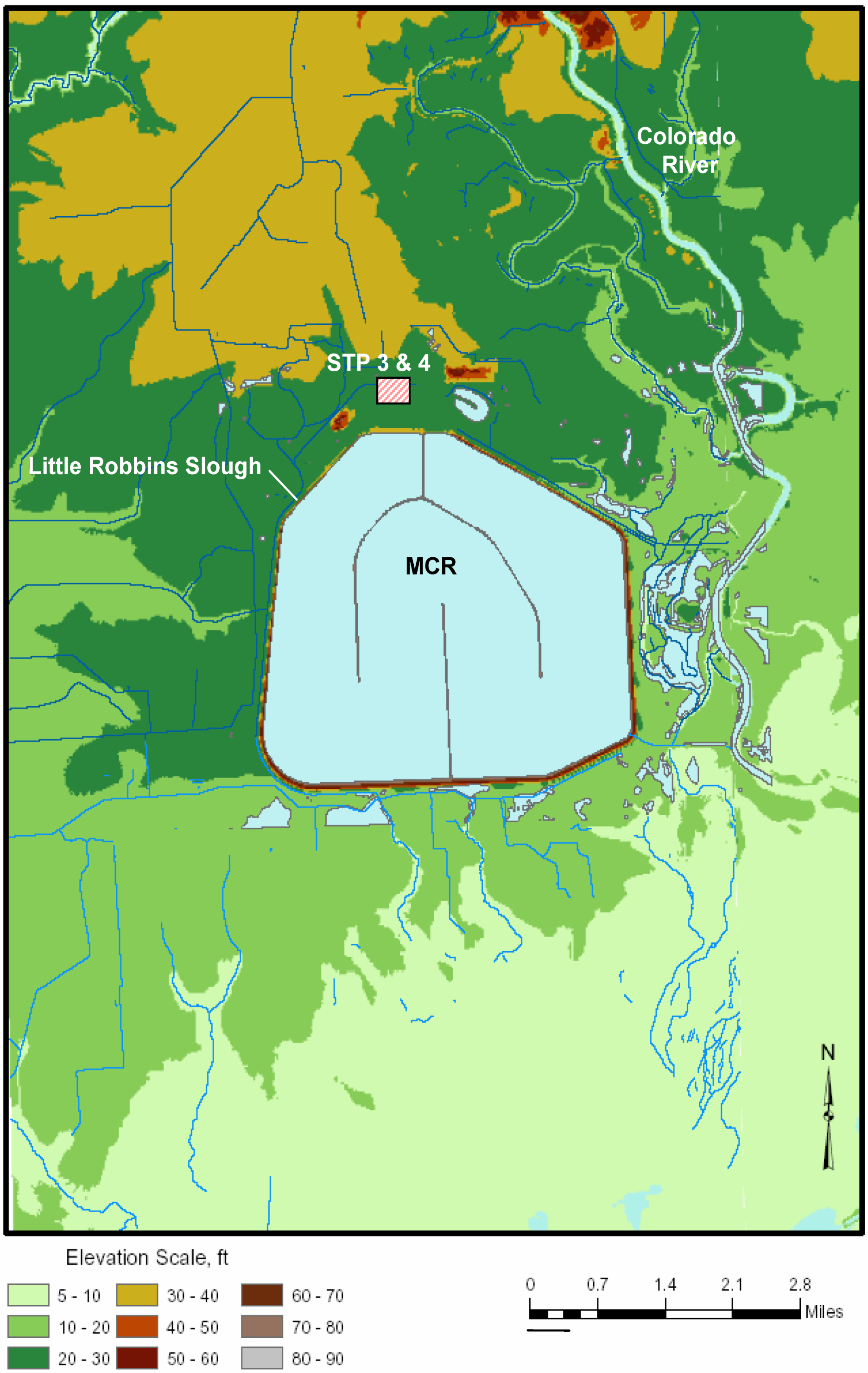

Figure 2.4S.1-2 Site Map of STP 3 & 4 (Topography based on USGS data)

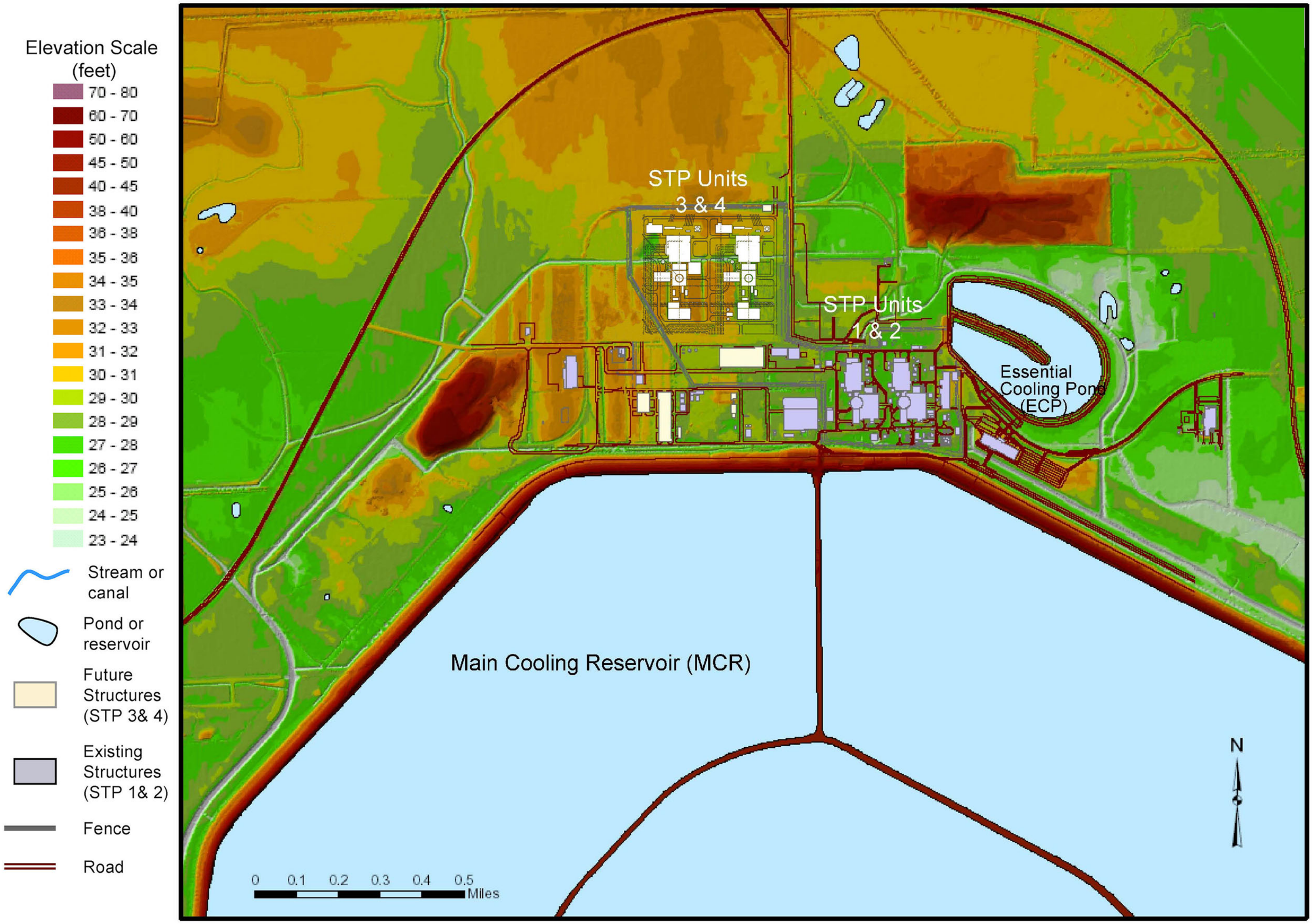

Figure 2.4S.1-3 Existing (Pre-Development) Topography and Major Structures at STP 3 & 4

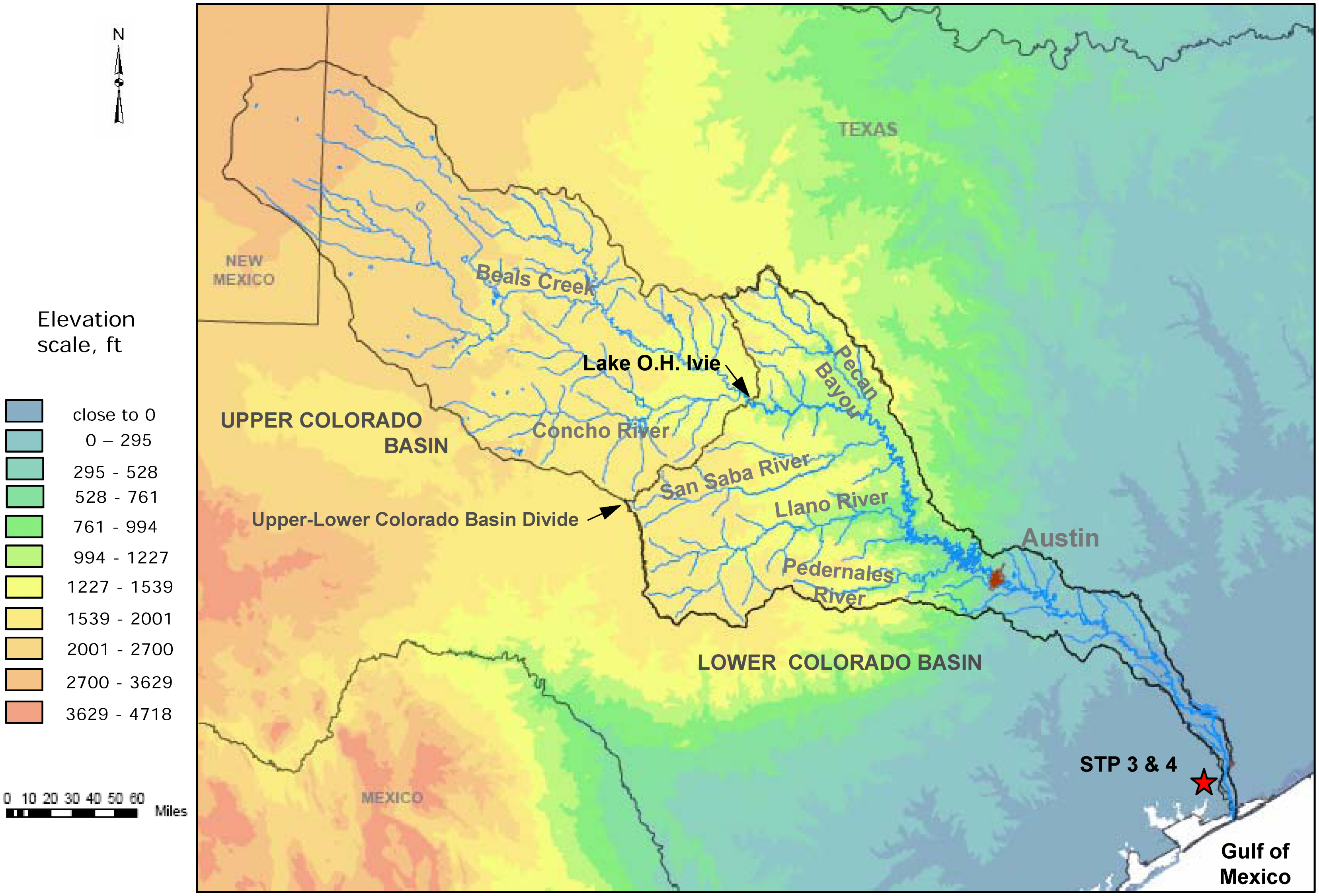

Figure 2.4S.1-4 The Colorado River Basin (Reference 2.4S.1-2)

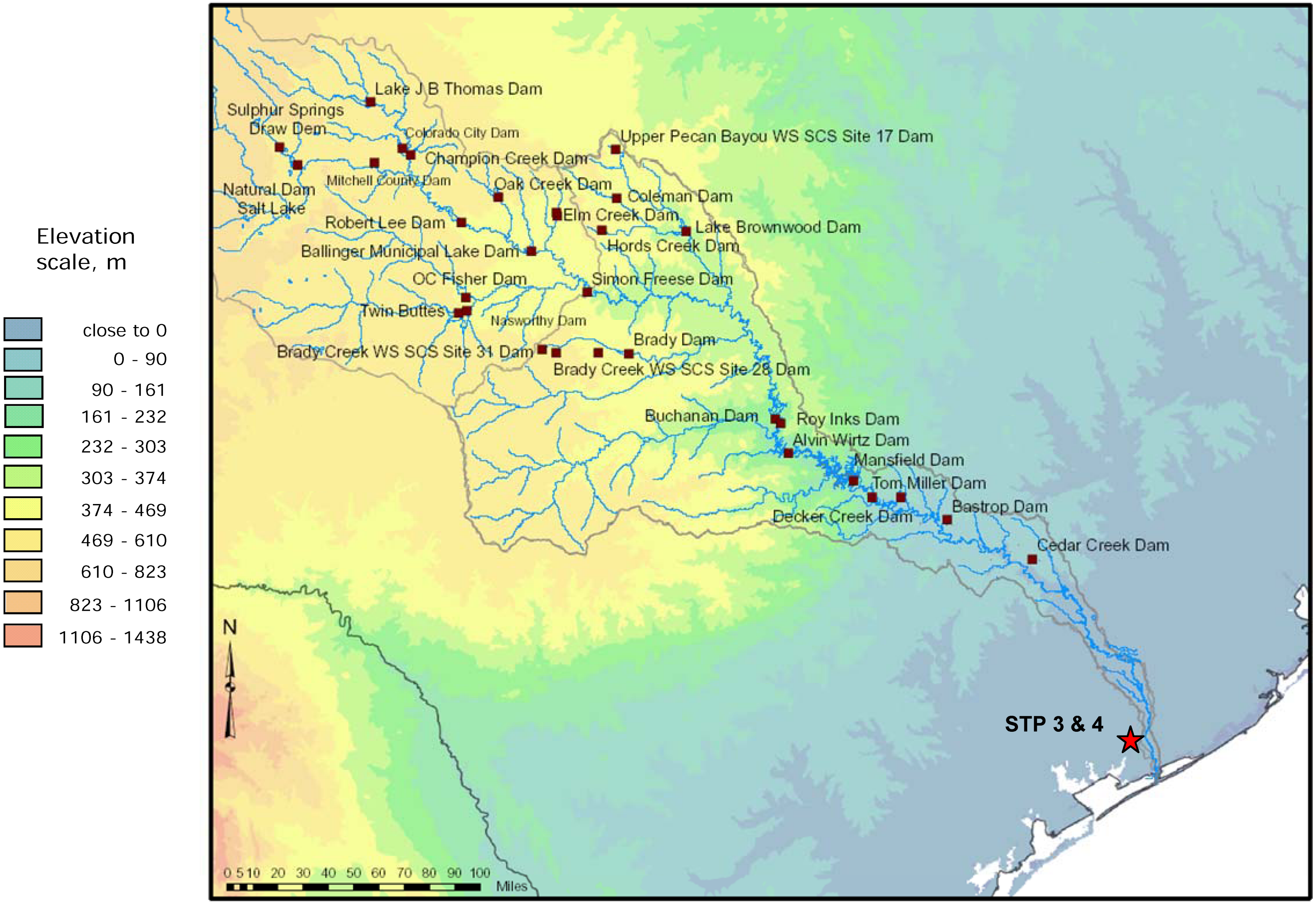

Figure 2.4S.1-5 Major Dams in the Colorado River Basin

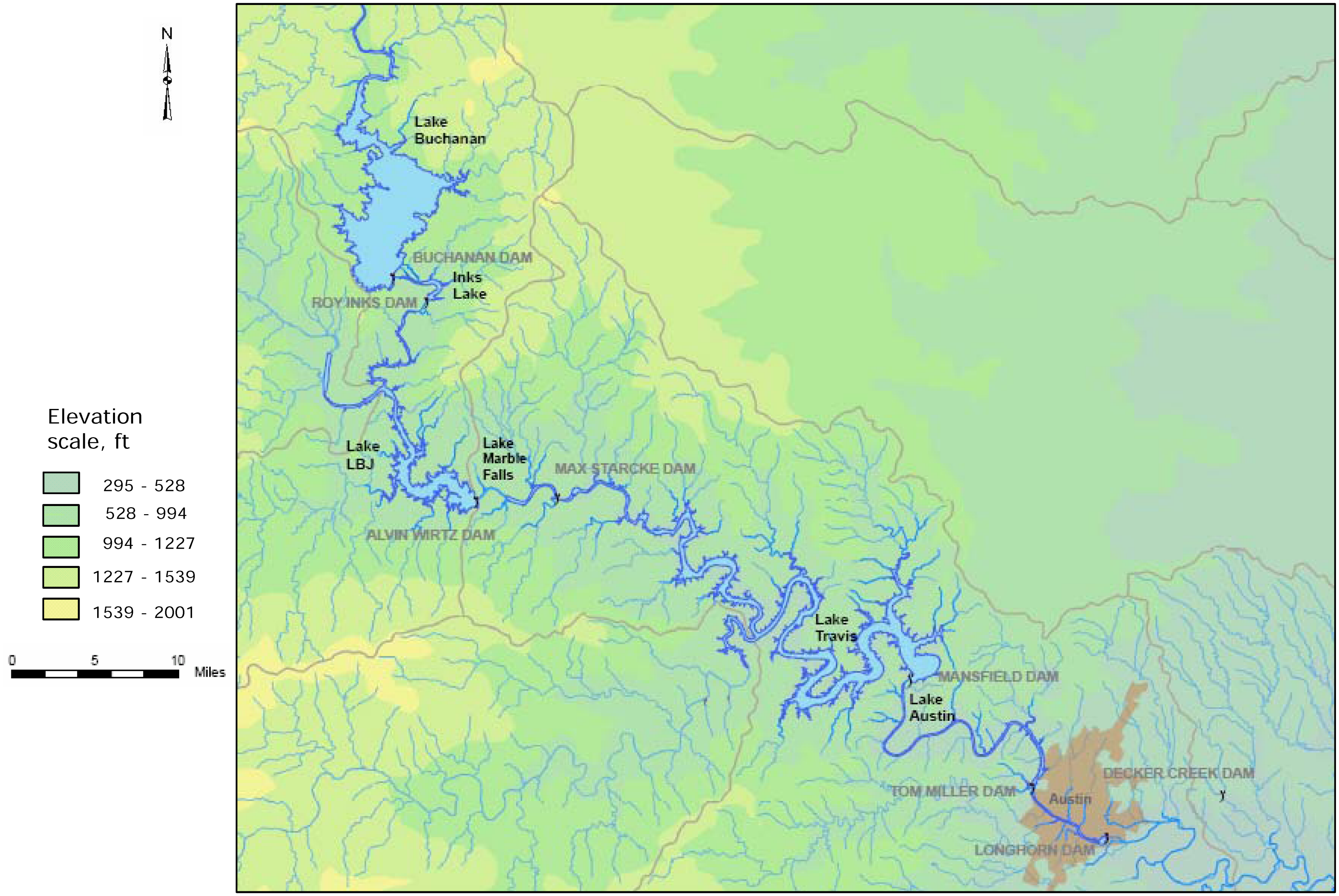

Figure 2.4S.1-6 The Highland Lakes and Dams in the Lower Colorado River Basin (Reference 2.4S.1-6)

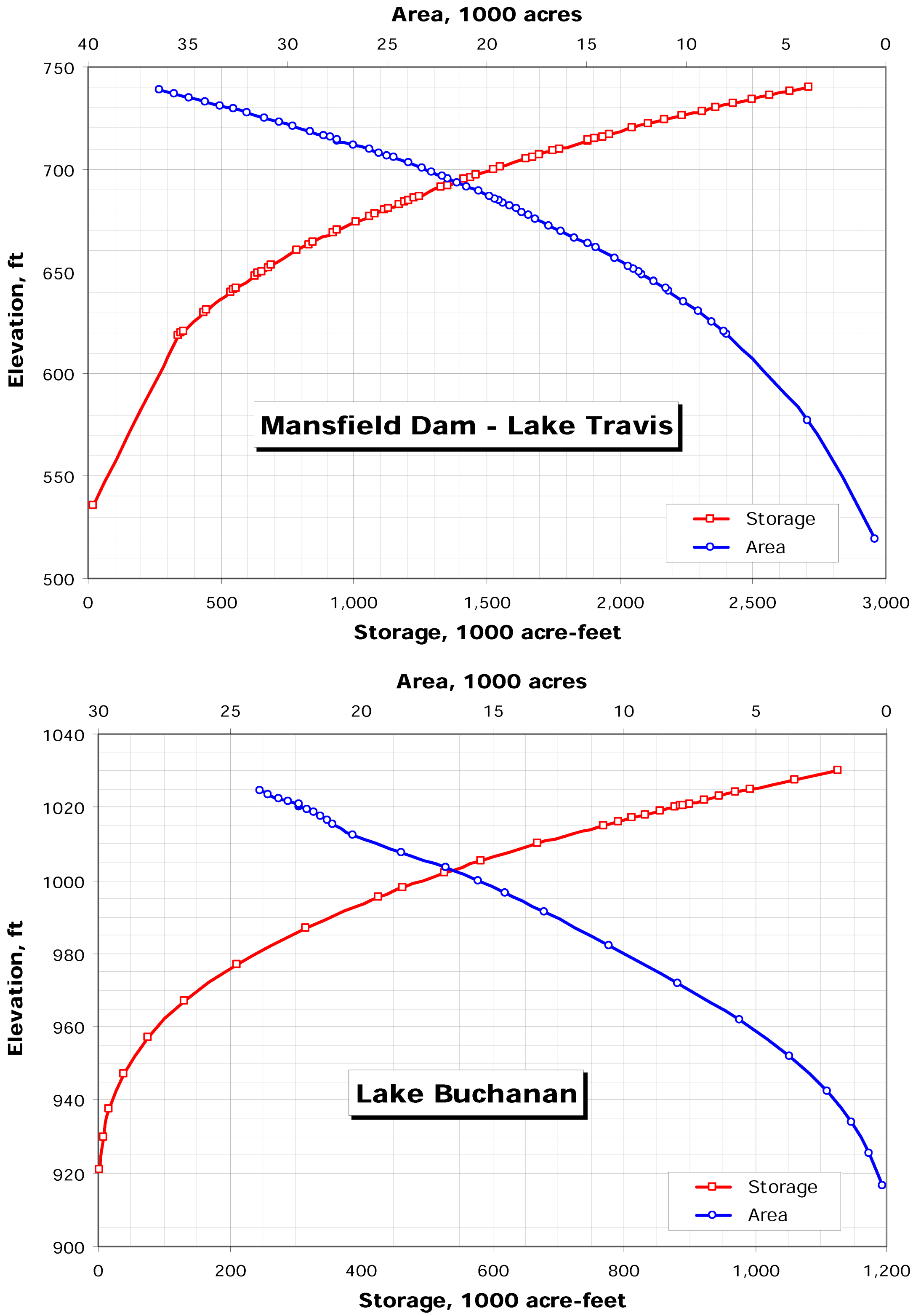

Figure 2.4S.1-7 Area-Capacity Curves for Major Reservoirs on the Colorado River

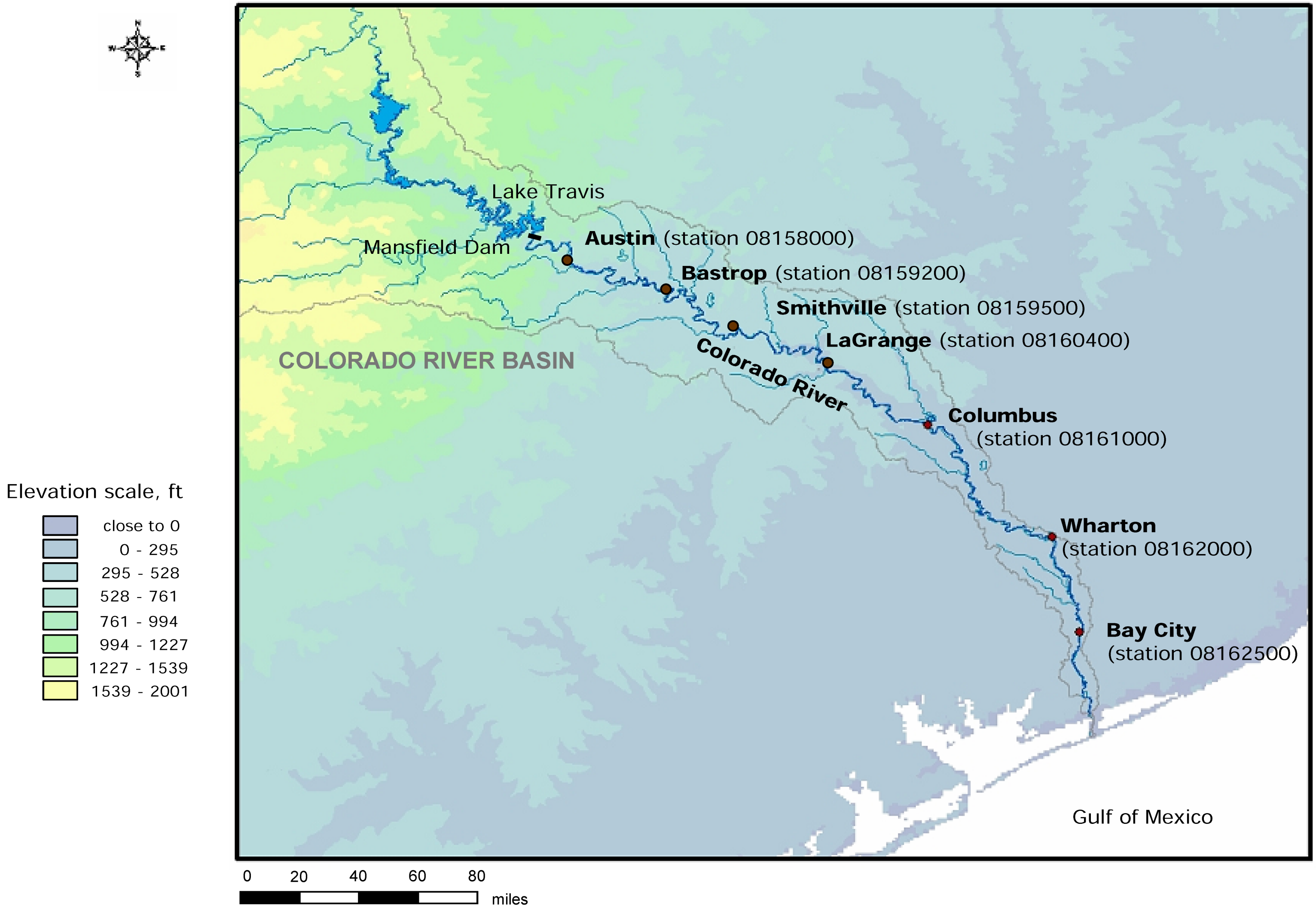

Figure 2.4S.1-8 The Colorado River Streamflow Gauging Stations Downstream of Mansfield Dam

Elevation Scale, ft

- 0 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70

Zone A
Areas of 100-year flood.

Zone B
Areas between the limits of the 100-year flood and 500-year flood;
or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile;
or areas protected by levees from the base flood.

Zone C
Areas of minimum flooding.

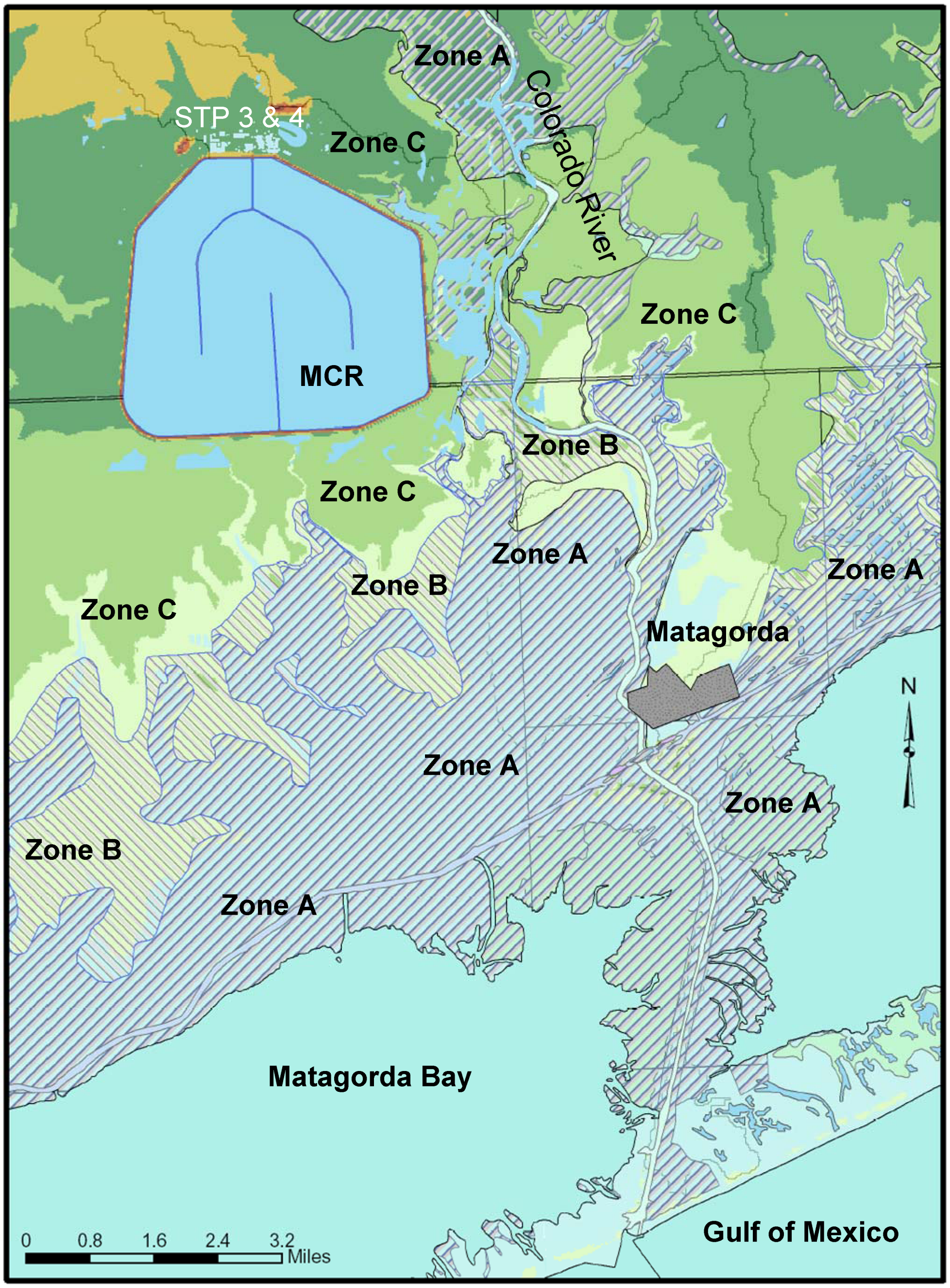

Figure 2.4S.1-9 Map of Flood Inundated Areas Near the STP 3 & 4

(Source: composite of Federal Emergency Management Agency maps 4854890375C, 4854890400C, 4854890550C, 4854890555D, 4854890560D, and 4854890565D)

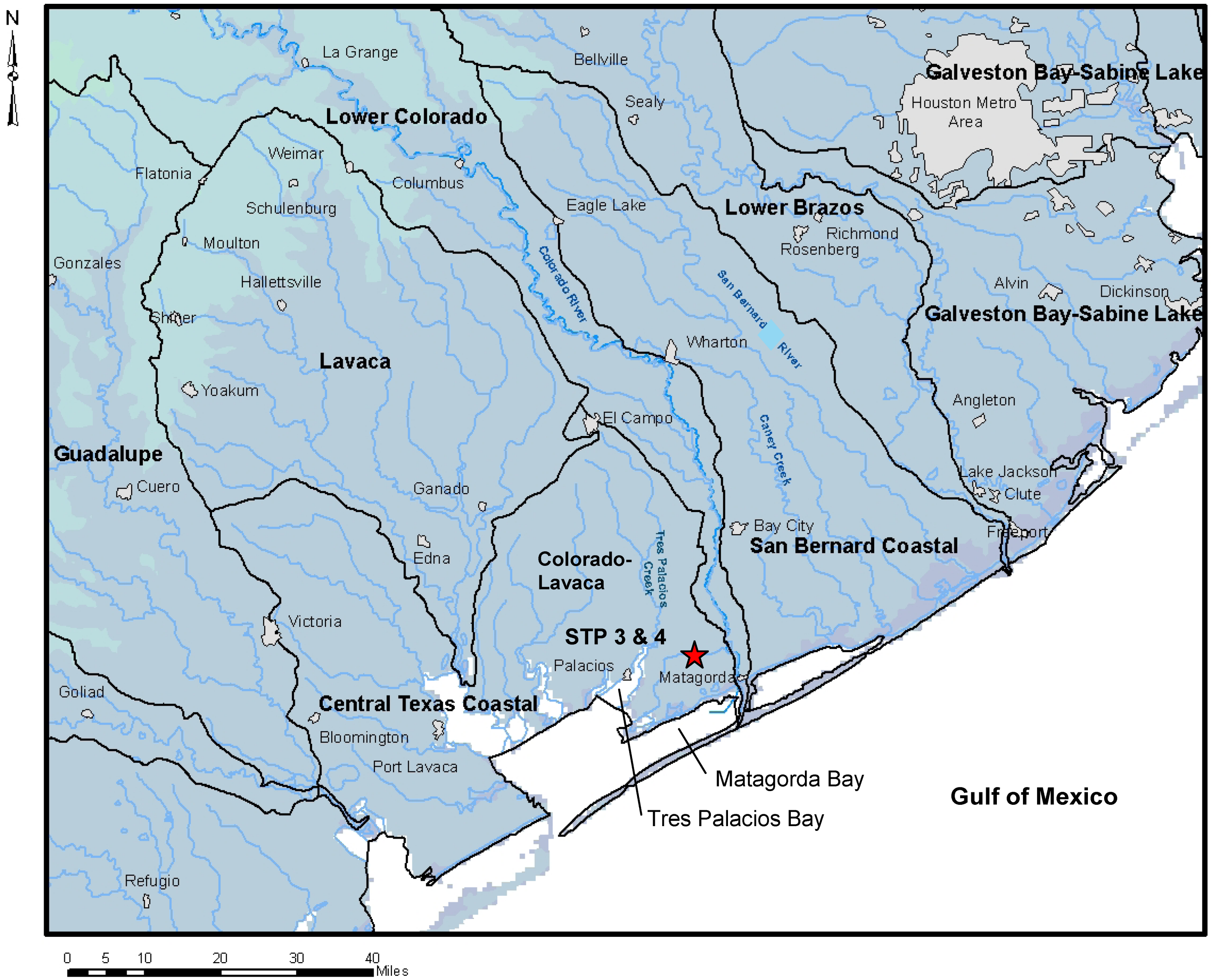

Figure 2.4S.1-10 River Basins Adjacent to the Lower Colorado Basin (Reference 2.4S.1-15)

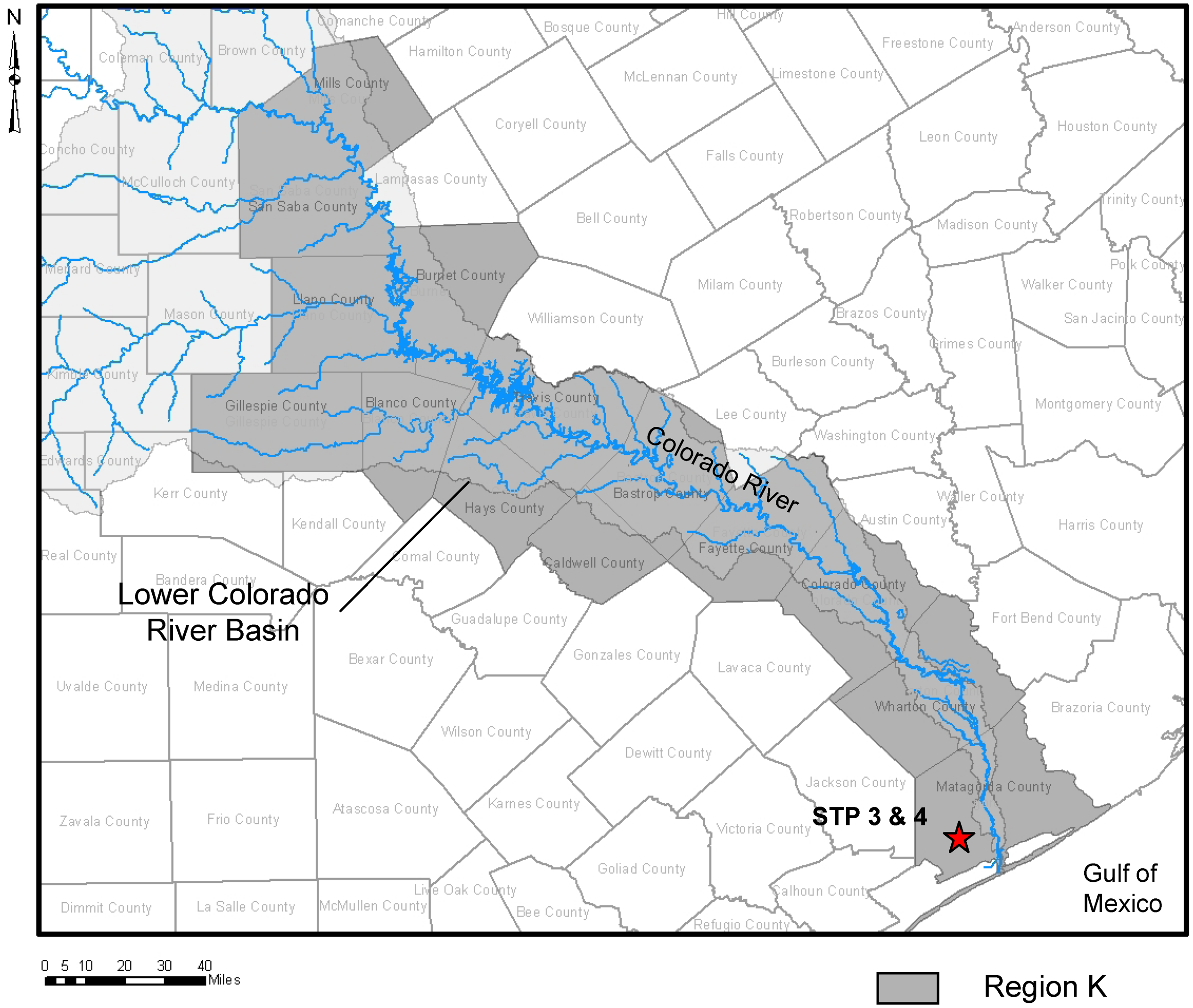

Figure 2.4S.1-11 Lower Colorado Water Planning Region (Region K)

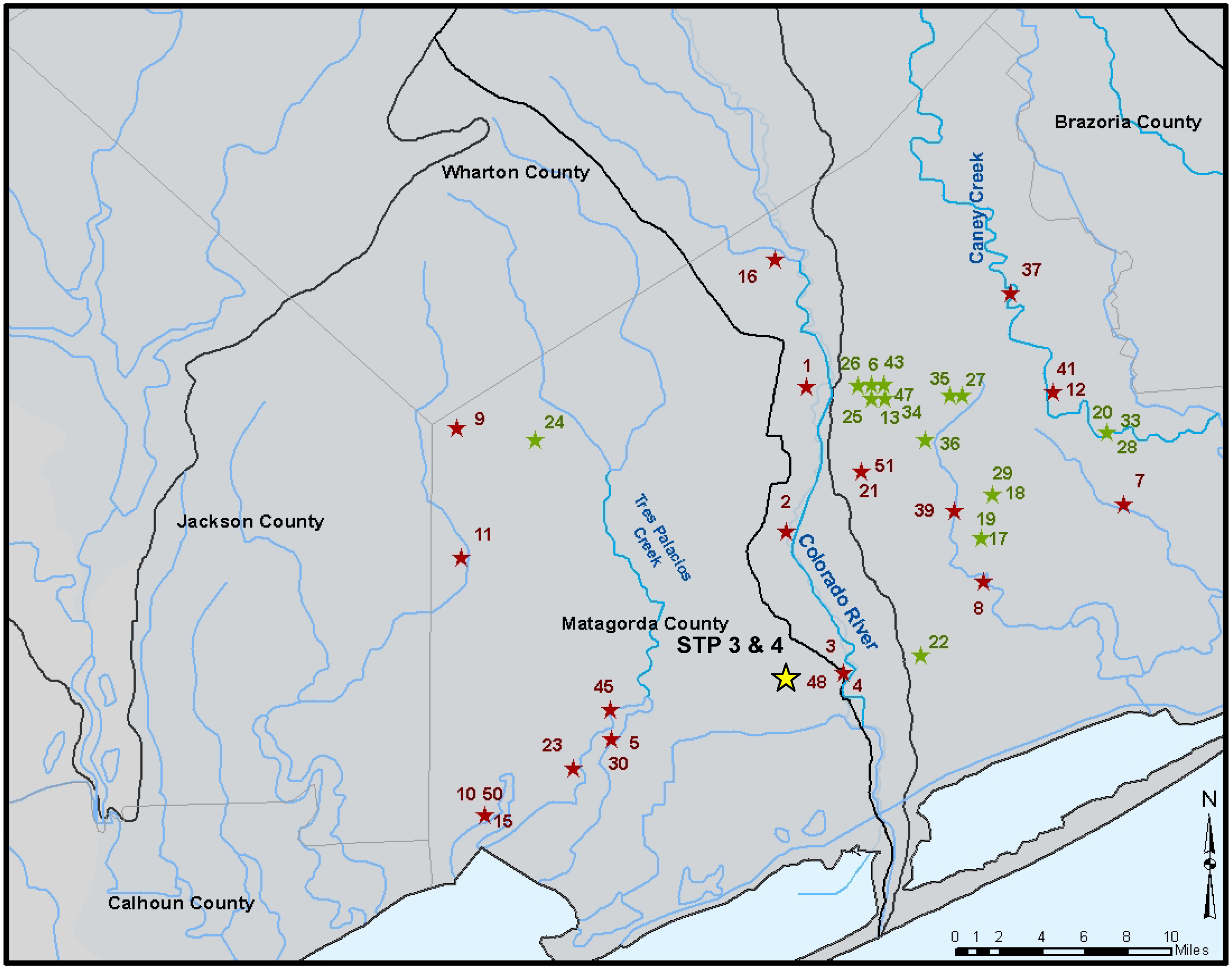

Figure 2.4S.1-12 Surface Water Users in Matagorda County (Reference 2.4S.1-13)