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2.4 Hydrologic Engineering

2.4.1 Hydrologic Description

This section describes the site and all safety-related systems, structures and components (SSC) from the standpoint of hydrologic considerations and the plant's interface with the hydrosphere.

2.4.1.1 Site and Facilities

VCS is located in Victoria County, Texas near the west bank of the Guadalupe River, at River Mile 29.6. It is approximately 13 miles south of the city of Victoria, Texas, and 8 miles west of Bloomington, Texas, near U.S. Highway 77, and 36 miles inland from the Texas Gulf Coast shoreline. (Figure 2.4.1-1) The VCS site consists primarily of the power block area, which includes all safety-related facilities, and approximately 4900 acres for a cooling basin. The power block is shown in Figure 1.2-2. The minimum finished site grade elevation for the power block is 95.0 feet in North American Vertical Datum of 1988 (NAVD 88) as indicated in Figure 1.2-2. The top of the cooling basin embankment dams (the perimeter embankments) is at elevation 102.0 feet NAVD 88, except at a few locations that need to be elevated to accommodate piping and spillway crossings. The top elevation of the interior dikes inside the cooling basin is at 99 feet NAVD 88. Natural grading outside the power block area is at about elevation 80.0 feet NAVD 88 and the natural grading surrounding the cooling basin ranges from about elevation 80 feet NAVD 88 in the northwest corner to about elevation 65 feet NAVD 88 along the southern edge. Over two-thirds of the area in the cooling basin towards the north is graded to a bottom elevation of 69 feet NAVD 88. The remaining basin area towards the south follows the natural grade that varies from 69 feet to about 65 feet NAVD 88. Figure 2.4.1-2 shows the topography at VCS and the surrounding areas.

The cooling basin is one of the major features on the site. The cooling basin has a surface area of about 4900 acres at the design pool level of 90.5 feet NAVD 88, as described in Subsection 2.4.8. The cooling basin is part of the nonsafety-related cooling system that has the design function of dissipating the heat load in the circulating water system of VCS. The basin is formed by approximately 11 miles of perimeter embankment dams that consist of clay or clayey sand fill that are constructed above ground. Internal earth dikes inside the cooling basin will be used to guide the circulating flow from the cooling basin outfall structure to the cooling basin intake structure to optimize the effective cooling area. Subsection 2.4.8 describes the hydrologic and hydraulic characteristics of the cooling basin and Subsection 2.5.5 describes the slope stability aspects of the basin embankments. The geohydrological description related to the cooling basin is provided in Subsection 2.4.12.

Flooding from several potential sources has been examined at the VCS site. The potential flooding scenarios applicable and investigated for the site include the following: probable maximum flood on streams and rivers, potential dam failures, probable maximum surge and seiche flooding, probable maximum tsunami, flooding due to ice effects, and potential flooding caused by channel diversions. Detailed descriptions of each of these flooding events and how they were estimated are found in Subsections 2.4.3 through 2.4.7 and Subsection 2.4.9.

The highest predicted flood level near the VCS power block area is a result of failure of the cooling basin embankment as described in Subsection 2.4.4, with the maximum estimated water level at elevation 91.0 feet NAVD 88.

As noted in Subsection 2.4.2.3, the site layout and facilities for the VCS site have not been finalized, and flood levels as a result of the local intense precipitation or local PMP will be determined as part of the COL application.

2.4.1.2 Hydrosphere

The VCS site is located within the Lower Guadalupe River basin. The main hydrologic features near the site include the Guadalupe and San Antonio Rivers, Victoria Barge Canal, Linn Lake, San Antonio Bay, Kuy Creek, and the Guadalupe-Blanco River Authority (GBRA) Calhoun Canal System.

2.4.1.2.1 Guadalupe and San Antonio Rivers

The Guadalupe River basin extends from Kerr County in the south central portion of Texas to its mouth in the San Antonio Bay at the Gulf of Mexico. The drainage area for this basin is 5953 square miles (Reference 2.4.1-1). Even though the San Antonio River discharges to the Guadalupe River just upstream from its mouth, the Texas Water Development Board considers the San Antonio River as a separate river basin and the Guadalupe River basin drainage area listed above does not include the San Antonio River basin drainage area. The San Antonio River basin extends from north of San Antonio, Texas, to its confluence with the Guadalupe River just upstream from Tivoli, Texas. The San Antonio River basin is adjacent to the Guadalupe River basin and shares a common border that runs in a general northwest to southeast direction as depicted in Figure 2.4.1-3, which shows the boundaries of both river basins. The drainage area for the San Antonio River basin is 4180 square miles (Reference 2.4.1-1). The total drainage area for the combined river basins at the stream gage at Tivoli, Texas, which is located downstream of the confluence with the San Antonio River and about 10 miles upstream of the mouth of the Guadalupe River, is 10,128 square miles (Reference 2.4.1-2). Major tributaries to the Guadalupe River include Coleto Creek, Peach Creek, Sandies Creek, the San Marcos River and its tributaries, the Blanco River, and Plum Creek. The Medina River and Cibolo Creek are principal tributaries of the San Antonio River. All of these rivers and tributaries contribute to the water supply for the raw water makeup (RWMU) system for the VCS cooling basin.

The Guadalupe and San Antonio River basins are located in a climate region classified as humid subtropical. Summers are hot and humid, while winters are often mild and dry. Most of the precipitation from May through September is from occasional thunderstorms, which contribute to much of the annual precipitation. The cool season, November through March, is typically the driest season of the year. Mean annual precipitation is 32 inches for the Guadalupe River basin (Reference 2.4.1-3). There is a general trend of decreasing precipitation from the eastern portions of the basins to the western portions (References 2.4.1-1 and 2.4.1-3).

Stream-flow gaging data collected in both basins since the 1930s indicate that there have been major droughts in almost every decade since gaging began. During the 30-year time period from 1941 to 1970, there were 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, which is also the drought of record. Recent less severe droughts in the South Central Texas Region have also occurred from 1983 to 1984, 1987 to 1990, and in 1996, 1999, and 2006 (Reference 2.4.1-1). The most recent regional drought occurred from 2007 to 2009 (Reference 2.4.1-15).

Flooding is also a frequent event in both basins. Details of flood history for the area are presented in Subsection 2.4.2. The largest flood on record on the Guadalupe River at Victoria (drainage area of 5198 square miles) occurred on October 20, 1998 (Reference 2.4.1-4). The largest flood on record on the San Antonio River at Goliad (drainage area 3921 square miles) occurred on September 23, 1967 (Reference 2.4.1-5).

The 1998 storm in the Guadalupe and San Antonio River basins was one of the largest storms on record for the area. Severe flooding in parts of south central Texas resulted from this storm. Record rainfall amounts were recorded at several locations, with at least 30 inches recorded at Marcos, Texas. Peak discharges were greater than the 100-year flood at many locations along both the San Antonio and Guadalupe Rivers and the flood of record at Victoria was recorded during this storm. Property damage resulting from the storm was estimated to be about $750 million (Reference 2.4.1-6).

Coleto Creek is a tributary to the Guadalupe River, with its confluence located downstream of Victoria and upstream of the VCS site. Flows on Coleto Creek are regulated by the Coleto Creek Dam and reservoir. The reservoir is primarily used for cooling water for the Coleto Creek Power coal fired power plant and water releases are based on both inflows to the reservoir and plant water needs. Additionally, the stream gage data at Coleto Creek, located downstream of the dam, indicates there are a few weeks of time when the minimum daily flow is near zero after the reservoir was built. (Reference 2.4.1-7).

There are 29 storage reservoirs in the Guadalupe River basin and 34 storage reservoirs in the San Antonio River basin with storage capacities of at least 3000 acre-feet. Tables 2.4.1-1 and 2.4.1-2 (Reference 2.4.1-8) provide detailed information on the dams associated with each of these storage reservoirs. The locations of the storage reservoirs are shown on Figure 2.4.1-4 for the Guadalupe River basin and Figure 2.4.1-5 for the San Antonio River basin. Although both basins have many additional storage reservoirs with volumes less than 3000 acre-feet, their impact on the river flows and basin hydrology is negligible due to their small storage capacities, thus they are not reported. The storage reservoirs in both basins provide flood control as well as water storage for municipal and industrial purposes. Detailed information, including stage-storage and stage-discharge data for Canyon Dam and Coleto Creek Dam, the two largest dams upstream of the VCS site in the Guadalupe River basin, is presented in Subsections 2.4.3 and 2.4.4. Stage-storage data for the cooling basin as well as detailed information on the discharge capacity of the spillway from the cooling basin are presented in Subsection 2.4.8.

The Guadalupe River gradient near the VCS site is relatively steep with a well defined, but wide floodplain. The average river bed slope near the site is about 0.00026 ft/ft for the reach between the southern limit of the city of Victoria near U.S. 59 crossing to the Union Pacific Railroad crossing near the southern boundary of the site. The river is located on the San Marcos Uplift which is the reason for the steeper gradient (Reference 2.4.1-9). The stream channel near the site is fairly shallow and flows can frequently extend into the floodplain area, which is wide and flat with many wetland and marsh areas adjacent to the river. The average width of the floodplain valley between high banks near the site is approximately 3.2 miles. Although the floodplain is wide at this location, ground elevations rise steeply from 25 feet NAVD 88 at the edge of the floodplain to 70 to 75 feet NAVD 88 along the eastern edge of the site.

As described in Subsection 2.4.9, just downstream of the site, the river crosses over the Vicksburg fault zone, which passes south of the site. The downstream fault block is subsiding and moving southeast towards the coast. Because of the movement, the river gradient downstream of the fault is shallower and the floodplain is wider when compared with these river features upstream of the fault. At the confluence with the San Antonio River, just upstream of the United States Geological Survey (USGS) gage near Tivoli, Texas, the river bed slope is essentially flat. Near Mission Lake, the floodplain is approximately 4.5 miles wide. Also, the Lower Guadalupe Saltwater Barrier and Diversion Dam, commonly referred to as the saltwater barrier, is located at River Mile 10.2 near Tivoli, Texas. The purpose of the saltwater barrier is to prevent saltwater intrusion into the freshwater supply and maintain an adequate water level in the river to allow diversion into the GBRA water supply canal. The saltwater barrier, a fabridam, is designed to maintain upstream minimum water levels at an elevation range between approximately 3.5 feet to 4.0 feet in National Geodetic Vertical Datum 29 (NGVD 29) (Reference 2.4.1-10) which is equivalent to elevations 3.06 feet to 3.56 feet NAVD 88 (Reference 2.4.1-11). When upstream water level lowers to approximately elevation 3.0 feet NAVD 88, fabric bags are inflated to raise the water level upstream, which also prevents intrusion of saline water further upstream. If the upstream water level rises above about elevation 3.6 feet NAVD 88, the bags are deflated to reduce the upstream water level. The elevations at which the fabric bags are inflated and deflated are not fixed and are adjusted depending on river flow conditions (Reference 2.4.1-10).

The Victoria Barge Canal is also located in the Guadalupe River floodplain east of the river and runs essentially parallel to the river meander axis. This 35-mile canal connects the Port of Victoria to the Gulf Intracoastal Waterway and provides shipping access to several industrial facilities in the lower Guadalupe River basin from San Antonio Bay. Although the canal is located in the Guadalupe River floodplain, it is not part of the drainage area for the Guadalupe River. However, during flooding events, the levees on either side of the canal are overtopped and the canal becomes part of the Guadalupe River floodplain.

Information on five USGS-maintained stream flow gage stations on the Guadalupe and San Antonio Rivers near the VCS site is provided in Table 2.4.1-3. The information presented includes the location, drainage area, period of record, and the mean, minimum, and maximum average annual flow for the period of record. The gages cover the major streams near the site, with the exception of Kuy Creek, a tributary to the Guadalupe River that passes south of the site and has a drainage area of approximately 62 square miles. The locations of these gages as well as other selected gages in the two river basins are shown in Figure 2.4.1-6. A stream gage on the Guadalupe River also exists at Bloomington, Texas. However, this gage only records water level data and has a sporadic period of record. Thus, this gage is not included in Table 2.4.1-3, although its location is shown in Figure 2.4.1-6. The stream gage at Tivoli does not provide accurate stream flow information for high flow data due to the low-lying floodplain where flood water levels are influenced by over-bank flows. Only sporadic data is available at this location. Additionally, the drainage area at Victoria (5198 square miles) plus the drainage area for Coleto Creek (514 square miles) represent approximately 96 percent of the Guadalupe River watershed. Thus, for the purposes of assessing water availability from the Guadalupe River for VCS, flow data from the gage at Victoria and the gage on Coleto Creek is used.

The RWMU system intake for VCS is located on the Guadalupe River just downstream of the diversion to the GBRA Calhoun Canal system and downstream of the confluence of the San Antonio and Guadalupe Rivers, where flows from the San Antonio River are also available for plant use. The most downstream gaging station on the San Antonio River is located at McFaddin, Texas. However, this gage has less than two years of data, which is not sufficient to provide long-term analysis of water supply. The gaging station at Goliad with a drainage area of 3921 square miles represents approximately 94 percent of the San Antonio River watershed and is used in combination with the Guadalupe River flow data at Victoria and Coleto Creek to assess the flow availability in meeting the plant's surface water demands.

In order to facilitate the evaluation of water supply characteristics at the VCS site, flow statistics are presented for the Victoria, Goliad, and Coleto Creek gaging stations. The flows at these three stations can be used to establish a reasonable estimate of the flow available in the river to VCS through the RWMU system intake. Detailed information on low water conditions is presented in Subsection 2.4.11. Monthly discharge data is available for a period of record from water years 1925 to 1928 and 1939 to 2007 for Goliad on the San Antonio River, from water years 1935 to 2007 for Victoria on the Guadalupe River, and from water years 1981 to 2007 for Coleto Creek. Tables 2.4.1-4, 2.4.1-5, and 2.4.1-6 provide the monthly mean flow rates for each station's period of record (References 2.4.1-4, 2.4.1-5, and 2.4.1-7).

Monthly flow data from the Victoria and Goliad stream gages during the three major statewide droughts before September 2007 (1947 to 1948, 1950 to 1957, and 1960 to 1967) are highlighted in Tables 2.4.1-4 and 2.4.1-5 (References 2.4.1-4 and 2.4.1-5).

The Flood Insurance Study for the Unincorporated Areas of Victoria County, Texas reports the peak discharges for various flood frequencies on the Guadalupe River at the confluence of Coleto Creek just downstream of Victoria, Texas (Reference 2.4.1-12). These values are presented in Table 2.4.1-7. The FEMA 100-year flood inundation map, which represents flood inundation before construction of the VCS plant, is presented in Figure 2.4.1-7.

2.4.1.2.2 Linn Lake

Linn Lake is a perennial natural shallow retention area located on the western edge of the Guadalupe River floodplain east of the VCS cooling basin, as shown in Figure 2.4.1-2. Originally it was an oxbow bend on the Guadalupe River, but has been cut off from the main river channel over time. The lake has an estimated surface area of approximately 470 acres and is principally fed by the Guadalupe River and surface runoff from floodplain areas north of the lake. The lake is at approximately the same elevation as the river and receives overflows even during normal river stages. The lake also receives surface runoff from the eastern portion of the VCS site through small tributaries along the western edge of the lake. In addition to receiving flow from the Guadalupe River, flow from the lake also returns to the river, depending on water levels in the lake and river.

2.4.1.2.3 San Antonio Bay System

The Guadalupe River discharges to the San Antonio Bay system about 8 miles, or 10 river miles, downstream of the confluence of the San Antonio River. The bay system consists of several smaller bays linked together to form one large bay. These smaller bays include Espiritu Santo, San Antonio, Guadalupe, Hynes, Ayres, and Mesquite Bays, and Mission Lake. The total surface area of the bay system is about 136,240 acres at mean low water and 141,200 acres at mean high water. The average depth of the bays, excluding the shipping channels, at mean low water ranges from 2.4 to 5.9 feet, with an average tidal range of 0.2 to 0.3 feet (Reference 2.4.1-9).

The Guadalupe River delta in the upper portions of the bay system is characterized by extensive brackish to freshwater marshes. The delta has had a history of delta lobe growth, abandonment, and deterioration. Sedimentation in the delta is characterized by stream deposition in a shallow, relatively quiescent body of water (Reference 2.4.1-9).

2.4.1.2.4 Local Hydrologic Features

There are several intermittent or ephemeral streams traversing the VCS site. The locations of these streams are shown in Figure 2.4.1-2. Kuy Creek, which passes by the southwest corner of the site and discharges to the Guadalupe River, has a drainage area of approximately 62 square miles. Dry Kuy Creek, which passes by the northwest corner of the site, flows southeast and discharges to Kuy Creek south of the site. There are a few other unnamed short intermittent and ephemeral streams on the site. Most are tributaries to Dry Kuy Creek; the others flow to Linn Lake or Kuy Creek. All of these streams are hydrologically connected by surface flow to the Guadalupe River.

The VCS cooling basin serves as the normal heat sink for the power plant. Makeup water for the cooling basin is supplied by the RWMU intake canal and pumphouse located on the Guadalupe River (see Subsection 2.4.1.2.6). Blowdown from the cooling basin is discharged to the Guadalupe River east of the site as shown in Figure 2.4.1-8.

The external design basis flood, i.e., excluding the local PMP event, for the safety-related structures of VCS is a result of flooding from the breach of the cooling basin embankments and is described in detail in Subsection 2.4.4. The external design basis flood level is established to be at elevation 91.0 feet NAVD 88.

2.4.1.2.5 Wetlands

A wetland survey conducted for the VCS site between March and April 2009, indicated that before construction, 62 areas, totaling 1843.42 acres, meet the criteria for designation as wetland in accordance with the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Reference 2.4.1-14). The designated wetland areas are shown in Figure 2.4.1-9. Wetland Wb13/14 has a surface area of 245.42 acres and represents the largest wetland outside of the Wp1 wetland complex (769.75 acres) associated with Linn Lake. Other sizeable wetlands include Wa6 (38.51 acres), Wa7 (10.64 acres), Wa8 (18.95 acres), Wa9 (10.92 acres), Wa16 (41.88 acres), Wa17 (10.68 acres), Wa44 (11.63 acres), Wb1 (207.16 acres), Wb5 (25.68 acres), Wb7 (12.97 acres), Wb12 (50.01 acres), Wb15 (222.21 acres), and Wb16 (88.92 acres). The remaining delineated wetlands each occupy less than 10 acres.

Of the 62 wetlands, 42 were determined to be isolated wetlands with no noticeable surface water connection. The extent to which the surveyed wetlands fall within federal jurisdiction will be determined during completion of the permitting activities at the COL stage. Two major classes of wetland systems occur on the VCS site; palustrine (freshwater), and lacustrine. A primarily lacustrine wetland (Wp1), with a palustrine forested component, associated with Linn Lake accounts for 769.75 acres (41.8 percent) of the total designated wetlands, and palustrine unconsolidated bottom and palustrine unconsolidated shore wetland systems account for 4.01 acres (0.2 percent) of total designated wetlands. The remaining 1069.66 acres (58.0 percent) of the designated wetlands are palustrine emergent wetland systems.

2.4.1.2.6 RWMU System Intake and Blowdown Discharge Hydrologic Characteristics

Makeup water is supplied to the cooling basin intermittently throughout the year via the RWMU system intake structure, approximately 8 miles southeast of the VCS site, to compensate for the inventory lost due to evaporation, blowdown, and seepage. Evaporation losses result from the operation of both the circulating water system and any applicable ultimate heat sink and auxiliary cooling system cooling towers. The cooling basin inventory also accounts for a very small drift loss from the applicable cooling towers. The only natural inflow into the cooling basin is direct rainfall because the cooling basin is self-contained and has no other contributing drainage area. The cooling basin receives return effluents from the various plant's facilities and systems, not including the radwaste discharges.

The freshwater source for the RWMU system is the Guadalupe River. The RWMU pumphouse is situated on ground that is located above the Guadalupe River floodplain 0.6 miles south of the river, approximately 8 miles southeast of the VCS site as shown in Figure 2.4.1-1. Freshwater is carried from the Guadalupe River to the pumphouse via a 3150 foot long intake canal. The entrance to the intake canal is located upstream of the Lower Guadalupe Diversion Dam and Saltwater Barrier across the river from the diversion to the GBRA Calhoun Canal system as shown in Figure 2.4.1-10.

As discussed in Subsection 2.4.8, the RWMU system intake canal and pumphouse are capable of delivering a flow rate of up to 267 cfs (120,000 gpm). Of the total water supply, a maximum 217 cfs (97,400 gpm) is supplied to the VCS cooling basin for makeup and a maximum 50 cfs (22,500 gpm) is available for future use by another non-VCS entity. A 90-inch-diameter transmission pipeline is used to deliver the flow to the cooling basin on the VCS site. The long-term annual average evaporation loss from the cooling basin is approximately 154.0 inches, evaluated based on a circulating water system heat load of 1.976×10^{10} Btu/hr, and a station capacity factor of 96 percent.

The RWMU intake is protected from saltwater intrusion by the Guadalupe River saltwater barrier, immediately downstream of the GBRA diversion and RWMU intake canal. In the event of an extreme hurricane surge, saltwater could intrude up to the RWMU system intake location. If this occurs, the RWMU system pumphouse would be shut down until the saltwater recedes after the surge-related flooding event. The closed-cycle cooling basin would continuously operate under this condition using the available inventory, which would be filled back as soon as the saltwater recedes.

Blowdown from the cooling basin to the Guadalupe River will be performed as needed to maintain water chemistry control in the cooling basin. The blowdown discharge system consists of a single 48-inch diameter pipe with multiple diffuser ports as outfall in the Guadalupe River at the location shown in Figure 2.4.1-8. The blowdown discharge flowrate will range from 0 to 40,000 gpm based on cooling basin chemistry conditions and raw water makeup availability.

2.4.1.2.7 Surface Water Users

The Texas Commission on Environmental Quality (TCEQ) maintains records of surface water withdrawals for the state of Texas. Among the water use categories specified by the state of Texas in the 2007 Water Plan are municipal, irrigation, steam electric, mining, and livestock. A review of the TCEQ surface water users database for Victoria, Calhoun, Goliad, and Refugio counties identified water users in the Guadalupe River basin (including Coleto Creek) and the San Antonio River basin with intakes that could potentially affect the availability and reliability of water supply to the VCS plant or be adversely affected by the plant.

As of October 26, 2007, 78 active surface water withdrawals were permitted in Victoria and Calhoun Counties within the Lower Guadalupe River basin. As of January 3, 2008, 13 active surface water withdrawals were permitted in Goliad County within the Lower San Antonio River basin (no surface water users in Refugio County within the Lower San Antonio River basin were reported by the TCEQ).

Tables 2.4.1-8 through 2.4.1-10 identify the surface water users, the water body from which withdrawals are made, and the permitted maximum volume of surface water withdrawal, where available, for the Lower Guadalupe and Lower San Antonio River basins. The locations of the surface water users are shown, by water right numbers, in Figure 2.4.1-11 using latitude and longitude information provided by the TCEQ.

The GBRA Saltwater Barrier and Diversion Dam creates a small impoundment facilitating diversions under water rights held either jointly or directly by the GBRA and Union Carbide Corporation. These rights total 175,701 acre-feet of water a year and represent about 30 percent of all surface water rights in the Guadalupe River-San Antonio River basin authorized for consumptive use. Table 2.4.1-11 provides a summary of the GBRA and Union Carbide Corporation permit numbers, priority dates, authorized uses, and authorized diversions. Table 2.4.1-12 provides a record of GBRA reported Calhoun (main) canal water use by water use category. The table also provides a list of the GBRA's industrial, municipal, and irrigation customers.

Assessment of impact of accidental releases of contaminants from VCS to surface water users is addressed in Subsection 2.4.13.

2.4.1.2.8 Groundwater and Groundwater Users

The local and regional groundwater characteristics are described in Subsection 2.4.12. A detailed list of current groundwater users, groundwater well locations, and the withdrawal rates in the vicinity of the VCS site is presented in Subsection 2.4.12.2. Groundwater availability to support plant water uses is described in Subsection 2.4.12.

Assessment of impact of accidental releases of contaminants from VCS to groundwater users is addressed in Subsection 2.4.13.

2.4.1.3 References

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2.4.1-12 Federal Emergency Management Agency (FEMA), Flood Insurance Study (FIS), Unincorporated Areas of Victoria County, Texas, 1998.

2.4.1-13 U.S. Geological Survey (USGS), *Stream Gage Data, Stream Flow Records, Gage 08188570, San Antonio River near McFaddin, Texas*. Available at http://nwis.waterdata.usgs.gov/tx/nwis/nwisman/?site_no=08188570&agency_cd=USGS, accessed June 9, 2008.

2.4.1-14 U.S. Army Corps of Engineers, *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region*, Vicksburg, MS, 2008.

2.4.1-15 Guadalupe-Blanco River Authority, Basin Briefing, November 2009, available at http://www.gbra.org/Library/BasinBriefingNov2009.aspx, accessed February 22, 2010.

Table 2.4.1-1 (Sheet 1 of 2)
Guadalupe River Basin Dams (Storage Greater than 3000 Acre-Feet)

No.	NAT ID	Dam Name	County	Latitude (deg)	Longitude (deg)	Year	Dam Height (ft)	Dam Length (ft)	Max Storage (ac-ft)	Effective Top of Dam (ft NGVD 29)
1	TX00004	CANYON DAM	COMAL	29.8667	–98.2000	1964	219	6,830	1,129,300	974.0
2	TX01546	COMAL RIVER WS SCS SITE 4 DAM	COMAL	29.6500	–98.2767	1965	73	2,000	5,293	806.3
3	TX01548	YORK CREEK WS SCS SITE 1 DAM	COMAL	29.8133	–98.0483	1967	81	1,157	4,570	742.8
4	TX01550	COMAL RIVER WS SCS SITE 3 DAM	COMAL	29.7383	–98.1583	1974	58	1,850	6,911	783.3
5	TX01575	PLUM CREEK WS SCS SITE 5 DAM	HAYS	30.0017	–97.8383	1963	38	2,510	3,368	668.0
6	TX01576	PLUM CREEK WS SCS SITE 6 DAM	HAYS	30.0017	–97.8217	1967	36	3,340	5,663	643.1
7	TX01584	YORK CREEK WS SCS SITE 5 DAM	HAYS	29.7767	–97.9833	1963	41	1,897	3,426	589.0
8	TX01599	LAKE MEADOW DAM	GUADALUPE	29.5283	–97.9383	1930	27	2,525	3,100	475.6
9	TX01600	LAKE PLACID DAM	GUADALUPE	29.5467	–98.0000	1964	25	2,057	5,400	Not available
10	TX01601	LAKE MCQUEENEY DAM	GUADALUPE	29.5933	–98.0400	1928	40	1,555	5,050	540.0
11	TX01602	LAKE DUNLAP DAM	GUADALUPE	29.6533	–98.0667	1928	41	1,626	5,900	589.4
12	TX01611	YORK CREEK WS SCS SITE 13 DAM	GUADALUPE	29.8200	–97.9250	1964	33	2,782	5,045	595.3
13	TX01912	LAKE GONZALES DAM	GONZALES	29.4950	–97.6250	1931	42	2,170	23,520	346.5
14	TX01913	LAKE WOOD DAM	GONZALES	29.4683	–97.4917	1931	42	6,450	8,120	304.0
15	TX03418	LOWER PLUM CREEK WS SCS SITE 34 DAM	CALDWELL	29.8650	–97.7550	1965	41	3,106	4,741	573.6
16	TX03420	LOWER PLUM CREEK WS SCS SITE 28 DAM	CALDWELL	29.8567	–97.5117	1963	34	4,300	5,404	479.5
17	TX03423	PLUM CREEK WS SCS SITE 14 DAM	CALDWELL	29.9533	–97.7433	1967	46	3,640	8,715	542.3
18	TX03425	PLUM CREEK WS SCS SITE 17 DAM	CALDWELL	30.0000	–97.7100	1969	35	1,860	5,312	Not available
19	TX03428	PLUM CREEK WS SCS SITE 21 DAM	CALDWELL	29.9567	–97.6533	1962	41	3,400	5,318	522.3
20	TX04547	COMAL RIVER WS SCS SITE 1 DAM	COMAL	29.6867	–98.2883	1978	70	2,530	6,763	919.3
21	TX04657	PLUM CREEK WS SCS SITE 16 DAM	HAYS	30.0033	–97.7400	1975	41	2,800	3,642	559.9
22	TX04693	LOWER PLUM CREEK WS SCS SITE 27 DAM	CALDWELL	29.8333	–97.5617	1974	28	3,830	3,170	Not available
23	TX04744	COLETO CREEK DAM	VICTORIA	28.7233	–97.1667	1980	65	21,000	169,000	120.0
24	TX04788	COMAL RIVER WS SCS SITE 2 DAM	COMAL	29.6750	–98.2517	1981	75	3,100	19,024	866.8
25	TX05945	UPPER SAN MARCOS RIVER WS SCS SITE 1	HAYS	29.9183	–97.9733	1983	80	2,905	18,399	Not available

Table 2.4.1-1 (Sheet 2 of 2)
Guadalupe River Basin Dams (Storage Greater than 3000 Acre-Feet)

No.	NAT ID	Dam Name	County	Latitude (deg)	Longitude (deg)	Year	Dam Height (ft)	Dam Length (ft)	Max Storage (ac-ft)	Effective Top of Dam (ft NGVD 29)
26	TX06328	UPPER SAN MARCOS RIVER WS SCS SITE 2	HAYS	29.9333	–97.9617	1985	51	1,465	3,034	726.7
27	TX06329	UPPER SAN MARCOS RIVER WS SCS SITE 4	HAYS	29.8850	–98.0317	1985	100	1,365	5,972	889.8
28	TX07247	UPPER SAN MARCOS RIVER WS NRCS SITE 5 DAM	HAYS	29.8683	–97.9681	1989	71	2,950	7,329	667.2
29	TX06432	UPPER SAN MARCOS RIVER WS SCS SITE 3	HAYS	29.9067	–97.9450	1991	60	1,630	4,323	Not available

Source: Reference 2.4.1-8

Table 2.4.1-2 (Sheet 1 of 2)
San Antonio River Basin Dams (Storage Greater than 3000 Acre-Feet)

No.	NAT ID	Dam Name	County	Latitude (deg)	Longitude (deg)	Year	Dam Height (ft)	Dam Length (ft)	Max Storage (Ac-ft)	Effective Top of Dam (ft NGVD 29)
1	TX04481	BOERING CITY LAKE DAM[(a)]	KENDALL	29.8217	–98.7667	1978	87	6,130	15,668	1,546
2	TX01448	CALAVERAS CREEK DAM	BEXAR	29.2783	–98.3050	1969	79	5,920	97,441	498
3	TX01450	CALAVERAS CREEK WS SCS SITE 3 DAM	BEXAR	29.3700	–98.3317	1954	37	3,100	3,400	595
4	TX01459	CALAVERAS CREEK WS SCS SITE 6 DAM	BEXAR	29.3800	–98.2917	1957	43	2,463	4,801	556
5	TX07263	ECLETO CREEK WS NRCS SITE 3 DAM	WILSON	29.1767	–97.8632	2000	31	2,700	3,340	404
6	TX06646	ECLETO CREEK WS NRCS SITE 9A DAM	DE WITT	29.0008	–97.7083	1993	30	3,183	4,100	373
7	TX06912	ECLETO CREEK WS SCS SITE 4 DAM	KARNES	29.0778	–97.8492	1994	28	2,886	3,910	341
8	TX02031	ESCONDIDO CREEK WS SCS SITE 11 DAM	KARNES	28.8600	–97.8450	1958	37	2,823	7,523	325
9	TX04315	ESCONDIDO CREEK WS SCS SITE 12 DAM	KARNES	28.8300	–97.9217	1974	28	2,667	3,388	342
10	TX02042	ESCONDIDO CREEK WS SCS SITE 13 DAM	KARNES	28.8133	–97.8767	1973	36	4,000	4,060	319
11	TX02034	ESCONDIDO CREEK WS SCS SITE 3 DAM	KARNES	28.7717	–97.9283	1956	41	2,310	3,180	425
12	TX02035	ESCONDIDO CREEK WS SCS SITE 4 DAM	KARNES	28.8150	–97.9017	1956	32	2,900	3,743	334
13	TX02040	ESCONDIDO CREEK WS SCS SITE 9 DAM	KARNES	28.8667	–97.9983	1957	30	2,674	4,330	419
14	TX02028	HONDO CREEK WS SCS SITE 1 DAM	KARNES	28.7483	–97.8033	1968	41	3,250	6,288	Not available
15	TX01461	MARTINEZ CREEK WS SCS SITE 1 DAM	BEXAR	29.4717	–98.3283	1964	38	2,172	3,509	681
16	TX01464	MARTINEZ CREEK WS SCS SITE 6A DAM	BEXAR	29.4783	–98.2900	1966	34	2,420	5,200	631
17	TX01787	MEDINA LAKE DAM	MEDINA	29.5400	–98.9333	1913	165	1,550	327,250	1,076
18	TX01788	MEDINA DIVERSION LAKE DAM	MEDINA	29.5100	–98.9000	1913	51	450	4,500	928
19	TX01453	MITCHELL LAKE DAM	BEXAR	29.2700	–98.4733	1967	10	3,500	5,000	530
20	TX04313	OLMOS DAM	BEXAR	29.4733	–98.4733	1926	68	1,941	14,240	Not available
21	TX05798	PANNA MARIA TAILINGS POND DAM	KARNES	28.9600	–97.9367	1978	60	9,810	4,598	375
22	TX07211	SALADO CREEK WS NRCS SITE 15R DAM	BEXAR	29.5504	–98.4500	2004	49	6,536	8,704	773
23	TX04716	SALADO CREEK WS SCS SITE 1 DAM	BEXAR	29.6633	–98.6000	1975	80	2,640	8,680	1,162
24	TX06600	SALADO CREEK WS SCS SITE 10 DAM	BEXAR	29.5958	–98.4375	1994	66	1,264	4,054	Not available

Table 2.4.1-2 (Sheet 2 of 2)
San Antonio River Basin Dams (Storage Greater than 3000 Acre-Feet)

No.	NAT ID	Dam Name	County	Latitude (deg)	Longitude (deg)	Year	Dam Height (ft)	Dam Length (ft)	Max Storage (Ac-ft)	Effective Top of Dam (ft NGVD 29)
25	TX04760	SALADO CREEK WS SCS SITE 11 DAM	BEXAR	29.6017	–98.4317	1979	65	1,775	6,318	893
26	TX04208	SALADO CREEK WS SCS SITE 12 DAM	BEXAR	29.6267	–98.3917	1974	70	3,250	7,425	946
27	TX04364	SALADO CREEK WS SCS SITE 13A DAM	BEXAR	29.6050	–98.3950	1976	43	1,690	3,026	Not available
28	TX01469	SALADO CREEK WS SCS SITE 2 DAM	BEXAR	29.6634	–98.5792	1971	65	2,200	4,317	1,162
29	TX01468	SALADO CREEK WS SCS SITE 4 DAM	BEXAR	29.6233	–98.5200	1972	57	1,760	30,798	1,053
30	TX04717	SALADO CREEK WS SCS SITE 5 DAM	BEXAR	29.6383	–98.5117	1976	64	3,200	5,807	1,099
31	TX06398	SALADO CREEK WS SCS SITE 7 DAM	BEXAR	29.5583	–98.5033	1987	47	22,640	7,016	Not available
32	TX01467	SALADO CREEK WS SCS SITE 8 DAM	BEXAR	29.6450	–98.4767	1973	61	1,675	7,100	1,077
33	TX04655	UPPER CIBOLO CREEK WS SCS SITE 3 DAM	KENDALL	29.7783	–98.7833	1980	76	2,436	4,732	1,584
34	TX01432	VICTOR BRAUNIG DAM	BEXAR	29.2400	–98.3717	1963	76	9,638	32,324	515

(a) Name from TCEQ is Upper Cibolo Creek WS SCS Site 1 Dam. The common name of Boering City Lake Dam is used in this chart.

Source: Reference 2.4.1-8

Table 2.4.1-3
USGS Stream Gages Near VCS Site

Gage No.	Name	River	Latitude	Longitude	County	Drainage Area (square miles)	Period of Record From Year[(a)]	Years of Record to 2007[(b)]	Historical Annual Mean Flow Rate (cfs)		
									Max.	Min.	Ave.
08176500	Victoria	Guadalupe	28° 47' 34"	-97° 00' 46"	Victoria	5198	1935	72	6993	132	1978
08177500	Victoria	Coleto	28° 43' 51"	-97° 08' 18"	Victoria	514	1939	46	302	2	117
08188500	Goliad	San Antonio	28° 38' 58"	-97° 23' 04"	Goliad	3921	1925	76	3289	98	781
08188570	McFaddin	San Antonio	28° 31' 52.5"	-97° 02' 33.7"	Refugio	4134	2006	1	N/A	N/A	N/A
08188800	Tivoli[(b)]	Guadalupe	28° 30' 20"	-96° 53' 04"	Refugio	10,128	2000	0	N/A	N/A	N/A

(a) For station peak annual stream flow data.
(b) No complete years of data are available at Tivoli before September 2007.

Sources: References 2.4.1-2, 2.4.1-4, 2.4.1-5, 2.4.1-7, and 2.4.1-13

Table 2.4.1-4 (Sheet 1 of 4)
Monthly Mean Flows for Guadalupe River at Victoria, TX, USGS 08176500

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1934	—	—	—	—	—	—	—	—	—	—	—	1,674
1935	788.7	1,941	762.6	1,120	7,866	9,037	1,860	1,170	4,594	1,981	1,081	2,057
1936	1,412	1,038	1,056	817.2	4,818	2,328	18,430	1,311	3,246	4,341	1,767	1,548
1937	1,404	1,355	2,834	1,365	959.6	2,733	936.1	685.3	652.8	810	659.7	1,154
1938	2,632	1,722	1,453	5,228	4,920	1,367	952.8	771.9	702.7	603.3	641.2	669
1939	712.5	654.1	611.6	597.2	715.9	728.4	772	419	417.8	516.2	449.8	495.6
1940	513.2	723.4	632	972.4	745	1,110	6,633	524	460.3	629.2	6,397	5,672
1941	2,570	3,964	4,398	4,721	12,990	4,782	2,521	1,410	1,164	1,359	1,195	934.4
1942	864.5	804.3	793.1	2,619	1,598	916.4	6,290	931.9	4,381	2,773	1,768	1,456
1943	1,411	1,109	1,131	1,033	905.6	1,387	939.2	669.8	755.6	658	651.1	732.1
1944	1,337	1,645	2,968	1,519	3,399	3,044	1,208	893.3	1,757	862.6	1,260	2,131
1945	3,235	3,257	2,761	5,570	1,521	1,337	919.2	708.9	645.9	1,268	802.1	1,037
1946	1,264	1,846	3,086	1,542	2,067	2,348	807.6	1,045	4,834	4,137	3,666	2,241
1947	3,588	2,141	2,162	2,185	2,160	1,167	907.3	1,351	693	583.1	637.7	719.6
1948	669.4	824	768.2	552.3	1,414	561	744.3	547.8	395.3	465.9	396.6	426.7
1949	488.1	1,001	1,567	4,101	2,768	1,130	893	660.6	575	2,731	854	990.8
1950	707.5	900	675.1	1,285	910.5	2,340	587.8	368.4	381.2	354.5	353.6	408.6
1951	393.1	423.7	427.5	455.3	564.1	2,279	309.9	186	375.4	238.2	314.6	326.1
1952	336.3	401.3	334.5	590.1	1,350	1,355	471.7	180.3	3,993	706.6	963.2	1,884
1953	1,652	833.8	650.5	730.9	2,551	336.4	319.3	485	1,730	1,684	692.6	885.7
1954	581.8	505	412.6	483.5	702.1	246.2	146.5	107.9	107.2	121.3	200.5	241.5
1955	258.5	950	329	290.3	770.9	797.3	214	210.7	158	100.1	106.9	182.7
1956	194.6	255.3	158.1	157.2	224.4	59.7	53.9	37.6	51.6	163.7	59.6	486.2
1957	118.2	410.1	1,165	4,147	6,954	5,312	676.4	355.4	3,859	7,945	4,209	1,990

Table 2.4.1-4 (Sheet 2 of 4)
Monthly Mean Flows for Guadalupe River at Victoria, TX, USGS 08176500

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1958	4,070	8,645	3,922	2,015	4,293	1,764	1,248	742.9	2,013	1,852	2,229	1,450
1959	1,271	1,967	1,302	3,304	1,675	1,132	1,290	825.7	739.1	2,504	1,299	1,114
1960	1,431	1,509	1,204	1,300	2,392	2,854	2,635	1,805	1,091	9,217	7,761	3,289
1961	3,833	4,640	2,459	1,619	1,151	6,855	2,637	1,175	1,901	1,035	2,235	996.6
1962	905.8	902.4	781	944.6	745.8	880.7	511.3	332	735.8	651.3	687.2	804.5
1963	697.4	1,043	663.2	738.1	489.4	368.1	303.8	172.3	200.7	213.5	775.3	473.6
1964	450.3	807.6	1,198	678	446.7	558.8	259.7	271.4	716.5	833.7	965.7	526.2
1965	1,599	4,735	1,271	1,220	4,327	4,018	1,116	698.5	706.9	1,275	1,969	2,620
1966	1,235	1,669	1,589	2,051	2,606	1,200	892.8	640.3	869.3	878	703.5	596.3
1967	596.3	540.9	512.5	474.1	392.4	280.3	208.9	302.3	9,335	2,270	2,213	1,114
1968	7,130	2,348	1,869	2,907	4,991	6,178	1,669	961.7	1,649	837.9	943.3	2,048
1969	933.6	3,326	2,982	3,671	3,255	1,535	861.7	708.4	841.5	1,353	1,225	1,532
1970	1,797	1,864	2,814	1,921	3,433	2,757	1,204	852.7	797.6	1,052	730.6	694.9
1971	670.8	612.6	583.2	429.6	367.1	377.8	322.6	1,570	2,914	1,453	1,448	2,026
1972	1,446	1,583	1,056	756.2	12,230	2,789	1,648	1,343	971.4	933	878.4	836.7
1973	1,128	1,635	2,531	5,174	2,253	7,511	4,277	2,721	2,189	10,550	3,397	2,144
1974	3,648	1,892	1,463	1,191	2,211	1,723	861.6	992.4	3,928	1,422	4,685	2,847
1975	2,100	4,611	2,249	2,234	8,850	6,441	3,308	1,995	1,461	1,155	991.2	1,169
1976	930.3	879.8	912.6	5,069	6,339	3,346	2,276	1,706	1,600	4,050	5,101	6,786
1977	2,975	4,726	2,289	10,320	4,645	2,566	1,743	1,169	1,058	929.2	1,561	938.6
1978	921.7	1,013	916.1	971.5	775.6	1,441	624.1	3,724	3,739	1,535	1,878	1,028
1979	4,767	3,911	3,828	5,223	7,601	5,865	2,286	1,988	1,681	923.8	859.9	820.9
1980	1,074	931.2	795.8	732.7	2,674	1,107	603.4	440.7	1,267	948.9	825.5	828.9
1981	847.9	913.5	1,263	1,666	2,146	10,020	3,833	1,875	11,340	2,178	4,397	1,703
1982	1,257	1,641	1,080	965.6	5,427	1,345	770.8	498.5	479.4	598.3	1,032	680.7

Table 2.4.1-4 (Sheet 3 of 4)
Monthly Mean Flows for Guadalupe River at Victoria, TX, USGS 08176500

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1983	707.5	1,525	2,152	1,375	1,457	1,271	1,325	640.9	760.2	702.4	891.8	526.4
1984	748.2	659.1	770.4	456.2	367.3	290.6	111.5	104.7	125.1	629.6	673.4	870.9
1985	2,027	1,564	2,327	2,570	1,595	2,684	2,514	1,022	722.2	1,640	3,527	3,227
1986	1,801	1,763	1,245	976	1,549	3,182	1,193	676.9	1,198	2,380	2,536	5,529
1987	4,476	3,190	4,563	2,136	2,229	23,750	6,759	4,473	2,363	1,692	1,379	1,210
1988	953.8	884.3	1,051	796.4	807.4	1,005	937.6	1,081	603.7	541.8	485.8	541.4
1989	704.5	767.9	768.1	750.9	1,408	640	314.6	186.1	141.6	235.5	397.6	452.2
1990	420.1	421.4	659.3	965.8	1,386	747.9	776	821.8	982.2	527.5	601.3	566
1991	3,000	2,645	1,330	3,992	2,596	1,438	1,495	695.2	1,022	865.8	907.7	9,753
1992	10,650	17,250	10,600	9,821	8,757	8,855	3,103	2,150	1,660	1,360	1,806	1,661
1993	1,902	2,521	3,132	1,800	5,851	5,473	1,938	918.9	768	912.2	920	887.7
1994	840.6	833.3	1,033	939.1	4,208	1,435	717.1	600.5	657.6	3,768	1,172	1,898
1995	2,080	1,109	2,525	2,018	990.2	3,136	1,231	764	636.3	610.5	689.9	728.6
1996	634.4	591.4	530.3	472	382.5	313.6	163	265	1,963	415.1	444.9	597.9
1997	1,001	767.8	2,546	6,536	3,738	9,942	6,293	2,690	1,272	2,960	1,137	1,221
1998	1,478	3,391	3,509	2,033	996.9	740.2	587.7	1,308	3,026	30,440	9,440	4,711
1999	2,210	1,589	1,494	1,307	1,475	1,942	1,124	713.6	531.4	510.9	558.4	565
2000	661.1	655.5	718.7	636.2	892.9	1,475	424.6	289.5	271.9	485.4	5,365	2,431
2001	2,672	2,267	3,368	1,856	1,701	1,051	792.6	894.1	7,430	1,429	3,493	5,343
2002	2,033	1,525	1,245	2,227	891.2	776	17,060	4,741	5,515	6,091	9,964	5,771
2003	3,878	4,888	3,556	1,900	1,528	1,405	1,385	1,070	1,479	1,401	1,226	1,011
2004	1,399	1,394	1,473	3,276	3,597	6,258	5,420	1,836	1,561	3,395	17,500	7,453
2005	3,157	4,595	6,122	2,228	2,638	1,633	1,237	1,064	953.8	827.5	753.9	773.4
2006	767.6	757.4	737.3	648.9	685.3	588.6	602	296.3	438.2	443.5	396.4	473.2
2007	1,758	835.6	4,824	3,994	4,860	3,870	12,040	7,406	5,105	—	—	—

Table 2.4.1-4 (Sheet 4 of 4)
Monthly Mean Flows for Guadalupe River at Victoria, TX, USGS 08176500

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean of monthly Discharge	1,740	1,990	1,850	2,130	2,810	2,820	2,120	1,110	1,800	2,080	2,030	1,750

Source: Reference 2.4.1-4
Notes:
Shaded months depict periods of extended drought.
October, November, and December 2007 are part of the 2008 water year and are not included.

Table 2.4.1-5 (Sheet 1 of 4)
Monthly Mean Flows for San Antonio River at Goliad, TX, USGS 08188500

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1924	—	—	—	—	—	—	361.9	232.8	283.3	214.4	205.2	278.9
1925	222.4	219.5	193.9	151.7	211.2	104.2	145.3	113.2	215.1	871.6	222.1	153.1
1926	203.1	132.2	385.5	2,023	1,067	298.7	248.3	137.6	100.3	232.7	184.7	188.3
1927	162.3	204.4	299	491.9	149.3	417.7	114.5	53.7	91.2	291.5	91.6	106.5
1928	117.5	112.2	173	145.1	419.8	502.7	91.4	51	391.5	135.7	763.8	289.5
1929	—	121	844	—	—	—	—	—	—	—	—	—
1939	—	—	175.2	145.6	138.4	166	257.7	185	119.6	95	98.1	134.8
1940	133	249.9	134.7	372.9	207	594.2	1,392	395.6	138.4	302	2,574	1,655
1941	612.5	1,082	692.1	1,438	3,610	1,628	886.2	454.6	917.6	555.5	480	314.1
1942	283.9	311.2	234.7	521.7	431.5	279.6	4,196	409.6	4,924	2,161	666	510.1
1943	484.1	408	464.3	393.5	452.5	871.4	479.7	252.8	339.1	256.3	316	283.1
1944	457.5	369.4	466.8	291.5	1,860	521.8	275.9	356.5	559.8	267.9	268.4	466.4
1945	714.2	870.6	533.1	1,144	401	505.1	260.5	240.1	214.3	438.4	253.9	262.4
1946	341.4	397	501.1	741.7	1,583	1,097	266.4	833.6	4,313	5,531	927.3	561.4
1947	795	515.6	553.1	453.7	933.4	344.9	256.6	347.5	271.7	224.7	274.6	284.5
1948	260.9	301.1	254.4	238.6	308.5	136.5	398.7	763.3	287.9	329.6	167.4	163
1949	186.9	298.6	264	2,288	716.7	1,010	778.6	295.8	209.4	1,195	312.4	425.4
1950	269.7	221.7	231.3	272.8	227.6	617.7	188.5	213.4	179.5	131.3	126.4	132
1951	124.6	198.6	174.5	195	493.5	1,113	121.4	90.2	789.5	150.4	155.6	150.5
1952	137	214.4	175	316.2	498.7	175.5	165.9	77.4	3,306	149.3	225.5	255.8
1953	271.4	163.6	171.1	206.5	940.6	85	123.6	324.5	1,319	233.7	155.8	195.9
1954	149.7	123.6	112.4	159.1	261.3	125.5	82.5	49.9	66.8	124.4	133	86.5
1955	126.6	352.2	177.3	89.3	314.2	166.4	69	165.1	242.5	75.1	76.2	114.9
1956	104.1	106.6	83.9	86.8	192.2	26.2	52.4	60.6	200.1	368	155.6	382.3

Table 2.4.1-5 (Sheet 2 of 4)
Monthly Mean Flows for San Antonio River at Goliad, TX, USGS 08188500

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1957	109.9	166.8	492.1	2,515	2,904	2,321	164.3	108.8	2,025	952.4	895.7	295.8
1958	1,641	2,884	638.1	366.8	2,065	454.2	505.3	196	932.1	1,202	1,608	582.4
1959	464.5	516.2	398.5	637.7	621.4	349.8	341.5	226.2	221.4	678.9	396.5	335.4
1960	393.8	381.7	393.8	349.5	318.5	572	518.1	553.1	248	2,520	1,769	943.9
1961	867.9	1,358	684.7	422.6	266.6	1,368	1,012	382.7	363.2	554.4	799.2	342.4
1962	331	325.3	244.6	326.8	251.7	696.7	165.7	146.2	317.7	152.6	235	378.5
1963	215	385	198.4	209.3	153.6	125.9	113.5	47.9	150.1	294.6	344.1	245.3
1964	213.7	536.9	446	193.2	152.4	289.6	88.8	472	206.8	316	599	228.8
1965	567.7	1,778	323.6	462	2,605	732.2	230.7	173	176.8	595.9	239.9	709.9
1966	291.6	359.9	322	487.2	595.8	267.9	186.8	240.8	377.1	207.1	162	183.4
1967	194.2	175	175.4	186.3	168.9	71.4	175.1	394.3	12,050	1,052	968.8	384.9
1968	4,309	1,014	647	678.2	2,063	843.1	538.4	292.4	853.6	315.1	317.1	584.4
1969	359.9	989.9	577.1	709	1,333	573.7	170.1	231.9	334.4	383.4	249.6	355.1
1970	458.4	471.2	695.5	350.1	1,134	1,296	232.8	234.3	221.3	272	204.5	202.8
1971	237.2	208.4	193.6	174.2	136.9	225.4	142.7	1,285	961.4	1,402	912.9	794.6
1972	536.5	451.2	353.9	555.6	4,235	1,073	516.9	521.1	517	609.5	463.8	395.9
1973	441.7	618.2	521.3	1,792	596.9	4,253	4,723	1,400	2,244	7,084	1,625	942.2
1974	825	676.1	587.2	513.4	779.4	521	254.4	1,041	1,660	678	1,088	715.3
1975	768.1	2,066	911.3	783.7	2,518	2,272	980.4	591	510	451.5	394.5	517.5
1976	420.9	351	369.7	1,558	2,680	713.1	1,121	573	865	1,847	2,403	1,836
1977	1,460	1,542	996.3	4,357	2,438	1,290	687.6	466.3	794.6	511.8	1,348	567.2
1978	513.6	594.4	532.2	686.2	452.5	937.6	198.4	1,736	1,860	633.8	1,001	572.2
1979	1,539	1,127	1,265	2,864	2,255	2,785	1,062	708.5	492.8	364.4	406.6	485.4
1980	565	483.6	328.9	383.4	1,316	358.2	207.3	701.8	1,018	310.5	404.2	407.5
1981	426.8	417.3	422	464.4	881	4,747	1,520	618.1	2,444	1,505	1,097	578.1

Table 2.4.1-5 (Sheet 3 of 4)
Monthly Mean Flows for San Antonio River at Goliad, TX, USGS 08188500

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1982	509.7	815.6	546.1	431.3	1,063	420.6	286.8	288.4	254.5	534.8	529.6	440.2
1983	414.4	480.3	642.3	329.5	417.4	374.4	320	337.8	822.1	371.2	480.2	293.3
1984	376.4	338	400.1	254.5	248.5	201.5	156	177	145.1	1,048	603.6	431.1
1985	664.3	437.5	805.4	796	421.2	909.7	950.8	247.3	432	982.9	1,324	560.3
1986	418.6	448.7	279	246	447.9	2,925	511	249.9	535.7	984.3	597.9	2,153
1987	1,495	1,436	1,591	787.7	1,600	15,370	1,774	819.1	719.1	480.7	606.5	626.6
1988	568.1	504.3	521.2	430.6	344.9	383	404.1	252.6	309.9	249.3	260.6	265.3
1989	371.4	376.5	330.1	409.7	360.5	367.7	149.2	184.4	142.1	223.9	403.5	314.1
1990	420.1	421.4	659.3	965.8	1,386	747.9	776	821.8	982.2	527.5	601.3	566
1991	3,000	2,645	1,330	3,992	2,596	1,438	1,495	695.2	1,022	865.8	907.7	9,753
1992	10,650	17,250	10,600	9,821	8,757	8,855	3,103	2,150	1,660	1,360	1,806	1,661
1993	1,902	2,521	3,132	1,800	5,851	5,473	1,938	918.9	768	912.2	920	887.7
1994	840.6	833.3	1,033	939.1	4,208	1,435	717.1	600.5	657.6	3,768	1,172	1,898
1995	2,080	1,109	2,525	2,018	990.2	3,136	1,231	764	636.3	610.5	689.9	728.6
1996	634.4	591.4	530.3	472	382.5	313.6	163	265	1,963	415.1	444.9	597.9
1997	1,001	767.8	2,546	6,536	3,738	9,942	6,293	2,690	1,272	2,960	1,137	1,221
1998	1,478	3,391	3,509	2,033	996.9	740.2	587.7	1,308	3,026	30,440	9,440	4,711
1999	2,210	1,589	1,494	1,307	1,475	1,942	1,124	713.6	531.4	510.9	558.4	565
2000	661.1	655.5	718.7	636.2	892.9	1,475	424.6	289.5	271.9	485.4	5,365	2,431
2001	2,672	2,267	3,368	1,856	1,701	1,051	792.6	894.1	7,430	1,429	3,493	5,343
2002	2,033	1,525	1,245	2,227	891.2	776	17,060	4,741	5,515	6,091	9,964	5,771
2003	3,878	4,888	3,556	1,900	1,528	1,405	1,385	1,070	1,479	1,401	1,226	1,011
2004	1,399	1,394	1,473	3,276	3,597	6,258	5,420	1,836	1,561	3,395	17,500	7,453
2005	3,157	4,595	6,122	2,228	2,638	1,633	1,237	1,064	953.8	827.5	753.9	773.4
2006	767.6	757.4	737.3	648.9	685.3	588.6	602	296.3	438.2	443.5	396.4	473.2

Table 2.4.1-5 (Sheet 4 of 4)
Monthly Mean Flows for San Antonio River at Goliad, TX, USGS 08188500

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007	1,758	835.6	4,824	3,994	4,860	3,870	12,040	7,406	5,105	—	—	—
Mean of Monthly Discharge	1,740	1,990	1,850	2,130	2,810	2,820	2,120	1,110	1,800	2,080	2,030	1,750

Source: Reference 2.4.1-5
Notes:
Shaded months depict periods of extended drought.
October, November, and December 2007 are part of the 2008 water year and are not included.

Table 2.4.1-6 (Sheet 1 of 2)
Monthly Mean Flows for Coleto Creek Near Victoria, TX USGS 08177500

YEAR	Monthly Mean in cfs Calculation period restricted by USGS staff due to special conditions at/near site											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980	—	—	—	—	—	—	—	—	—	4.62	5.45	5
1981	5.84	5.09	5.44	5.84	447.6	1,115	87.7	89.3	245.3	579.4	273	24.2
1982	15.3	479.2	33.6	21.4	429.5	13.1	4.89	5.18	4.03	4.66	338.3	5.55
1983	5.44	117.4	182.5	6.51	5.61	5.94	335.6	22.9	6.08	208.3	152.8	8.87
1984	58.6	19.9	220.2	4.74	7.05	5.08	5.01	5	5.11	43.6	24.6	22.6
1985	27.7	23.5	291.9	338.7	31.3	13.5	123	5.23	4.73	5.75	5.18	5.01
1986	5.51	5.08	4.85	4.76	5.53	37.5	4.06	2.8	2.62	156	10.9	295.6
1987	90.3	303.4	42.9	11.8	4.46	1,168	10	5.18	6.73	5.3	9.48	5.98
1988	5.65	5.73	6.53	5.1	4.78	5.25	4.7	2.04	2.11	2.53	3.66	2.39
1989	3.01	2.6	3.01	3.75	2.91	2.5	1.97	1.06	1.56	1.65	2.21	2.37
1990	2.34	2.46	2.92	65	2.88	1.82	397.4	3.08	2.13	2.39	2.14	2.4
1991	3.66	3.15	2.67	719.3	3.86	114	50.9	4.14	3.71	3.14	2.46	434.1
1992	347	960.6	32	956	442.2	64	5.34	4.89	4.47	4.09	4.95	5.26
1993	5.34	52.4	236.3	19.2	939.9	1,426	13.9	6.5	7.36	5.41	5.1	4.55
1994	5.5	5.97	40.5	5.13	328.6	27.3	4.46	4.51	4.63	1,074	5.86	5.81
1995	64.6	4.95	85.8	27.9	7.11	4.85	3.67	2.43	1.81	1.61	2.01	2.18
1996	1.93	1.98	2.05	2.07	2.09	2.41	1.31	2.14	1.98	1.71	1.9	2.01
1997	4.58	3.11	545.2	1,817	117.6	1,133	10.9	6.2	5.69	657.5	13.5	5.56
1998	28.5	191.6	149.3	5.02	4.62	4.43	4.15	3.47	989.8	1,313	949.5	83.9
1999	24.2	15.6	14	7.5	6.28	50.3	11.5	4.61	4.97	4.86	5.37	2.61
2000	4.09	3.26	13.4	17.2	14.1	36.1	8.77	3.91	1.78	2.1	2.57	3.06
2001	85.6	2.35	20.6	6.43	158.1	0.043	0.009	369.9	1,202	52.7	249.8	272.1
2002	11.1	3.02	3.08	3.48	2.83	5.1	341.2	0.931	136.3	458.6	511.3	212.4

Table 2.4.1-6 (Sheet 2 of 2)
Monthly Mean Flows for Coleto Creek Near Victoria, TX USGS 08177500

YEAR	Monthly Mean in cfs Calculation period restricted by USGS staff due to special conditions at/near site											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	94.5	57.3	18.6	2.22	2.56	3.07	89.4	3.04	371.7	77.4	144.5	9.09
2004	133.5	33	94.7	423.6	725.1	278.6	68.4	5.44	5.32	5.6	1,186	29.3
2005	141.3	465.3	358.7	28.1	225.1	21.9	5.3	5.13	5.31	5.06	5.31	5.28
2006	5.23	5.88	5.66	6.46	5.68	6.99	4.66	4.51	3.48	3.77	3.02	3.95
2007	27.7	9.39	562.9	98.1	76	6.61	1,518	61.3	55.1	—	—	—
Mean of monthly Discharge	45	103	110	171	148	206	115	24	114	174	145	54

Source: Reference 2.4.1-7
Note: October, November, and December 2007 are part of the 2008 water year and are not included.

Table 2.4.1-7
Guadalupe River Peak Discharge Frequency at Confluence with Coleto Creek

Flooding Source And Location	Drainage Area (square miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
Guadalupe River at confluence of Coleto Creek	5200	48,000	99,000	129,000	219,000

Source: Reference 2.4.1-9

Table 2.4.1-8 (Sheet 1 of 2)
Victoria County Surface Water Users

Water Right Number	Type[(a)]	Owner Name	Latitude (deg)	Longitude (deg)	River Basin	Stream Name	Amount in Acre-Feet Per Year[(b)]	Use Type	Priority Date
3858	Cert of Adj	First Victoria Natl Bank Trust I	28.93	–97.15	Guadalupe	Guadalupe River	1,000	Irrigation	6/27/1951
3859	Cert of Adj	South Texas Electric Coop Inc.	28.89	–97.14	Guadalupe	Guadalupe River	110,000	Industrial	2/18/1964
3860	Cert of Adj	City of Victoria	28.81	–97.03	Guadalupe	Guadalupe River	260	Municipal / Domestic	8/15/1951
3860	Cert of Adj	City of Victoria	28.81	–97.03	Lavaca-Guadalupe	Guadalupe River	—	Municipal / Domestic	8/15/1951
3860	Cert of Adj	City of Victoria	28.81	–97.03	Guadalupe	Guadalupe River	—	Storage	8/15/1951
3860	Cert of Adj	City of Victoria	28.81	–97.03	Lavaca-Guadalupe	Guadalupe River	—	Storage	8/15/1951
3861	Cert of Adj	E.I. Dupont De Nemours & Co	28.66	–96.96	Guadalupe	Guadalupe River	60,000	Industrial	8/16/1948
3862	Cert of Adj	Paradise Ranch Landowners Assn. Inc.	28.65	–96.96	Guadalupe	Guadalupe River	263	Irrigation	12/12/1951
3862	Cert of Adj	E.I. Dupont De Nemours & Co	28.65	–96.96	Guadalupe	Guadalupe River	137	Irrigation	12/12/1951
3863	Cert of Adj	Jess Womack II Et Al	28.57	–96.91	Guadalupe	Guadalupe River	200	Irrigation	3/1/1951
3863	Cert of Adj	Guadalupe-Blanco River Authority	28.57	–96.91	Guadalupe	Guadalupe River	3,000	Municipal / Domestic	3/1/1951
3863	Cert of Adj	Guadalupe-Blanco River Authority	28.57	–96.91	Guadalupe	Guadalupe River	—	Industrial	3/1/1951
3863	Cert of Adj	Guadalupe-Blanco River Authority	28.57	–96.91	Guadalupe	Guadalupe River	—	Irrigation	3/1/1951
3895	Permit	Kate S O'Connor Trust	28.64	–96.96	Guadalupe	Guadalupe River	9,676	Industrial	7/10/1978
4020	Permit	Nelson Pantel	28.92	–97.15	Guadalupe	Guadalupe River	100	Irrigation	1/21/1980
4062	Permit	Jay M. Easley Et Al	28.88	–97.10	Guadalupe	Guadalupe River	90	Irrigation	7/14/1980
4182	Permit	William A. Kyle Jr. Et Al	28.90	–97.14	Guadalupe	Guadalupe River	200	Irrigation	12/21/1981
4324	Permit	Spring Creek Develop. Co.	28.85	–97.01	Guadalupe	Spring Crk	—	Recreation	2/7/1983
4441	Permit	S.F. Ruschhaupt III	28.95	–97.16	Guadalupe	Guadalupe River	200	Irrigation	4/2/1984
5012	Permit	Joe D. Hawes	28.51	–96.92	Guadalupe	Elm Bayou	140	Irrigation	9/10/1985
5376	Permit	Heldenfels Brothers Inc.	28.84	–97.01	Guadalupe	Spring Crk	2	Industrial	8/16/1991
5424	Permit	Housing Auth. of City of Victoria	28.87	–97.01	Guadalupe	Unnamed Trib. Spring Crk	—	Recreation	7/23/1992

Table 2.4.1-8 (Sheet 2 of 2)
Victoria County Surface Water Users

Water Right Number	Type[a]	Owner Name	Latitude (deg)	Longitude (deg)	River Basin	Stream Name	Amount in Acre-Feet Per Year[b]	Use Type	Priority Date
5466	Permit	City of Victoria	28.81	–97.03	Guadalupe	Guadalupe River	20,000	Municipal / Domestic	5/28/1993
5485	Cert of Adj	Victoria WLE LP	28.79	–97.01	Guadalupe	Guadalupe River	209,189	Industrial	8/15/1951
5486	Cert of Adj	Coleto Creek WLE LP	28.72	–97.17	Guadalupe	Guadalupe River	20,000	Industrial	1/7/1952
5486	Cert of Adj	Coleto Creek WLE LP	28.72	–97.17	Guadalupe	Guadalupe River & Coleto Crk	12,500	Industrial	1/10/1977
5489	Permit	Jess Womack II Et Al	28.52	–96.92	Guadalupe	Cushman Bayou	750	Other	5/12/1994

(a) Certificate of Adjudication is abbreviated as "Cert of Adj."
(b) "—" denotes data not available.

Table 2.4.1-9 (Sheet 1 of 4)
Calhoun County Surface Water Users

Water Right Number	Type[(a)]	Owner Name	Latitude (deg)	Longitude (deg)	River Basin	Stream Name	Amount in Acre-Feet Per Year[(b)]	Use Type	Priority Date
3746	Permit	Patrick H. Welder, Jr.	28.55	–96.83	Lavaca-Guadalupe	Victoria Barge	1,284.3	Irrigation	10/1/1979
3746	Permit	Standard Oil Chemical Co.	28.55	–96.83	Lavaca-Guadalupe	Victoria Barge	715.7	Irrigation	10/1/1979
3864	Cert of Adj	Texas Parks & Wildlife Dept.	28.49	–96.81	Lavaca-Guadalupe	Hog Bayou	50	Irrigation	12/31/1955
4276	Permit	Del & Gloria Williams	28.46	–96.84	Guadalupe	Guadalupe River	272	Industrial	6/25/1985
4794	Cert of Adj	Aluminum Co of America	28.65	–96.56	Colorado-Lavaca	Lavaca Bay	56,455	Industrial	5/4/1970
5173	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	2,500	Irrigation	2/3/1941
5173	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	8/12/1988
5173	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	2/3/1941
5173	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	2/3/1941
5173	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	2/3/1941
5173	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	8/12/1988
5174	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	1,870	Irrigation	6/15/1944
5174	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	6/15/1944
5174	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	6/15/1944

Table 2.4.1-9 (Sheet 2 of 4)
Calhoun County Surface Water Users

Water Right Number	Type[(a)]	Owner Name	Latitude (deg)	Longitude (deg)	River Basin	Stream Name	Amount in Acre-Feet Per Year[(b)]	Use Type	Priority Date
5174	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	6/15/1944
5174	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	6/15/1944
5174	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	6/15/1944
5175	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	940	Industrial	2/13/1951
5175	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	2/13/1951
5175	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Mining	2/13/1951
5175	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Other (stockraising)	2/13/1951
5175	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	2/13/1951
5175	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	2/13/1951
5175	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Mining	2/13/1951
5175	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Other	2/13/1951
5176	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	9,944	Municipal/ Domestic	6/21/1951
5176	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	6/21/1951
5176	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	6/21/1951

Table 2.4.1-9 (Sheet 3 of 4)
Calhoun County Surface Water Users

Water Right Number	Type[(a)]	Owner Name	Latitude (deg)	Longitude (deg)	River Basin	Stream Name	Amount in Acre-Feet Per Year[(b)]	Use Type	Priority Date
5176	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Municipal/ Domestic	6/21/1951
5176	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	6/21/1951
5176	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	6/21/1951
5177	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	32,615	Municipal/ Domestic	1/3/1944
5177	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	1/3/1944
5177	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	1/3/1944
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Municipal/ Domestic	1/3/1944
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	1/3/1944
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	1/3/1944
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	10,000	Municipal/ Domestic	1/3/1944
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	1/3/1944
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	1/3/1944
5177	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	8,632	Industrial	1/26/1948
5177	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	1/26/1948

Table 2.4.1-9 (Sheet 4 of 4)
Calhoun County Surface Water Users

Water Right Number	Type[(a)]	Owner Name	Latitude (deg)	Longitude (deg)	River Basin	Stream Name	Amount in Acre-Feet Per Year[(b)]	Use Type	Priority Date
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	1/26/1948
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	1/26/1948
5178	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	106,000	Municipal/ Domestic	5/5/1954
5178	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	5/5/1954
5178	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	5/5/1954
5178	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Municipal/ Domestic	5/5/1954
5178	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Industrial	5/5/1954
5178	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lk, Hogg Bayou, Goff Bayou	—	Irrigation	5/5/1954
5484	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River	—	Industrial	5/15/1964
5639	Cert of Adj	Terry M. Whitaker Et Al	28.59	–96.77	Lavaca-Guadalupe	Coloma Crk	40	Irrigation	8/23/1999

(a) Certificate of Adjudication is abbreviated as “Cert of Adj.”
(b) "—" denotes data not available.

Table 2.4.1-10
Goliad County Surface Water Users

Water Right Number	Type[(a)]	Owner Name	Latitude (deg)	Longitude (deg)	River Basin	Stream Name	Amount in Acre-Feet Per Year	Use Type	Priority Date
2193	Cert of Adj	James M. Pettus Et Al	–97.603798	28.692085	San Antonio	San Antonio River	284	Irrigation	12/31/1963
2194	Cert of Adj	Julia Gannt Newton Et Al	–97.581062	28.686396	San Antonio	San Antonio River	1020	Irrigation	11/14/1947
2195	Cert of Adj	Kenneth B. Perkins	–97.571136	28.685186	San Antonio	San Antonio River	410	Irrigation	1/13/1956
2196	Cert of Adj	Coleto Cattle Company	–97.565994	28.680069	San Antonio	San Antonio River	336	Irrigation	11/30/1950
2197	Cert of Adj	James M. Pettus Et Al	–97.52832	28.653498	San Antonio	San Antonio River	86	Irrigation	1/31/1967
2198	Cert of Adj	San Antonio River Authority	–97.507668	28.647745	San Antonio	San Antonio River	333	Irrigation	4/25/1950
2199	Cert of Adj	Sam Houston Clinton Et Al	–97.491386	28.642643	San Antonio	San Antonio River	325	Irrigation	1/20/1949
3820	Permit	June Pettus	–97.52449	28.649004	San Antonio	San Antonio River	950	Irrigation	4/20/1981
3820	Permit	Mrs. Joe Cohn	–97.52449	28.649004	San Antonio	San Antonio River	Not applicable	Irrigation	4/20/1981
5079	Permit	John Brooke	–97.539726	28.66877	San Antonio	San Antonio River	114	Irrigation	7/28/1986
5220	Permit	Clarence F. Schendel Et Al	–97.459122	28.648272	San Antonio	San Antonio River	330	Irrigation	2/27/1989
5313	Permit	Edwin Jacobson Et Al	–97.610405	28.707199	San Antonio	San Antonio River	100	Irrigation	8/30/1990
5478	Permit	Patricia Pittman Light	–97.486397	28.642387	San Antonio	San Antonio River	300	Irrigation	1/14/1994

(a) Certificate of Adjudication is abbreviated as "Cert of Adj."

Table 2.4.1-11
GBRA's Water Rights in the Lower Guadalupe River Basin

Permit Number	Certificate of Adjudication	Priority Date	Authorized Use	Owner	Authorized Diversion (Ac-Ft/Yr)
1319	18-5173	2/3/1941	Irrigation/Industrial	GBRA/Union Carbide	2,500
1362	18-5174	6/15/1944	Irrigation/Industrial	GBRA/Union Carbide	1,870
1564	18-5175	2/13/1951	Irrigation/Industrial/ Mining/Livestock	GBRA/Union Carbide	940
1592	18-5176	6/21/1951	Irrigation/Industrial/ Municipal	GBRA/Union Carbide	9,944
1375	18-5177	1/3/1944	Irrigation/Industrial/ Municipal	GBRA/Union Carbide	32,615
		1/3/1944	Irrigation/Industrial/ Municipal	Union Carbide	10,000
		1/26/1948	Irrigation/Industrial	GBRA/Union Carbide	8,632
1614	18-5178	1/7/1952	Irrigation/Industrial/ Municipal	GBRA/Union Carbide	106,000
1562	18-3863	3/1/1951	Irrigation/Industrial/ Municipal	GBRA	3,000
2120	18-5484	5/15/1964	Diversion Dam & Saltwater Barrier	GBRA	N/A
				Total	175,701

Table 2.4.1-12
GBRA Record of Reported Calhoun Canal Water Use (Acre-Feet per Year)

Year	Industrial	Municipal	Irrigation	Total
2000	26,637	4,754	18,539	49,930
2001	26,047	3,849	21,774	51,670
2002	21,919	5,837	23,893	51,649
2003	20,482	10,398	14,030	44,910
2004	19,370	4,882	15,508	39,760
2005	20,254	8,482	19,809	48,545
2006	22,264	6,946	15,813	45,023

Industrial Customers	—	Ineos Nitriles DOW Chemical Company Seadrift Coke
Municipal Customers	—	City of Port Lavaca Port O' Connor Municipal Utility District GBRA Calhoun County Rural Water System
Irrigation Customers	—	Rice Farmers Aquaculture Farmers Waterfowl Enhancement

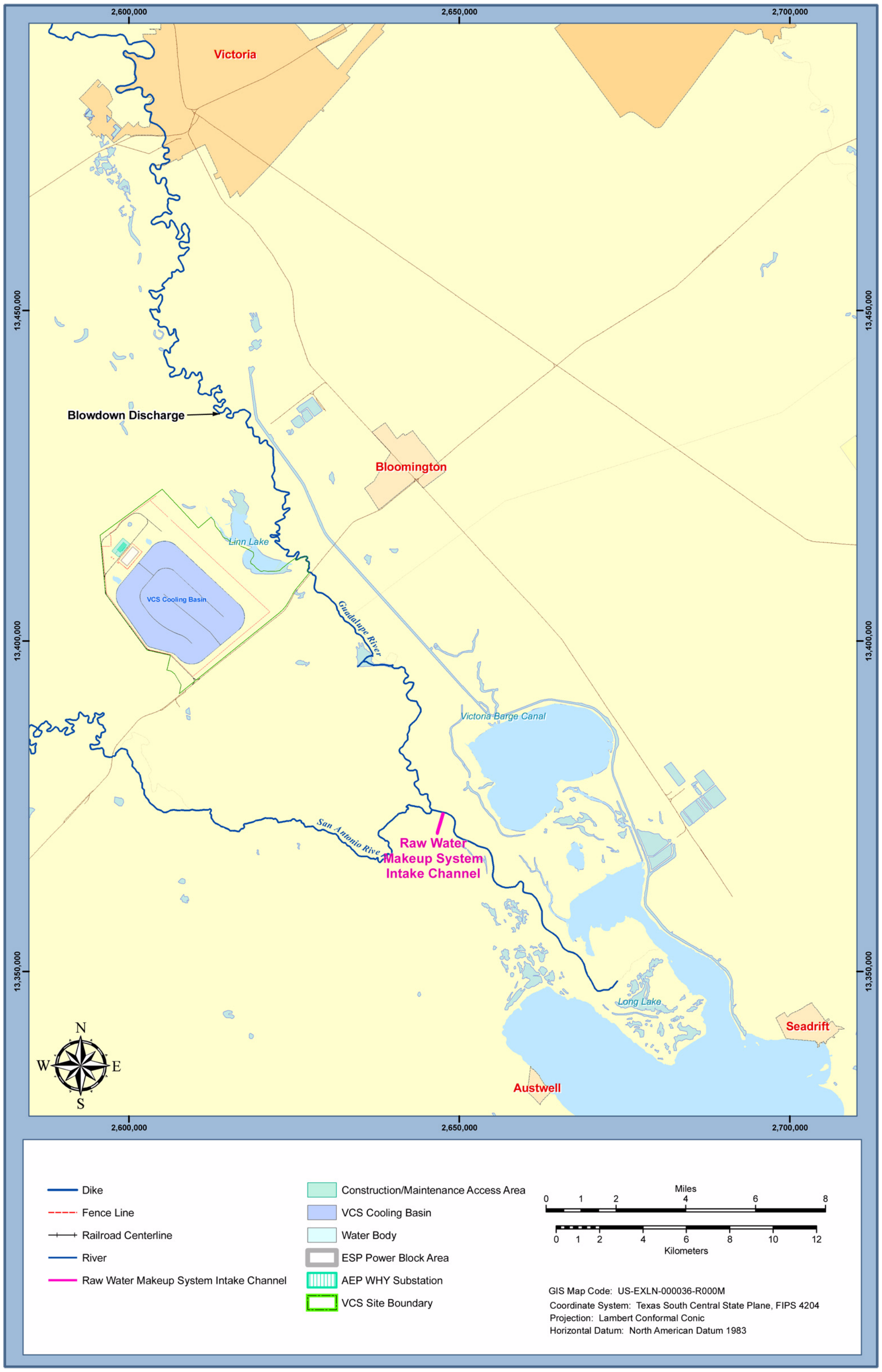

Figure 2.4.1-1 VCS Site Location

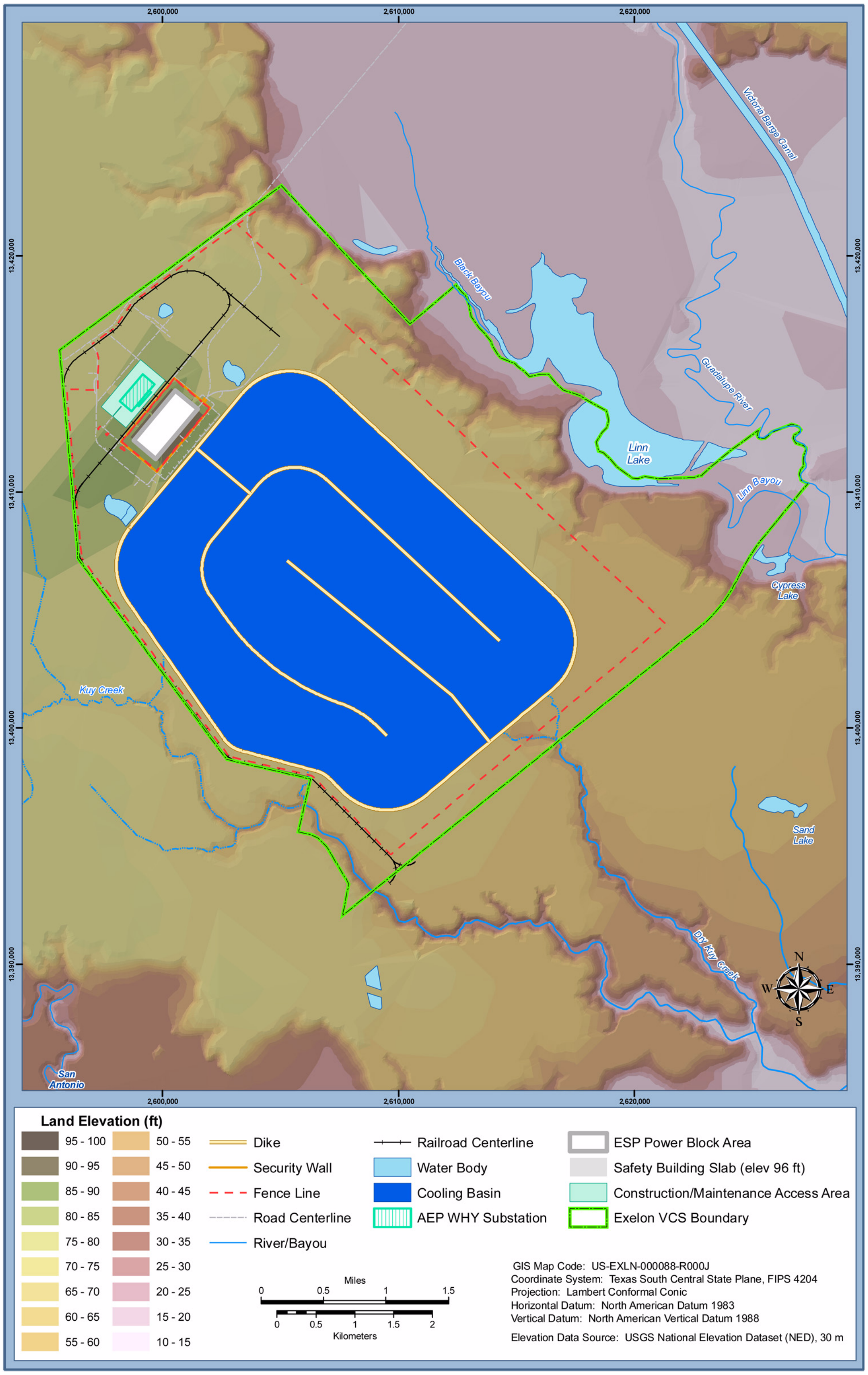

Figure 2.4.1-2 VCS Site Topography

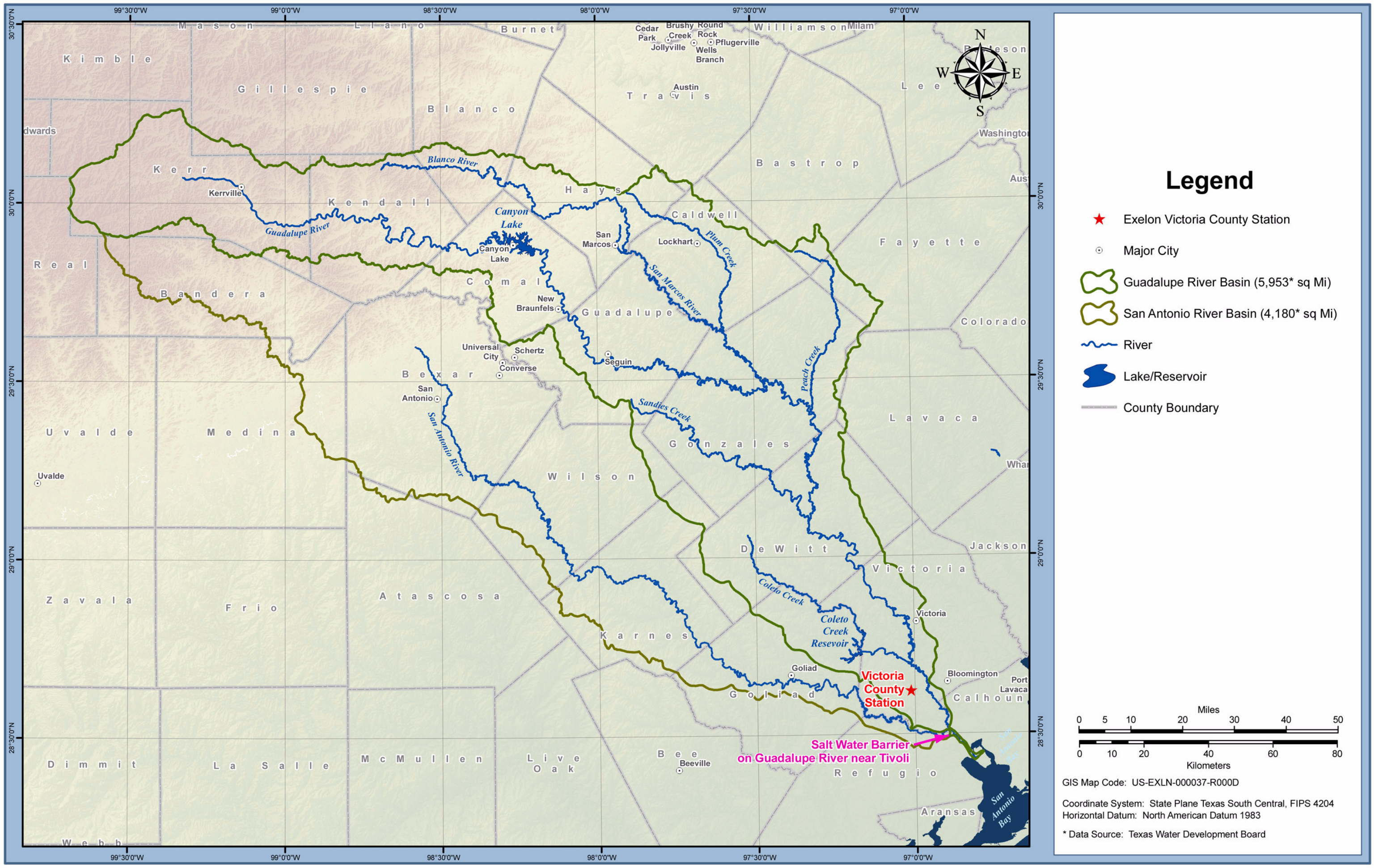

Figure 2.4.1-3 Guadalupe and San Antonio River Basin Watersheds

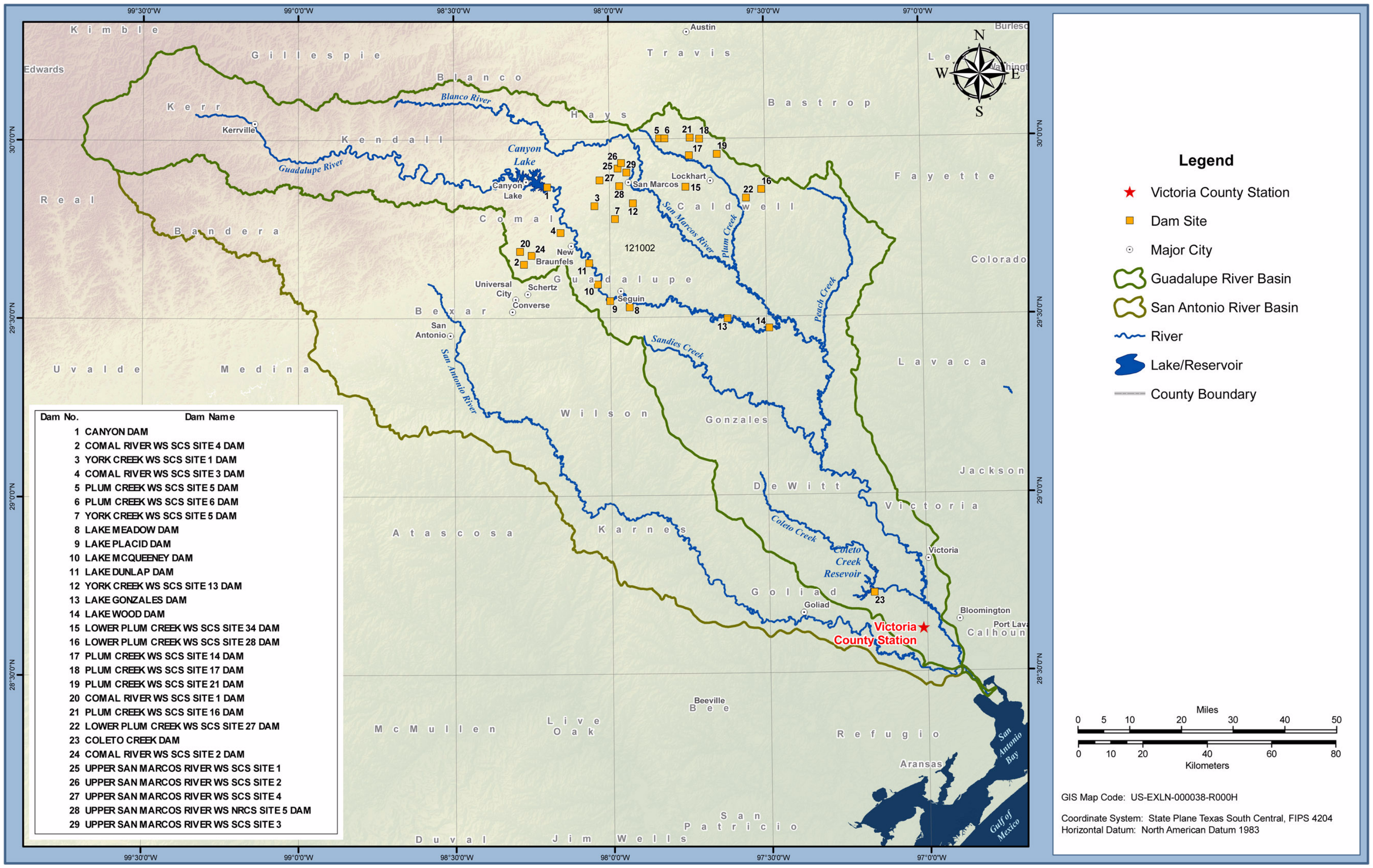

Figure 2.4.1-4 Guadalupe River Basin Dams

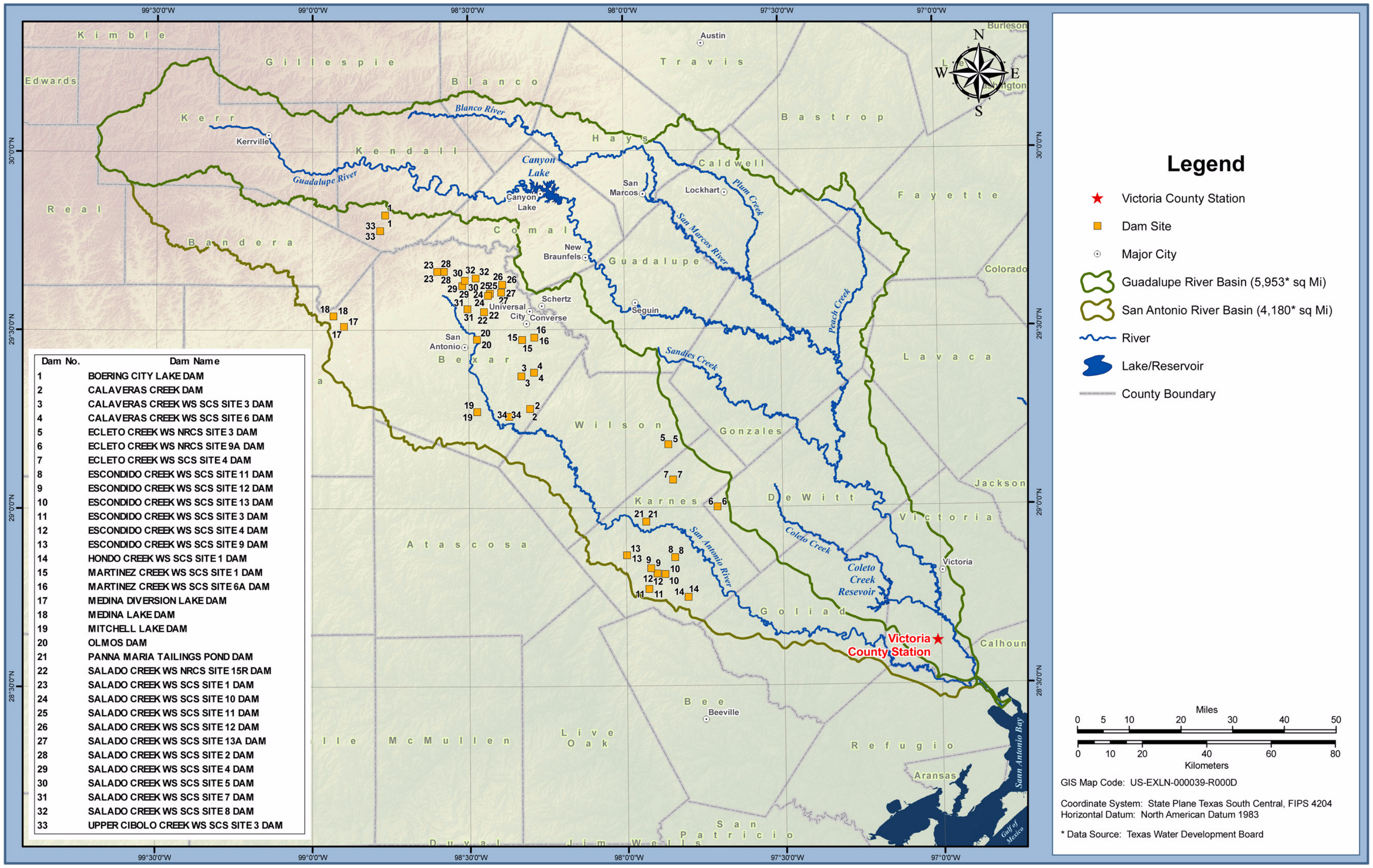

Figure 2.4.1-5 San Antonio River Basin Dams

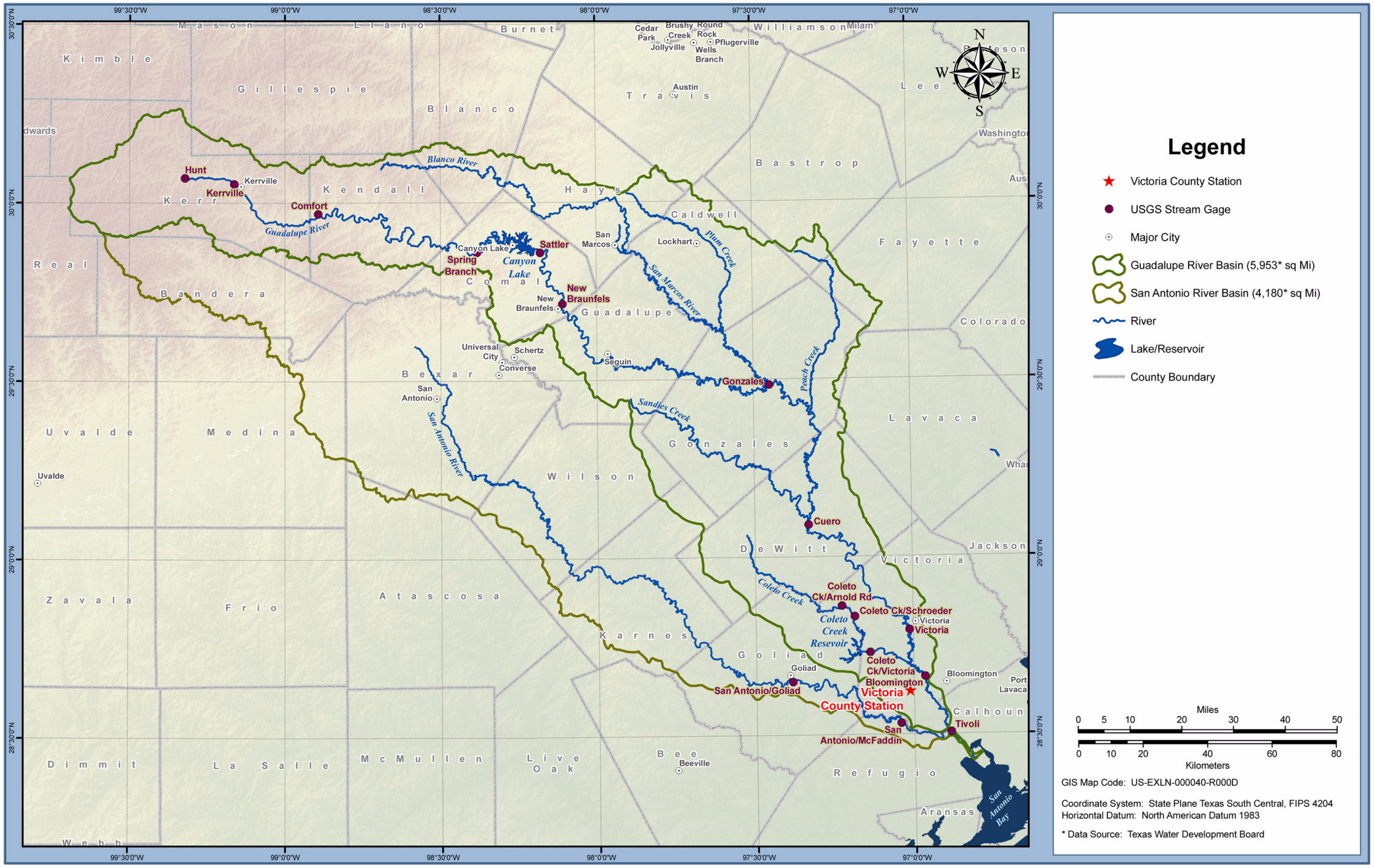

Figure 2.4.1-6 Guadalupe and San Antonio River Basins: Selected Stream Gages

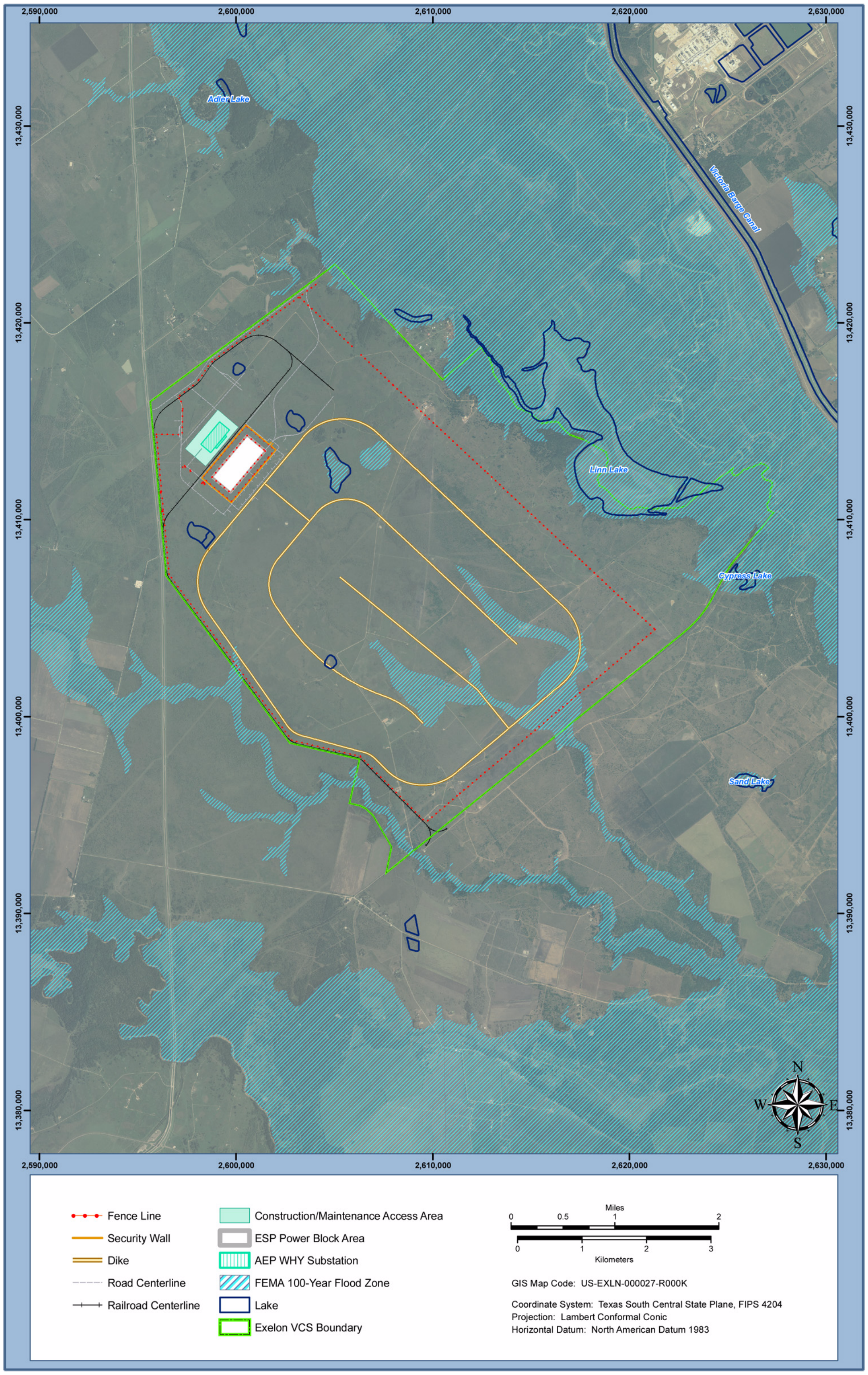

Figure 2.4.1-7 VCS Site Floodplain Map

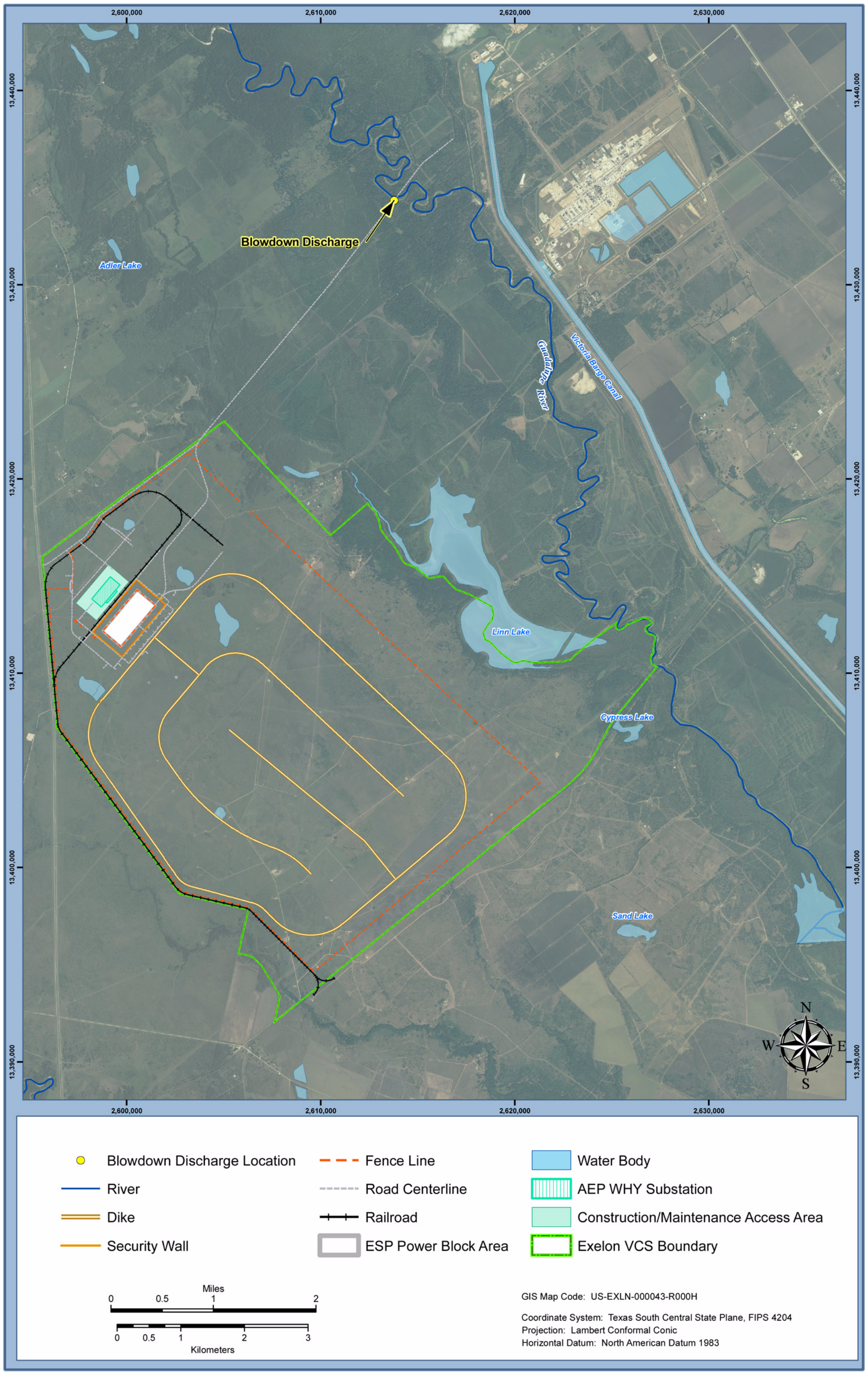

Figure 2.4.1-8 VCS Blowdown Discharge Location Map

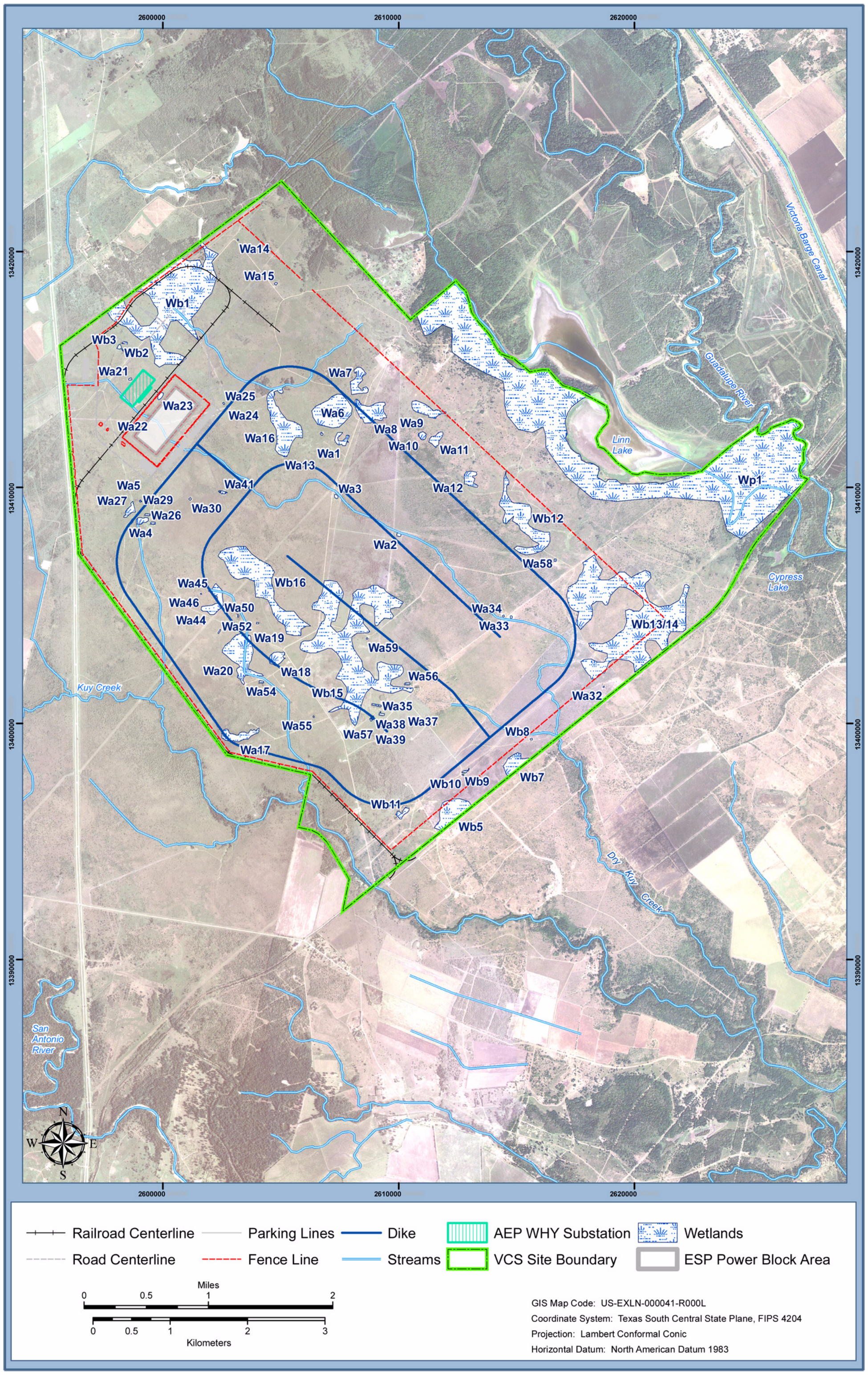

Figure 2.4.1-9 Existing Streams and Wetlands

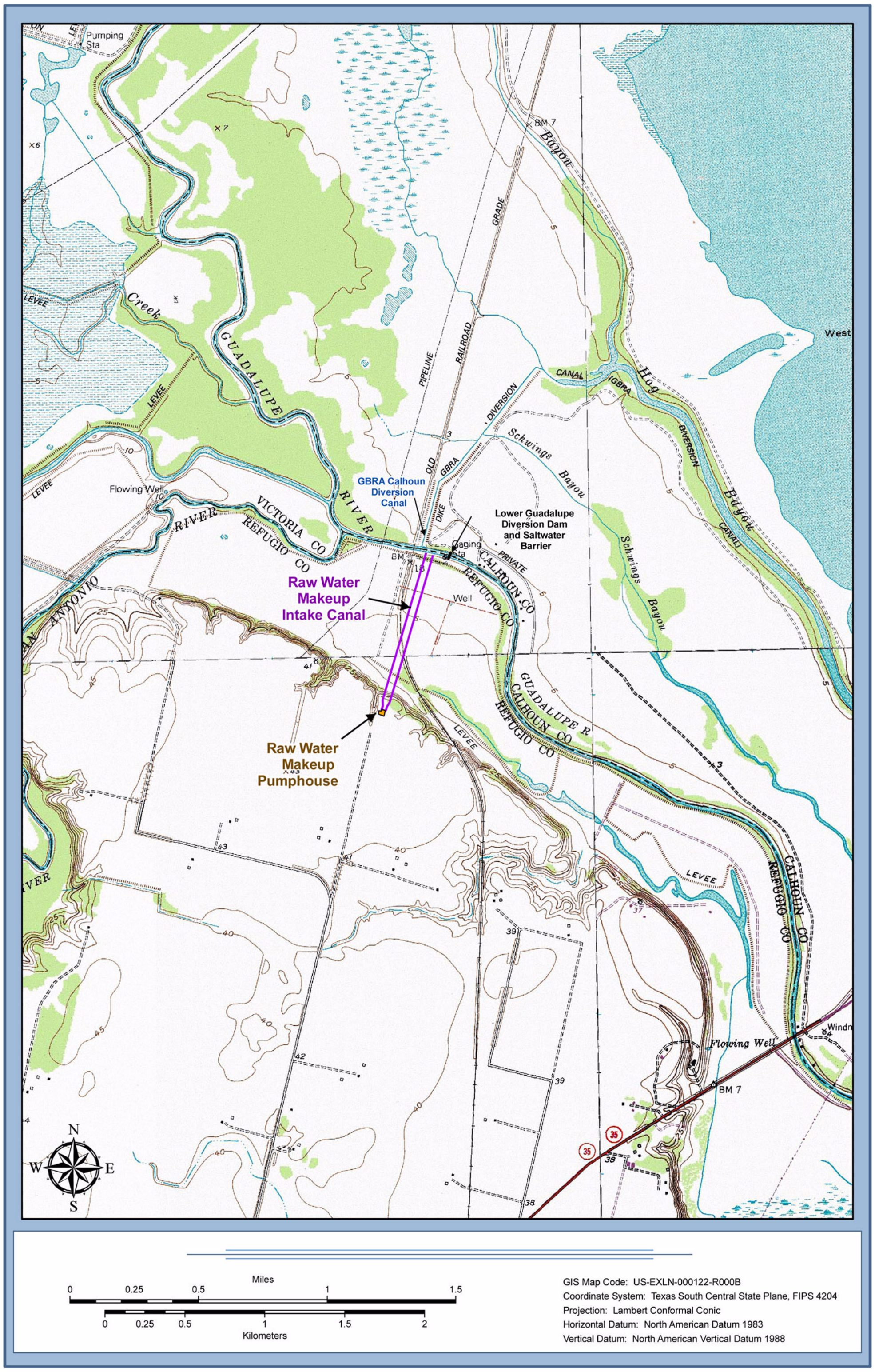

Figure 2.4.1-10 VCS Raw Water Makeup (RWMU) System Intake Location Map

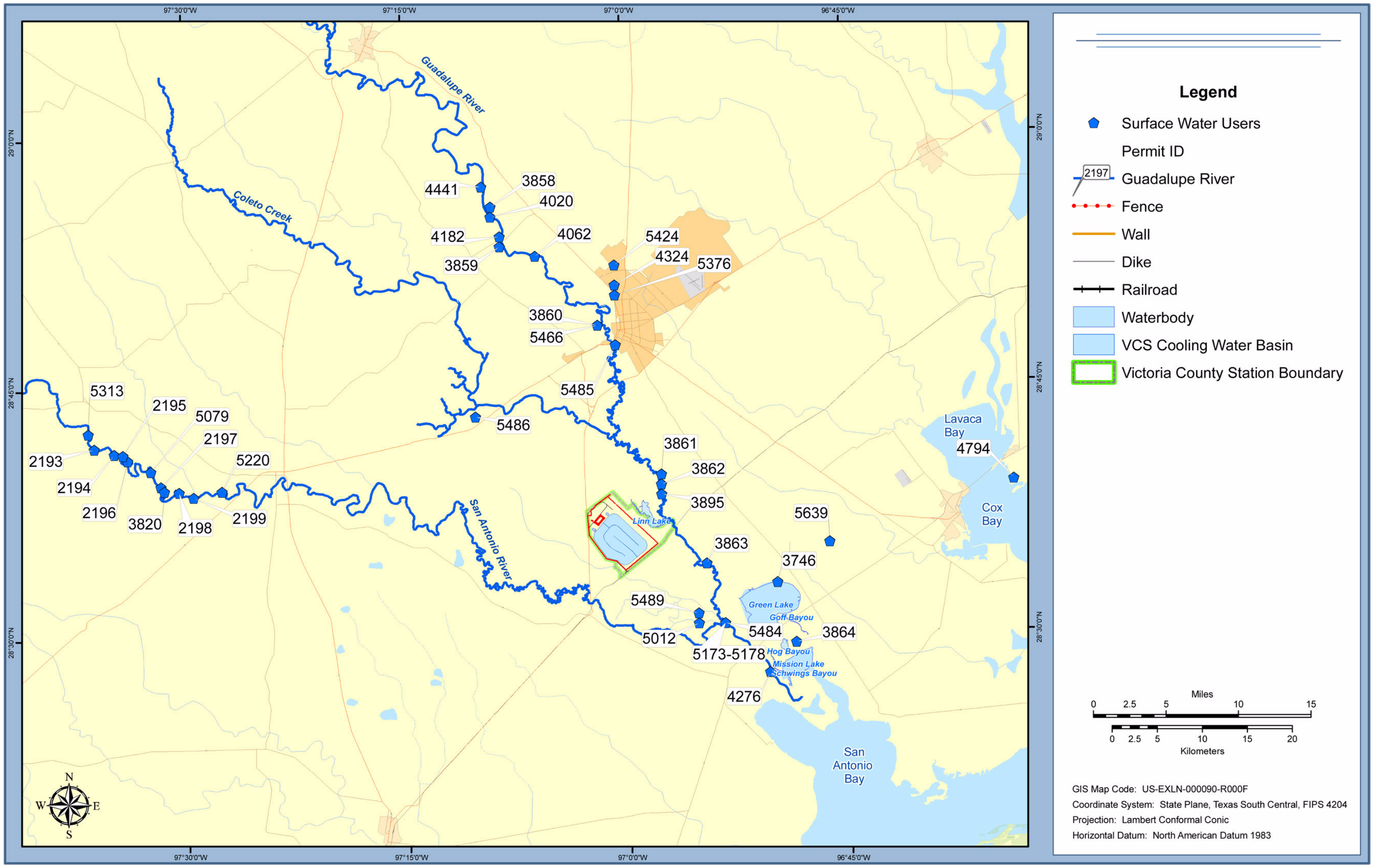

Figure 2.4.1-11 Surface Water Users in the Vicinity of VCS