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Chapter 2 Environmental Description

Chapter 2 describes the existing environmental conditions at the VCS site, the site vicinity, and the region. These descriptions provide sufficient detail to identify those resources that have the potential to be affected by the construction, operation, or decommissioning of the new units. The chapter is divided into eight sections:

- Site Location (Section 2.1)
- Land (Section 2.2)
- Water (Section 2.3)
- Ecology (Section 2.4)
- Socioeconomics (Section 2.5)
- Geology (Section 2.6)
- Meteorology, Air Quality, and Noise (Section 2.7)
- Related Federal and Other Project Activities (Section 2.8).

2.1 Site Location

Exelon proposes to construct and operate two ESBWR units, referred to as Unit 1 and Unit 2, at a site located in Victoria County, Texas. The site is an approximately 11,500-acreundeveloped property located in a rural area, approximately 13.3 miles south of the city of Victoria, Texas.The site boundary is the same as the property boundary.

The site is not located within a township, because the state of Texas does not use the Public Land Survey System. The system used by Texas is called Original Texas Land Surveys (OTLS) and the VCS site falls within the following blocks of that system: BBBC_RR CO, A. L. Fernet, F. Jones, J. A. McFaddin, D. Nira, PI Co 2, PI Co 3, F. Ramon, L. Serna, J. Vairin, and T. G. Winn. These names correspond to the original land grantees of the state of Texas as compiled by the Texas General Land Office and represent the most detailed standard designations of the OTLS system. (RCT 2007)

The Units 1 and 2 reactor buildings will be located at the following coordinates:

			Texas State Plane Coordinates		**Universal Transverse Mercator (UTM) Zone 14 (meters)**	
	Latitude	Longitude	Northing	Easting	Northing	Easting
Unit 1	N28° 36’ 48”	W97° 1’ 54”	N13412300.00	E2600000.00	3,166,741	692,445
Unit 2	N28° 36’ 56”	W97° 1’ 47”	N13413066.04	E2600642.79	3,166,975	692,642
Center point	N28° 36’ 52”	W97° 1’ 50”	N13412683.02	E2600321.39	3,166,858	692,544

North American Datum 1983 (NAD 83)

Units 1 and 2 and supporting infrastructure will be located in the area delineated in Figure 2.1-1. The location and orientation of the principal station structures within the power block is shown on Figures 3.1-1 and 3.1-2. The center point between the Unit 1 and Unit 2 reactor buildings will serve as the reference point for distance measurements in relation to the site.

The exclusion area boundary will be an oval centered at the center point between Units 1 and 2 and having a northwest-southeast distance of 8000 feet and a northeast-southwest distance of 9000 feet (Figure 2.1-1). As shown on Figure 2.1-1, the exclusion area boundary will be within the property and site boundaries.

Access to the site will be from U.S. Highway 77. The closest operating railway, owned by Union Pacific, runs approximately 4 miles southeast of the Unit 1 and 2 power block.The Guadalupe River is approximately 4.1 miles east of the site, and the Victoria Barge Canal, which connects to the Gulf Intracoastal Waterway, is approximately 5.2 miles east of the site.

Units 1 and 2 will be located approximately 3 miles west of Linn Lake and 4.3 miles northwest of the town of McFaddin (Figure 2.1-2). The closest population center to the site with more than 25,000 residents is the city of Victoria (Figure 2.1-3). At the time of the 2000 census, the city of Victoria had a population of 60,603 (USCB 2000). The 2006 population estimate for the city of Victoria was 62,169 (USCB 2006).Population distributions are provided for the 10-mile and 50-mile radii in Table 2.5.1-1.

Figure 2.1-4 provides an oblique aerial view of the VCS site.

2.1.1 References

RCT 2007. Railroad Commission of Texas, *Original Texas Land Survey GIS shapefile surv469s.shp*, 2007, Victoria County, available at http://www.tnris.org/datadownload/county.jsp?Name=Victoria, accessed January 18, 2008.

USCB 2000. U.S. Census Bureau, *Population Finder, Victoria City, Texas*, available at http://www.factfinder.census.gov, accessed December 3, 2007.

USCB 2006. U.S. Census Bureau, *Population Finder, Victoria City, Texas*, available at http://www.factfinder.census.gov, accessed March 8, 2008.

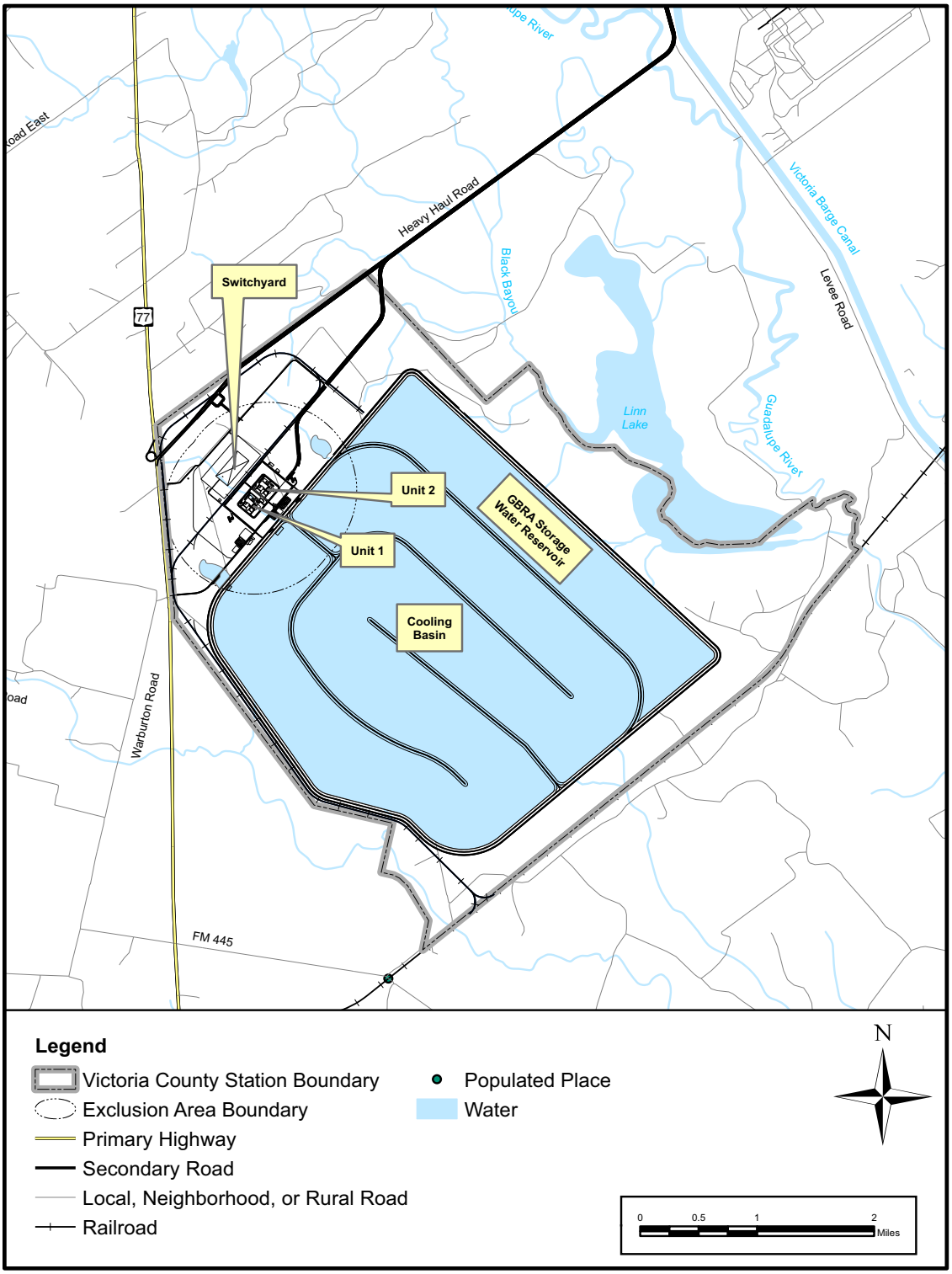

Figure 2.1-1 Victoria County Station Site and Proposed Plant Footprint

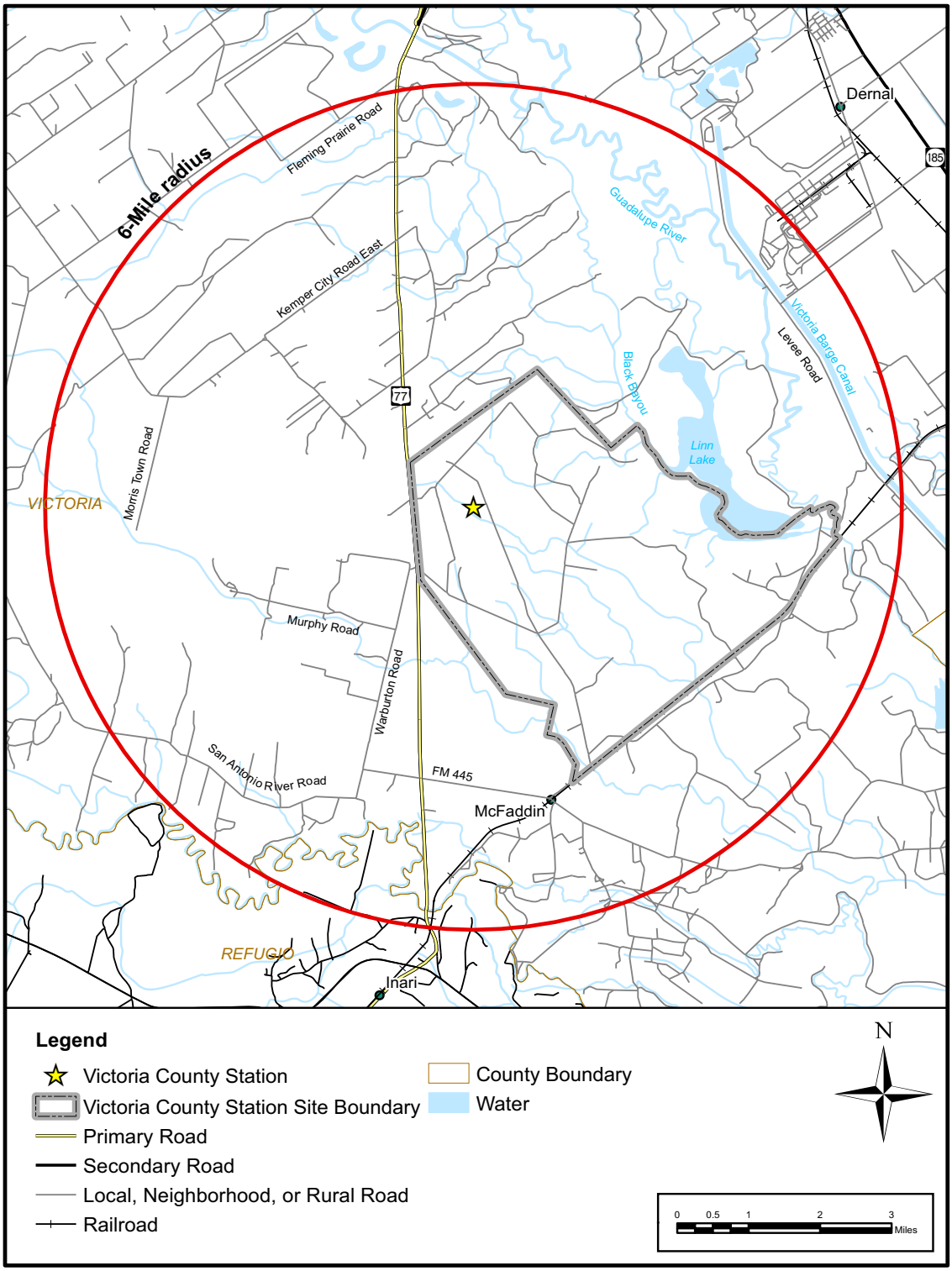

Figure 2.1-2 6-Mile Vicinity

Figure 2.1-3 50-Mile Region

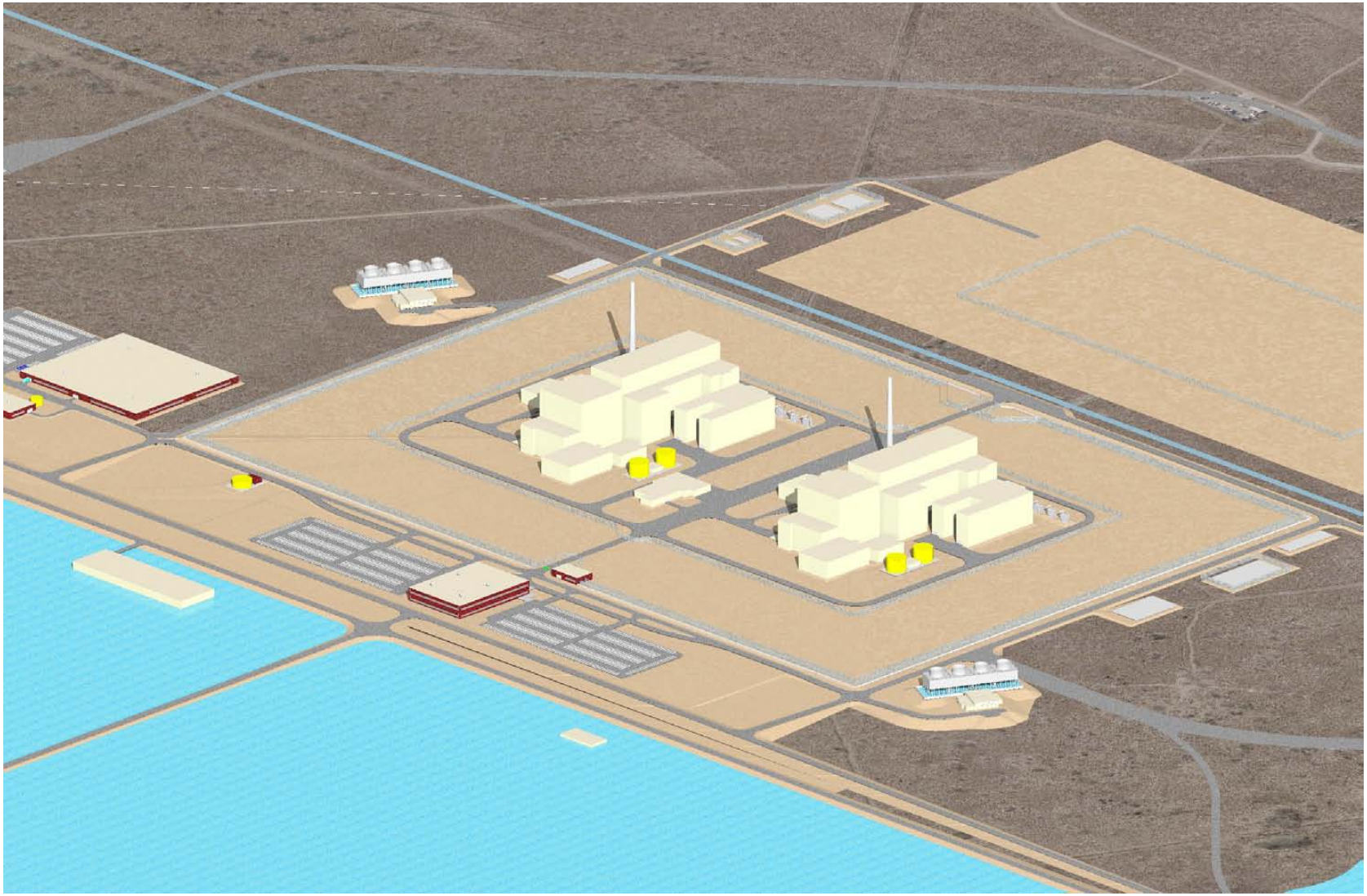

Figure 2.1-4 Oblique Aerial Photograph of VCS Site

2.2 Land Use and Transmission

An understanding of the land involved in the proposed project is essential to the analyses on land use, ecology, and other disciplines in Chapters 4 and 5. Accordingly, this section describes the land characteristics of the proposed VCS, site and vicinity, transmission corridors, offsite areas, and the region. As presented in Subsection 2.5.4, there are no Native American lands within the 50-mile radius. More detailed land use information, as it pertains to socioeconomics, is provided in Section 2.5.

2.2.1 The Site and Vicinity

2.2.1.1 The Site

Exelon has entered into an agreement to purchase the proposed 11,532-acre site for construction of a nuclear power plant. Exelon will acquire all mineral rights, including all related oil and gas leases, under the power block area. Exelon will acquire a surface waiver from the mineral interest owners and oil and gas lessees for the areas comprising the cooling basin and the exclusion area. For mineral rights and leases outside the exclusion area boundary and cooling basin footprint, Exelon will evaluate the impact on construction and operation of the plant of allowing the current land use to continue. Exelon will acquire such additional mineral rights and leases necessary to assure the safe construction and operation of the plant. There are approximately 100 wells, with approximately 23 active wells, associated with oil and gas exploration/production within the property boundary, including approximately 10 permitted exploration sites as of October 2007. There are currently three gas pipelines running through the site owned by Kinder Morgan (successor-in-interest to Natural Gas Pipeline Company of America and Texas Illinois National Gas Pipeline Co.), Williams (successor-in-interest to Transcontinental Gas Pipe Line Corporation) and Gulf South Pipeline Company, LP. These pipelines would be rerouted to the north of the power block to connect to existing pipelines in already disturbed areas.

Based on geographic information system (GIS) and aerial interpretation of the site using U.S. Geological Survey (USGS) land use classifications, most of the site is considered rangeland. Figure 2.2-1 and Table 2.2-1 indicate the land use within the site. The proposed location was chosen to enable functional and safe operation of a nuclear power plant, including support facilities and an onsite cooling basin. The proposed land use is compatible with the surrounding environment and communities.

The location of VCS, with respect to nearby roads, highways, waterways, and communities and cities in the vicinity, is shown in Figures 2.1-1 and 2.1-2. Figure 2.1-3 shows the 50-mile region. U.S. Highway 77 is the nearest major roadway and is located along the western border of the site. Road access to the site is provided by U.S. Highway 77. There are currently no public roads, railroads, or waterways within the site. The rail spur discussed in Subsection 2.2.2.3 would not become a public rail line. The proposed VCS site is not located in the Texas Coastal Management Zone (CCC Undated).

The topography of the site consists of fairly flat rangeland, sloping gently from the highest elevations (over 80 feet above MSL) along the northwestern perimeter to the lowest elevations (approximately 12 feet above MSL) near the eastern perimeter (Subsection 6.4.2.1). The area in which the plant facilities would be constructed is currently at an elevation of approximately 80 feet.

The wetlands within the site are located primarily in the floodplain of the Guadalupe River, near the eastern site boundary. Exelon performed a wetland delineation of the site and found that most of the wetlands on the central portion of the site lack permanent surface connections to navigable U.S. waters and groundwater and, thus, are not jurisdictional wetlands (pending U.S. Army Corps of Engineers confirmation). The wetlands bordering Linn Lake are linked to a navigable U.S. water (Linn Lake) and are, therefore, jurisdictional wetlands (pending U.S. Army Corps of Engineers confirmation).

According to the Natural Resources Conservation Service (NRCS), a division of the U.S. Department of Agriculture, much of the site is considered "prime or unique farmland," as defined by NRCS § 657.5, Identification of Important Farmlands (see Subsection 4.1.1.1 for a more detailed discussion). The site is currently primarily used for livestock grazing. Herds of approximately 1000 to 1200 cattle and 150 horses are shifted from parcel to parcel for grazing. There are two residences within the site boundary associated with ranch operations. These residences are expected to be relocated outside the site boundary. There are three leases authorizing recreational hunting of white-tail deer, feral hogs, wild turkeys, and doves on the site property. These leases will be restricted or terminated as a condition of sale of the property to Exelon.

2.2.1.2 The Vicinity

The vicinity is defined as the area within 6 miles of the site (Figures 2.1-2 and 2.2-2). The topography of the area is characterized by fairly flat land, with elevations ranging from sea level to about 80 feet in areas to the north-northeast and north-northwest of the site (Subsection 6.4.2.1). Based on GIS and aerial interpretation of the vicinity using USGS land use classifications, the largest use category is rangeland. Of the approximately 71,936 acres within the 6 miles (Figure 2.2-2 and Table 2.2-1), approximately 0.9% is water and 99.1% is land. Of the total land, 47% is classified as rangeland, 24.5% is forestland, 19% is agricultural, and 7.4% is wetland. There are several oil and gas pipelines and wells in the vicinity, belonging to a variety of owners. There is no mining conducted in the vicinity.

There are no government, state, or locally owned recreational areas within 6 miles of the site. However, private property owners in the vicinity have previously allowed seasonal hunting on their properties. The INVISTA-DuPont Educational services facility, located within 6 miles, is used for education and recreation. The facility sponsors the Wetland Environmental Science Education Encounter program for local school children on 53 acres of wetlands (Koch Jan 2008).

The Victoria Barge Canal provides transport from the Gulf Intracoastal Waterway to the Port of Victoria. A portion of the canal is located within the 6-mile vicinity (Figure 2.1-2). Operation of the canal is described in Subsection 2.5.2.2.3.

The closest municipality (Figure 2.1-3) is the city of Victoria, Texas, approximately 13.3 miles north of VCS. There is a comprehensive land use plan in place for the city of Victoria, discussed in more detail in Subsection 2.5.2.4, which provides guidelines for regulations and development. The jurisdiction of the plan does not extend to the VCS site. There are no schools located within the vicinity (TEA Jun 2007). There are no medical facilities located within 6 miles; the nearest center for medical assistance is the city of Victoria (City-Data 2008). There are no municipal airports within 6 miles. There are no prisons located within 6 miles (TDCJ 2008). The site does not affect current egress limitations, which would come under the purview of local emergency management agencies.

2.2.2 Transmission Corridors and Offsite Areas

New transmission lines would be constructed from the VCS switchyard to termination points in the existing transmission system. Other offsite areas include a heavy haul road (Subsection 2.2.2.2), a rail connection (Subsection 2.2.2.3), makeup water and discharge water pipelines (Subsection 2.2.2.4), and an emergency operations facility (Subsection 2.2.2.5). Figures 2.2-3, 2.2-4, and 2.2-5 present these offsite facilities locations.

2.2.2.1 Proposed Transmission Corridors

Exelon, in cooperation with the Electric Reliability Council of Texas (ERCOT) South Regional Transmission Service Provider Group and American Electric Power (AEP), the transmission service provider, estimates that the following eight 345 kV lines would be needed for the proposed project:

- VCS to Hillje (two lines on double-circuit towers)
- VCS to Coleto Creek (two lines on double-circuit towers)
- VCS to Blessing
- VCS to Whitepoint
- VCS to South Texas Project
- VCS to Cholla

ERCOT is the operator of the electric grid and manager of the deregulated market for 75% of the land area and 85% of the electric load for the state of Texas (ERCOT Feb 2006).

Proposed routes for the new transmission lines would be determined under the Public Utility Regulatory Act of 2001 (Title 2, Texas Utilities Code), which requires electric utilities (AEP) to obtain a certificate of convenience and necessity before providing electrical service to the public. The Act empowers the Public Utility Commission of Texas (PUCT) to issue the certificate, providing certain conditions are satisfied regarding community values, recreational and park areas, historical and aesthetic values, environmental integrity, the need for the service, and other considerations. PUCT regulations regarding certificates of convenience and necessity are found in the Texas Administrative Code, Title 16, Part 2, Chapter 25.

In its application for a certificate, AEP would submit a detailed routing study that includes a description of the process of selecting the study area, identifying the routing constraints, selecting potential line segments, and the selection of the preferred and alternate routes. Maps of the proposed routes would include habitable structures, radio transmitters and other electronic installations, airstrips, irrigated pasture or cropland, parks and recreational areas, historical and archaeological sites, and environmentally sensitive areas. The certificate application would also include an assessment of the environmental impact of the project. The PUCT requires that public meetings be held and that summaries of public response be supplied with the certificate application. The PUCT would make the final route selection, which is not expected to occur before the COL is issued.

Because the corridor routes are not currently known, Exelon has prepared a macro-corridor analysis to determine probable route characteristics. The analysis is based on a methodology jointly developed by the Electric Power Research Institute (EPRI) and Georgia Transmission Company (GTC). The EPRI-GTC siting methodology (EPRI-GTC Feb 2006) uses GIS software to merge satellite imagery and road, terrain, and existing transmission line data into one digital map of the study area. This map is comprised of a grid of 100-square-foot cells. Each cell on the map is ranked. Features such as residential land use, agriculture and wetlands, historical resources, and important ecological habitats are ranked from one (most suitable) to nine (least suitable). Using the cell values, a computer algorithm calculates optimal paths for three types of suitability surfaces:

- Locating with existing transmission lines
- Locating with existing road rights of way
- Crossing less developed areas

The optimal paths are identified as macro-corridors, which tend to be 2 to 3 miles wide. Figure 2.2-3 depicts the macro-corridors, indicating the land uses and important features. Table 2.2-2 provides acreages and aerial percents for land use categories for both the recommended macro-corridor and a 200-foot-wide representative route. Land use in the representative route is primarily agricultural (69%). Wetlands and open water represent approximately 7% of the representative route land area, while the remainder of the land is urban (2%), forest (9%), and shrub/scrub/herbaceous (13%).

The Whitepoint and STP lines are not new transmission lines, except for the short connection from VCS to the existing STP-Whitepoint line. AEP would construct a loop from VCS to this line that is contained within the macro-corridor. Therefore, the macro-corridor shown in Figure 2.2-3 does not extend to Whitepoint (near Corpus Christi) and STP (southeast of Blessing).

The Cholla line would terminate at a new substation in DeWitt County, approximately 40 miles northwest of VCS. The need for the Cholla line was not initially identified by AEP, so it is not included in the macro-corridor study, and Table 2.2-2 land use values do not include this corridor. Nevertheless, the expected location of the Cholla substation is indicated on Figure 2.2-3. Exelon expects that the route could largely follow an existing 138 kV transmission line in an expanded corridor.

In addition to the direct connections to VCS, there would be new transmission lines and other improvements added to the regional transmission system to prevent line overloads, provide economic dispatch of generated power, and enhance system reliability.

Because the route selection study submitted to the PUCT would be prepared by AEP well after submission of the VCS COL application, the corridor routes ultimately selected may be different than those depicted here. Exelon expects that environmental impacts would not be significantly different. AEP would follow the PUCT process, which is expected to result in routing similar to that from the EPRI-GTC process.

2.2.2.2 Heavy Haul Road

A heavy haul road would be constructed from the VCS site to the Port of Victoria Turning Basin (Figure 2.2-4). Although not finalized, the road would traverse undeveloped land, Black Bayou, and the Guadalupe River. The heavy haul road would extend approximately 3 miles from the site boundary to the floodplain of the Guadalupe River and an additional 2 miles to the Port of Victoria Turning Basin. Offsite land use in the approximately 275 acres comprising the heavy haul road and blowdown corridor consists of approximately 116 acres of forestland, 78 acres of mapped wetlands, 49 acres of water, 21 acres of rangeland, 9 acres of agricultural land, and 2 acres of barren land. The heavy haul road would accommodate transport of large components from the Port of Victoria Turning Basin. These large components would be needed for the construction of VCS.

2.2.2.3 Rail Spur Connection

The nearest operating railroad is immediately adjacent to the south boundary of the site (Figure 2.1-2). This rail line is owned and maintained by Union Pacific and is used for the transportation of industrial, chemical, and agricultural resources along U.S. Highway 185. Frequency of use by Union Pacific, Burlington Northern Santa Fe, and Texas Mexican Railroad is 54 trains during a 24-hour period (USDOT Mar 2008). As depicted in Figure 2.2-1, a connection from this rail line to the new rail spur would be constructed near the southern corner of the site.

2.2.2.4 Intake and Discharge Piping and Structures

Makeup water to the cooling basin would be drawn from the Guadalupe-Blanco River Authority (GBRA) canal at a new raw water makeup (RWMU) system intake structure, as shown in Figure 2.2-5. A new pipeline would follow the existing corridor containing U.S. Highway 185 and the railroad. However, some new corridor would be needed. This new offsite corridor would cross approximately 97 acres of agricultural land, 51 acres of forestland, 47 acres of rangeland, 33 acres of mapped wetland, and 14 acres of water (Table 2.2-3). The RWMU system pumphouse and portion of the intake pipeline located adjacent to U.S. Highway 185, from southeast of the town of Bloomington to the intake location, would be within the Coastal Management Zone (CCC Undated).

The cooling basin blowdown discharge piping would follow the heavy haul road corridor back to the Guadalupe River and then turn south as indicated in Figure 2.2-5. This southern portion of discharge piping is approximately 5000 feet long and 12 disturbed acres..

2.2.2.5 Emergency Operations Facility

Exelon will maintain an emergency operations facility (EOF) to assist with the management of off-normal events at VCS. The EOF will also serve to coordinate event response activities with federal, state, and local emergency management agencies. The EOF will be located in the Victoria County Annex Building at 205 N. Bridge Street, Victoria, Texas. This facility is outside the VCS 10-mile EPZ. Currently, this building provides office space for various city government functions; however, it will be refurbished and equipped to become a state-of-the-art EOF.

2.2.3 The Region

The region is defined as the area within 50 miles of the VCS site, but excluding the site and vicinity discussed in Subsection 2.2.1. All or parts of 16 Texas counties are located within 50 miles of the VCS site: Aransas, Bee, Calhoun, Colorado, DeWitt, Goliad, Gonzales, Jackson, Karnes, Lavaca, Matagorda, Nueces, Refugio, San Patricio, Victoria, and Wharton. Figure 2.1-3 shows the 50-mile radius bounded by the 16 counties. Major land use classifications and waterways in the region are shown in Figure 2.2-6. Major highways and rail lines are shown in Figure 2.1-3.

In determining what regional land use information would be relevant to Subsection 2.2.3, Exelon evaluated worker commuting patterns and other economic data to determine the counties in the region subject to land use changes from the proposed project. The evaluation determined that the potential for land use changes was limited to the site, the vicinity, and those counties in the region that would receive the bulk of new residents and taxes. Therefore, the counties of interest that are the focus of this subsection are: Calhoun, DeWitt, Goliad, Jackson, Refugio, and Victoria. Additional information on land use in the region is provided in Section 2.5. There are no known county land-use plans for any of these six counties.

As summarized in Table 2.2-4, the region within 50 miles of the site encompasses 5,024,000 acres. Of that, 887,760 acres (17.5%) are water. Land use categories within 50 miles include 33.7% agriculture, 24.3% forestland, 18.5% rangeland, 3.3% wetlands, 2.4% urban, and 0.4% barren land.

In the region, there are several federal, state, county, and city public lands, offering both recreational and educational services. These public lands are primarily owned and maintained by the U.S. Fish and Wildlife Service, Texas General Land Office, Texas Parks and Wildlife Department, and private conservation agencies. They are discussed in detail in Subsection 2.5.2.5.2.

2.2.3.1 Victoria County

Victoria County is located in the Gulf Coastal Plain region of southeastern Texas. Victoria County is bounded on the north by Lavaca and DeWitt Counties, on the east by Jackson County, on the west by Goliad County, and on the south by Refugio and Calhoun Counties. Primary access routes in Victoria

County include U.S. Highways 59, 77, and 87. The city of Victoria has a comprehensive land use plan that primarily discusses zoning within the city, Victoria 2020: *Remembering the Past, Preparing for the Future*. Additional information on the City of Victoria and Victoria County land use and recreation is provided in Subsections 2.5.2.4 and 2.5.2.5.

Victoria County has a total area of 889 square miles, of which 883 square miles are land and 6 square miles are water (TXAC Undated a). The county elevation increases from the southeast to the northwest, with the elevation rising from sea level to 300 feet near Mission Valley in the northwest (TSHA 2007a).

In 2002, there were 1286 farms totaling approximately 513,828 acres in Victoria County (NASS 2002a). The 2002 numbers reflect a rise from 1084 farms in 1997 and 1018 farms in 1992 (AgCensus 2004a). The 2002 numbers reflected an increase in total farm acreage from 458,111 acres in 1997 and 430,736 acres in 1992. (AgCensus 2004a)

In 2002, approximately 64% of the farmland in Victoria County was used for livestock ranching and 32% for cropland (NASS 2002a). The chief agricultural products of Victoria County are cattle, sorghum for grain, corn for grain, soybeans, cotton, and hay. The chief agricultural crops have not changed since the 1992 Census of Agriculture was conducted. In 2002, the yields of agricultural products for Victoria County were:

- 69,544 head of cattle and calves
- 941,824 bushels of sorghum for grain
- 1,766,516 bushels of corn for grain
- 320,840 bushels of soybeans as beans
- 15,696 bales of cotton
- 36,486 tons dried of all hay}

2.2.3.2 Calhoun County

Calhoun County is located in the Gulf Coastal Plain between Corpus Christi and Houston. Calhoun County is bordered on the north by Victoria and Jackson Counties; on the east by Matagorda County; and on the south and west by Aransas County, Refugio County, and the Gulf of Mexico. The county seat of Calhoun County is Port Lavaca, accessible by major roadways that include U.S. Highway 87 and Texas 35. Railroad service from the coastal areas inland is provided by Union Pacific and Burlington Northern Santa Fe. Additional information on Calhoun County land use and recreation are provided in Subsections 2.5.2.4 and 2.5.2.5.

The total area of Calhoun County is 1032 square miles, of which 512 square miles are land and 520 square miles are water (TXAC Undated b). The county elevation ranges from sea level to 50 feet above sea level (TSHA 2007b).

In 2002, the county had 328 farms and ranches covering 247,827 acres, an increase from 257 farms covering 213,390 acres in 1997 and 249 farms covering 208,073 acres in 1992 (AgCensus 2004b,

NASS 2002b). Of the farms in the county in 2002, 59% were devoted to pasture, 38% to crops, and 7% to woodlands (NASS 2002b). Cattle, sorghum for grain, corn for grain, rice, cotton, and soybeans are the chief agricultural products. Since 1992, there has been a steady increase of cattle ranches and soybean farms, while the number of corn for grain, sorghum for grain, rice, and cotton farms has decreased. In 2002, the yields of the primary agricultural products in Calhoun County were:

- 23,892 head of cattle and calves
- 517,415 bushels of sorghum for grain
- 759,918 bushels of corn for grain
- 159,161 hundredweight (cwt) of rice
- 20,287 bales of cotton
- 117,455 bushels of soybeans

2.2.3.3 DeWitt County

DeWitt County is located in the Gulf Coastal Plain and is bounded on the north by Gonzales and Lavaca Counties, on the east by Victoria County, on the south by Goliad County, and on the west by Karnes County. The county seat is the town of Cuero, the county's largest municipality, accessible by major roadways that include Alt. U.S. Highway 77/183 and U.S. Highway 87. Additional information on DeWitt County land use and recreation is provided in Subsections 2.5.2.4 and 2.5.2.5.

The total area of DeWitt County is 910 square miles, of which only 1 square mile is water (TXAC Undated c). The county elevation ranges from 150 feet in the eastern corner to more than 540 feet above sea level in the southwest (TSHA 2007c).

In 2002, the county had 1786 farms and ranches covering 576,896 acres, an increase from 1502 farms covering 560,093 acres in 1997 and 1515 farms covering 569,212 acres in 1992 (AgCensus 2004c, NASS 2002c). Of the farms in the county in 2002, 64% were devoted to pasture, 29% to crops, and 7% to woodlands (NASS 2002c). Cattle, sorghum for grain, corn for grain, hay, and peanuts are the chief agricultural products. Since 1992, there has been a steady increase in cattle ranches and peanut farms, sorghum farms have decreased, and the number of corn for grain and hay farms has remained relatively unchanged. In 2002, the yields of the primary agricultural products in DeWitt County were:

- 117,113 head of cattle and calves
- 27,676 bushels of sorghum for grain
- 485,198 bushels of corn for grain
- 80,899 tons dried of all hay
- 390,000 pounds of peanuts for nuts}

2.2.3.4 Goliad County

Goliad County is located in the Gulf Coastal Plain in southeast Texas and is bounded on the north by DeWitt County, on the east by Victoria County, on the south by Refugio and Bee Counties, and on the west by Karnes County. The county seat of Goliad County is the town of Goliad, accessible by major roadways that include U.S. 59, Alt. U.S. 77/U.S. 183, and Texas 239. Additional information on Goliad County land use and recreation is provided in Subsections 2.5.2.4 and 2.5.2.5.

The total area of Goliad County is 860 square miles, of which 6 square miles are water (TXAC Undated d). The county elevation ranges from 100 feet to 250 feet above sea level (TSHA 2007d).

In 2002, the county had 984 farms and ranches covering 506,019 acres, an increase from 786 farms covering 433,568 acres in 1997 and 726 farms covering 465,365 acres in 1992 (AgCensus 2004d, NASS 2002d). Of the farms in the county in 2002, 70% were devoted to pasture, 22% to crops, and 7% to woodlands (NASS 2002d). Cattle, sorghum for grain, corn for grain, cotton, and hay are the chief agricultural products. Since 1992, there has been a steady increase of cattle ranches, while the number of corn for grain, sorghum for grain, and hay farms has remained relatively unchanged. Cotton production has increased from zero farms in 1997 to three farms in 2002. In 2002, the yields of the primary agricultural products in Goliad County were:

- 63,398 head of cattle and calves
- 85,009 bushels of sorghum for grain
- 185,893 bushels of corn for grain
- 2275 bales of cotton
- 34,044 tons dried of all hay

2.2.3.5 Jackson County

Jackson County is located in the Gulf Coastal Plain southwest of Houston. Jackson County is bordered on the north by Lavaca and Wharton Counties, on the east by Matagorda County, on the south by Calhoun County, and on the west by Victoria County. The county seat of Jackson County is Edna, accessible by major roadways that include U.S. 59 and Texas State Highway 111. The city of Edna has an official land management plan, *The Comprehensive Plan for the City of Edna Jackson County*. Additional information on Jackson County land use and recreation is provided in Subsections 2.5.2.4 and 2.5.2.5.

The total area of Jackson County is 858 square miles, of which 830 square miles are land and 28 square miles are water (TXAC Undated e). The county elevation ranges from sea level to 150 feet above sea level (TSHA 2007e).

In 2002, the county had 917 farms and ranches covering 470,500 acres, an increase from 790 farms covering 462,927 acres in 1997 and 775 farms covering 461,829 acres in 1992 (AgCensus 2004e, NASS 2002e). Of the farms in the county in 2002, 39% were devoted to pasture, 53% to crops, and 7%

to woodlands (NASS 2002e). Cattle, sorghum for grain, corn for grain, rice, cotton, soybeans, and hay are the chief agricultural products. Since 1992, there has been a steady increase in the number of cattle ranches and corn for grain, soybeans, and hay farms, while the number of cotton farms has remained relatively unchanged. Sorghum for grain and rice production has been steadily declining since 1992. In 2002, the yields of the primary agricultural products in Jackson County were:

- 52,317 head of cattle and calves
- 2,198,972 bushels of sorghum for grain
- 3,951,824 bushels of corn for grain
- 972,177 cwt of rice
- 45,000 bales of cotton
- 215,835 bushels of soybeans
- 30,818 tons dried of all hay}

2.2.3.6 Refugio County

Refugio County is located in the Gulf Coastal Plain of Texas. Refugio County is bordered on the north by Victoria and Calhoun Counties, on the east by Aransas County, Hynes Bay, and Copano Bay, on the south by San Patricio County, and on the west by Bee and Goliad Counties. The county seat of Refugio County is the city of Refugio, accessible by major roadways that include U.S. Highway 77, Alt. U.S. Highway 77/183, and Texas State Highway 202. Additional information on Refugio County land use and recreation is provided in Subsections 2.5.2.4 and 2.5.2.5.

The total area of Refugio County is 818 square miles, of which 770 square miles are land and 48 square miles are water (TXAC Undated f). The county elevation ranges from sea level at the shore to 100 feet above sea level in the northwest corner (TSHA 2007f).

In 2002, the county had 274 farms and ranches covering 505,954 acres; an increase in the number of farms from 230 farms covering 550,165 acres in 1997. There were 230 farms covering 667,177 acres in 1992 (AgCensus 2004f, NASS 2002f). Of the farms in the county in 2002, 75% were devoted to pasture, 21% to crops, and 7% to woodlands (NASS 2002f). Cattle, sorghum for grain, corn for grain, cotton, and hay are the chief agricultural products. Since 1992, there has been a steady increase in the number of cattle ranches, while the number of hay farms has remained relatively unchanged. Production of corn for grain, sorghum for grain, and cotton has steadily declined. In 2002, the yields of the primary agricultural products in Refugio County were:

- 41,239 head of cattle and calves
- 1,388,470 bushels of sorghum for grain
- 590,411 bushels of corn for grain
- 39,419 bales of cotton

- 5613 tons dried of all hay

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Table 2.2-1
Site and Vicinity Land Use (Acres)

Land Use Category		Site	Vicinity
Urban or Built-up Land			
Residential		0	36
Industrial		0	463
Mixed Urban or Built-up Land		0	8
	Total	0 (0%)	507 (0.7%)
Agricultural Land			
Cropland and Pasture		10	13,499
Confined Feeding Operations		0	143
Other Agricultural Land		0	58
	Total	10 (0.1%)	13,700 (19%)
Rangeland			
Herbaceous Rangeland		1.7	2060
Shrub and Brush Rangeland		10,653	31,693
Mixed Rangeland		0	51
	Total	10,655 (92.4%)	33,804 (47%)
Forestland			
Deciduous Forestland		97	2834
Evergreen Forestland		0	808
Mixed Forestland		324	13,957
	Total	421 (3.7%)	17,599 (24.5%)
Water			
Streams and Canal		0	348
Lakes		0	33
Reservoirs		0	268
	Total	0 (0%)	649 (0.9%)
Wetland			
Forested Wetland		170	2450
Nonforested Wetland		276	2879
	Total	446 (3.9%)	5329 (7.4%)
Barren Land			
Sandy Areas Other than Beaches		0	4
Transitional Areas		0	345
	Total	0 (0%)	349 (0.5%)
Total		11,532	71,936

Table 2.2-2
Recommended Macrocorridor and Representative Route Land Use

Land-Use Category	Recommended Macrocorridor		Representative Route	
	Acres	Percent of Area	Acres	Percent of Area
Open water	2453	1.1	12	0.5
Urban	9645	4.3	48	2.2
Barren land	246	0.1	0	0.0
Deciduous forest	7116	3.1	78	3.5
Evergreen forest	7162	3.2	112	5.1
Mixed forest	751	0.3	8	0.4
Shrub/Scrub	24,061	10.6	241	10.9
Herbaceous	3409	1.5	41	1.9
Hay/Pasture	73,092	32.2	775	35.1
Cultivated crops	81,099	35.8	747	33.8
Woody wetlands	12,822	5.7	118	5.3
Emergent herbaceous wetlands	4895	2.2	31	1.4
Total	226,751	100	2211	100

Note: Land area associated with the Cholla line is not included in the above values.

Table 2.2-3
Offsite Areas Land Use (Acres)

Land Use Category	Heavy Haul Road and Blowdown Pipeline	RWMU System Intake Pipeline
Urban or Built-up Land		
Residential	0	0
Industrial	0	0
Mixed Urban or Built-up Land	0	0
Total	0	0
Agricultural Land		
Cropland and Pasture	9	97
Confined Feeding Operations	0	0
Other Agricultural Land	0	0
Total	9	97
Rangeland		
Herbaceous Rangeland	10	0
Shrub and Brush Rangeland	11	47
Mixed Rangeland	0	0
Total	21	47
Forest Land		
Deciduous Forestland	7	0
Evergreen Forestland	0	7
Mixed Forestland	109	44
Total	116	51
Water		
Streams and Canal	33	1
Lakes	0	0
Reservoirs	16	14
Total	49	15
Wetland		
Forested Wetland	77	21
Nonforested Wetland	1	12
Total	78	33
Barren Land		
Sandy Areas Other than Beaches	0	0
Transitional Areas	0	0
Strip Mines, Quarries, and Gravel Pits	2	0
Total	2	0
Total[a]	275	242

a. Due to rounding, the individual entries may not sum to the total value.

Table 2.2-4
50-Mile Region Land Use (Sheet 1 of 2)

Land Use Category		Acres	Percent
Urban or Built-up Land			
Urban (1990 Enhanced)		19247	
Residential		30347	
Commercial and Services		9740	
Industrial		48,471	
Transportation, Communications and Utilities		7852	
Industrial and Commercial Complexes		10	
Mixed Urban or Built-up Land		758	
Other Urban or Built-up Land		2133	
	Total	118,558	2.4%
Agricultural Land			
Cropland and Pasture		1,685,753	
Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas		200	
Confining Feeding Operations		399	
Other Agricultural Land		4990	
	Total	1,691,342	33.7%
Rangeland			
Herbaceous Rangeland		172,045	
Shrub and Brush Rangeland		687,801	
Mixed Rangeland		69,456	
	Total	929,302	18.5%
Forest Land			
Deciduous Forest Land		226,704	
Evergreen Forest Land		213,745	
Mixed Forest Land		778,885	
	Total	1,219,334	24.3%
Water			
Streams and Canal		5539	
Lakes		13,696	
Reservoirs		7331	
Bays and Estuaries		14,804	
Other Waters		837,390	
	Total	878,760	17.5%
Wetland			
Forested Wetland		85,827	
Nonforested Wetland		79,583	

Table 2.2-4
50-Mile Region Land Use (Sheet 2 of 2)

Land Use Category		Acres	Percent
	Total	165,410	3.3%
Barren Land			
Beaches		5346	
Sandy Areas Other than Beaches		2181	
Strip Mines, Quarries, and Gravel Pits		3753	
Transitional Areas		10,013	
	Total	21,293	0.4%
Total		5,024,000	

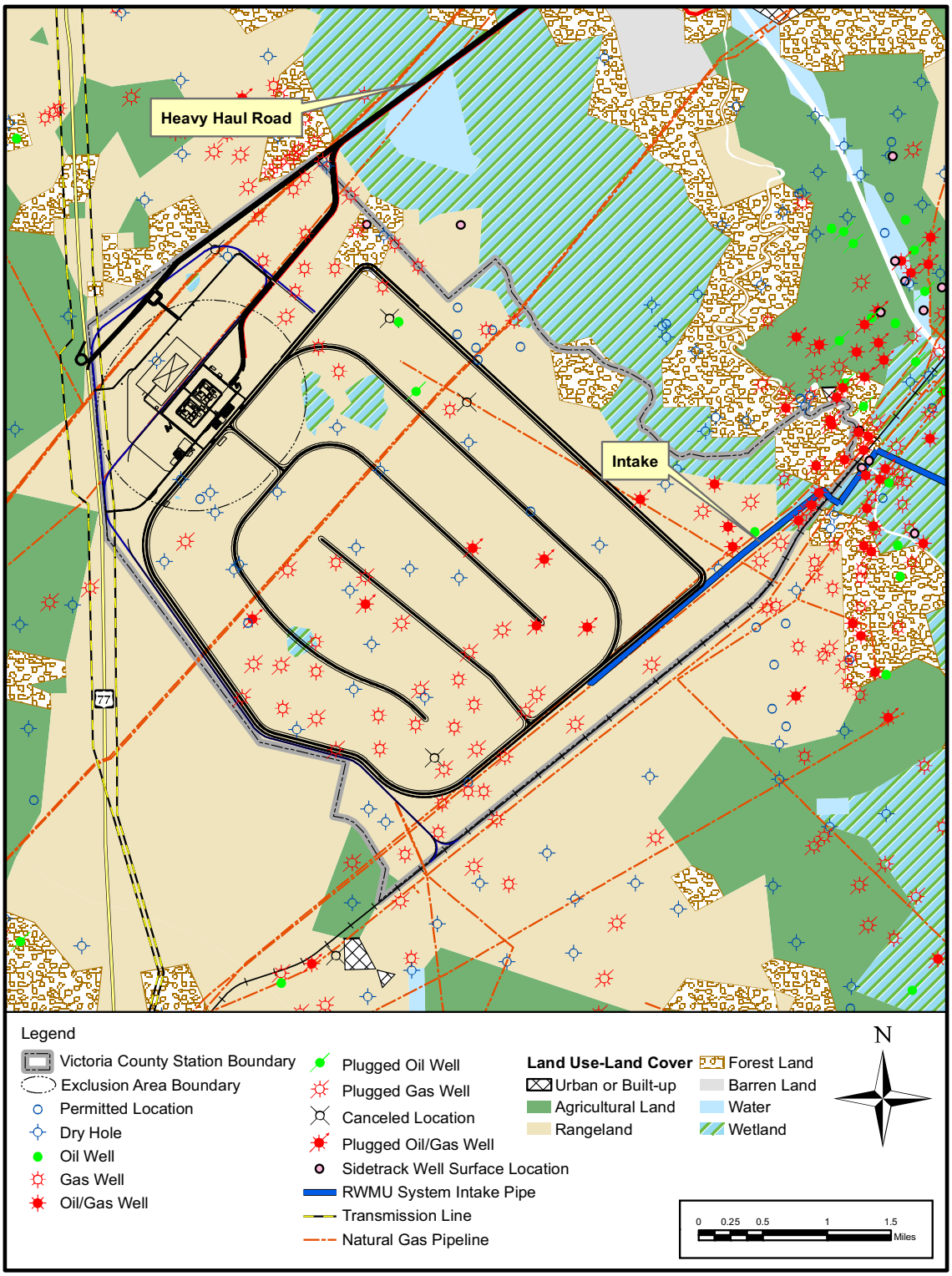

Figure 2.2-1 VCS Site Land Use

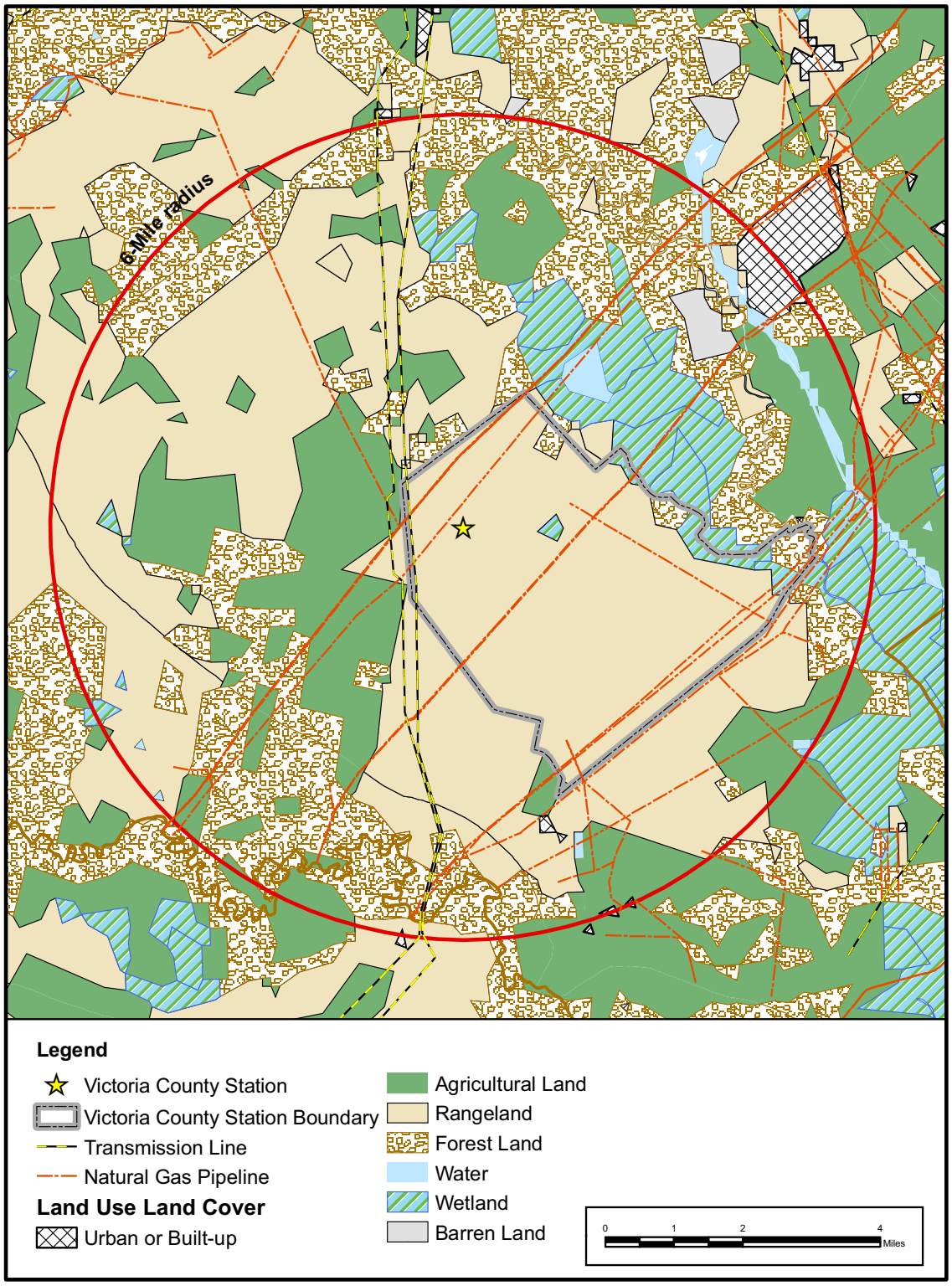

Figure 2.2-2 6-Mile Land Use

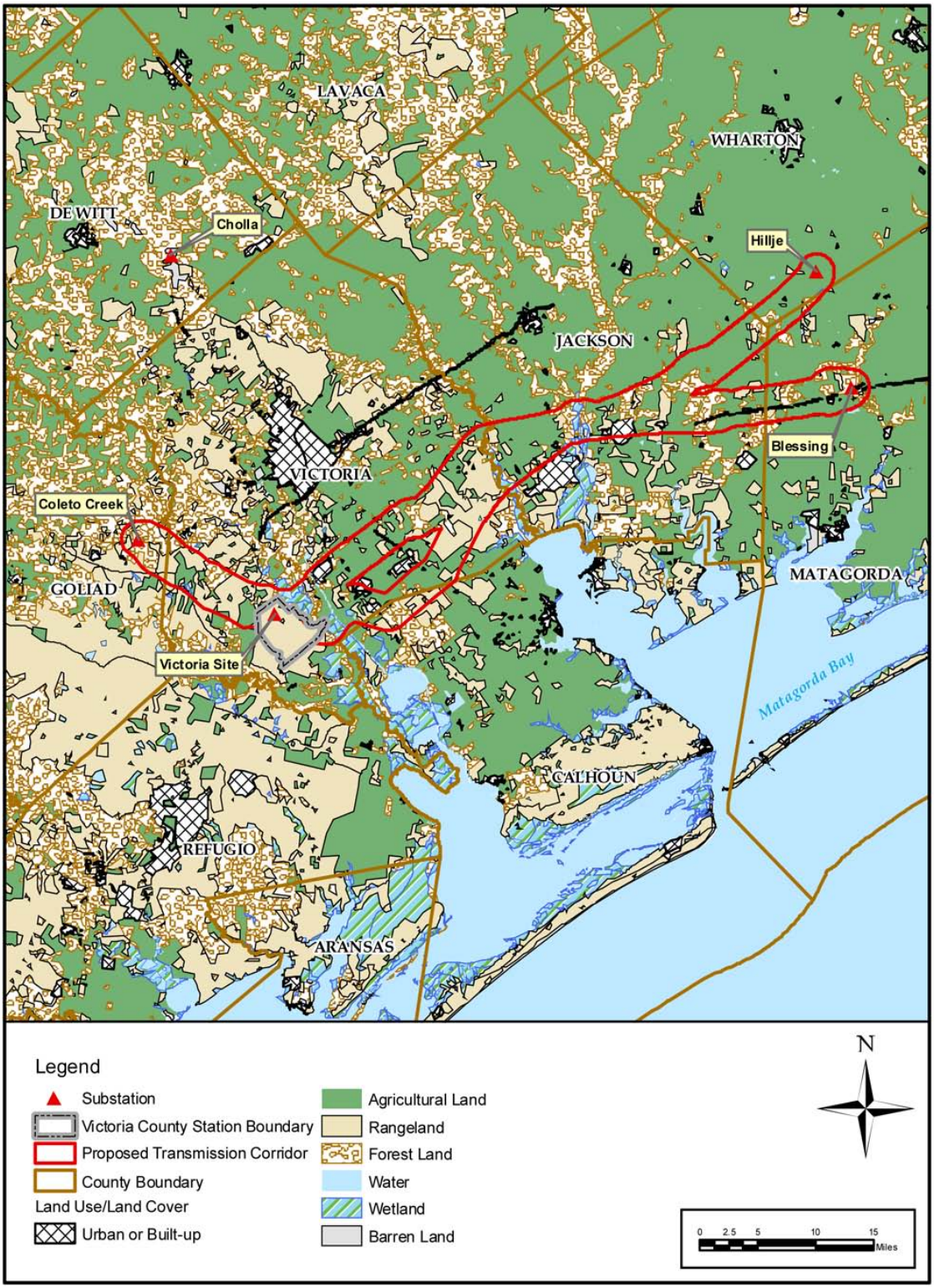

Figure 2.2-3 Transmission Corridor Land Use

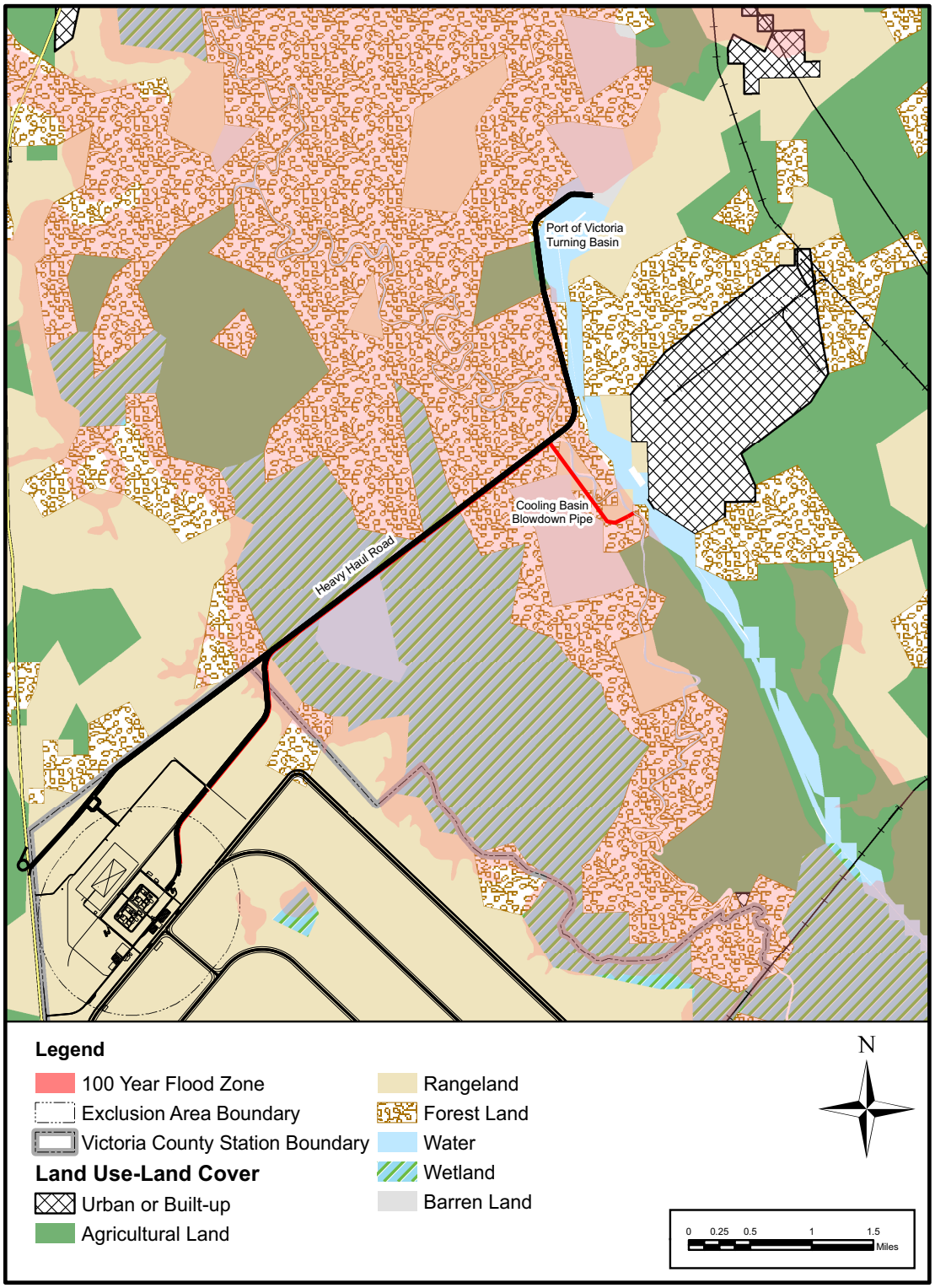

Figure 2.2-4 Offsite Area Land Use

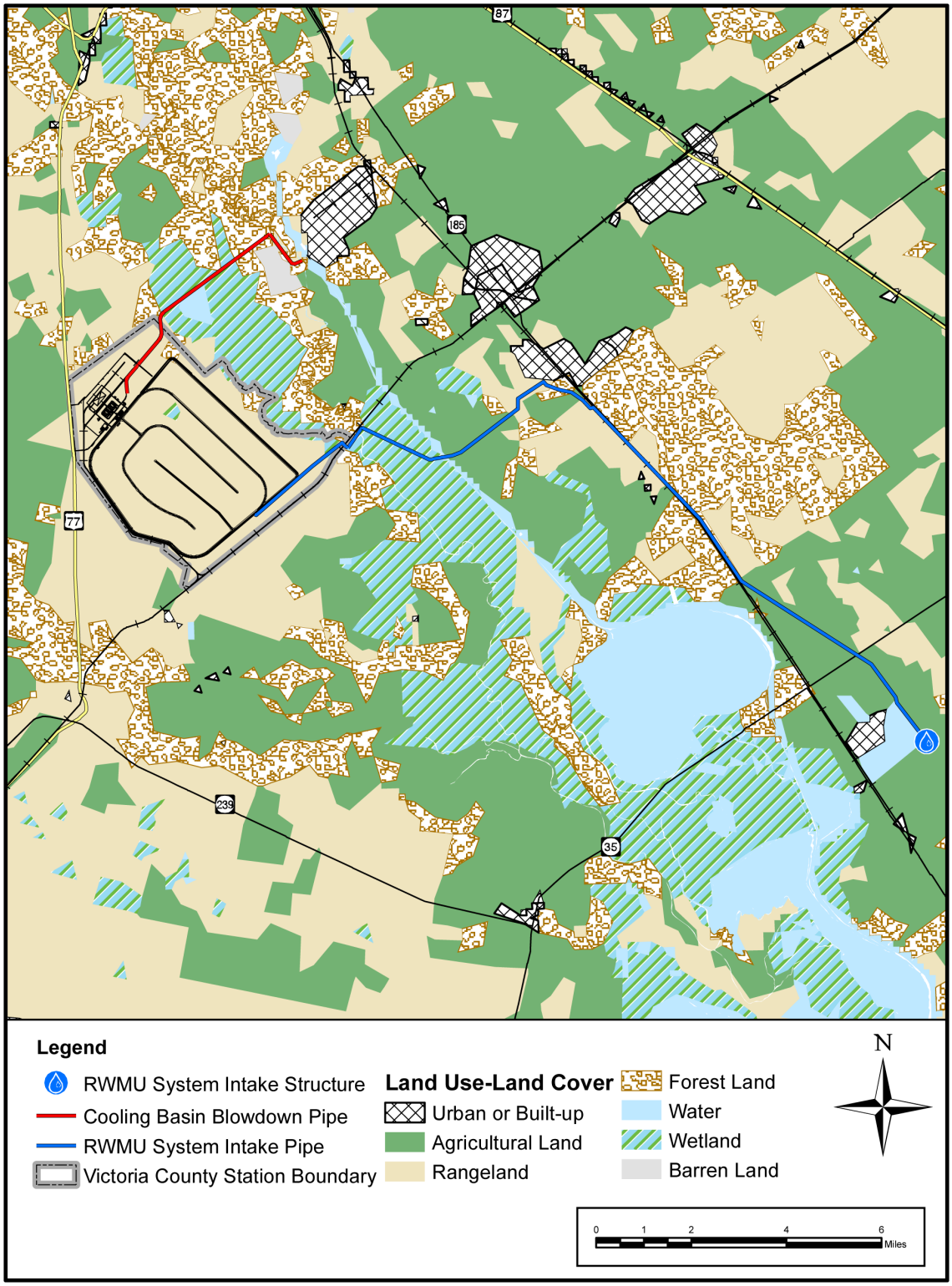

Figure 2.2-5 Intake and Discharge Pipelines Land Use

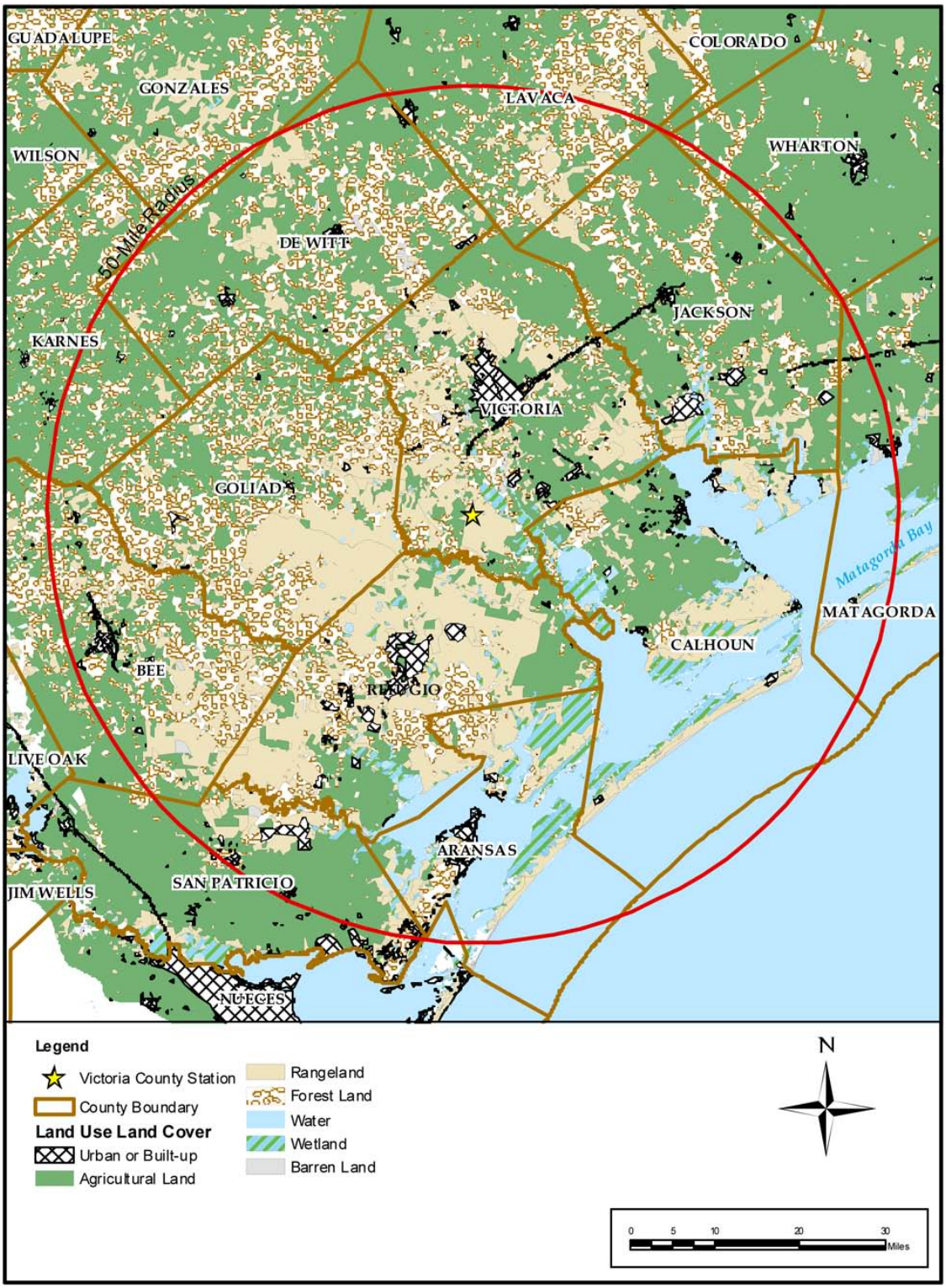

Figure 2.2-6 50-Mile Land Use

2.3 Water

This section describes the hydrology, water use, and water quality characteristics of the VCS site and surrounding region that could affect or be affected by the construction and operation of two ESBWR units. The potential water-related impacts of construction and operations are described in Sections 4.2 and Section 5.2, respectively.

VCS is located in Victoria County, Texas, near the west bank of the Guadalupe River, opposite river mile 29.6. Measured from the center of the two reactors in the power block, VCS is approximately 13 miles south of the city of Victoria, Texas; approximately 8 miles west of Bloomington, Texas; and east of U.S. Highway 77 (see Figure 2.3.1-1). The existing ground elevation at the power block site is approximately 80 feet (NAVD 88). A cooling basin with approximately 4900 acres of nominal surface area will be constructed south of the power block to function as the normal power heat sink for the two new units. Also, a storage water reservoir, approximately 1300 acres in area, is planned immediately west of the cooling basin for the Guadalupe Blanco River Authority (GBRA) to transfer water to the Coleto Creek Reservoir and other water users. The existing ground surface elevations in the area of the cooling basin and the GBRA Storage Water Reservoir (GSWR) range from about 80 feet (NAVD 88) in the northwest corner to about 65 feet (NAVD 88) along the southern edge.

The power block final grading elevations will be in the range of 88 feet (NAVD 88) to approximately 95 feet (NAVD 88). All safety-related facilities will have a design plant grade, also referred to as the finish floor elevation, of 96 feet (NAVD 88). The top of the cooling basin and GSWR embankment will be at 102.0 feet (NAVD 88), with exceptions at the piping penetration areas. These areas have elevated bridges over the piping to allow an uninterrupted roadway on the embankment. The bottom elevation of the cooling basin is designed to be at 69 feet (NAVD 88) or lower, hence grading will be necessary primarily in the northern part of the cooling basin where the natural grade is higher than 69 feet (NAVD 88). For the GSWR, the bottom grade will follow the existing natural ground elevations. Detailed descriptions of the cooling water systems of VCS, the cooling basin, and the GSWR are provided in Section 3.4.

New transmission lines would be constructed to connect VCS with the existing regional electric grid. The final routes of the new transmission corridors have not been selected, but the probable route characteristics have been determined using a macro-corridor study that outlines options for transmission line routes, as described in Subsection 2.2.2. The general hydrological environment of the representative transmission corridors, and potential hydrologic impacts of the transmission lines during construction and operation are described in Section 4.2 and Section 5.2, respectively.

2.3.1 Hydrology

This subsection describes the surface water bodies and groundwater aquifers that could affect the plant water supply and effluent disposal or that could be affected by the construction and operation of VCS. The site-specific and regional data on the physical, hydrologic, and hydrogeologic characteristics of these water resources are summarized in the following subsections.

2.3.1.1 Surface Water

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, Linn Lake, San Antonio Bay, Kuy Creek, Dry Kuy Creek, the Victoria Barge Canal, and the GBRA Calhoun County Canal System. Each of these features is described in detail in this subsection.

2.3.1.1.1 The Guadalupe and San Antonio River Basin

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 the Guadalupe River basin is 5953 square miles (TWDB 2007). Even though the San Antonio River discharges to the Guadalupe River just upstream from its mouth, the Texas Water Development Board (TWDB 2007) 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 upstream from Tivoli, Texas. The drainage area for the San Antonio River basin is 4180 square miles (TWDB 2007). The San Antonio River basin is adjacent to the Guadalupe River basin and runs in a general northwest to southeast direction as shown in Figure 2.3.1-2. The total drainage area for the combined river basins at the stream gage at Tivoli, Texas, is 10,128 square miles (U.S. Geological Survey 2008A). Major tributaries to the Guadalupe River include Coleto Creek, Peach Creek, Sandies Creek, and the San Marcos River and its tributaries, the Blanco River, and Plum Creek. There are no major tributaries to 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 and GSWR.

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 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 (HDR 2006). There is a general trend of decreasing precipitation from the eastern portions of the basins to the western portions (HDR 2006 and TWDB 2007).

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. 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 (TWDB 2007). Water use information in both river basins is described in Subsection 2.3.2 and the impacts of VCS on the water users in the region are described in Section 5.2.

Flooding is also a frequent event in both basins. Annual peak discharges for the Guadalupe River at Victoria and the San Antonio River at Goliad are shown in Tables 2.3.1-1 and 2.3.1-2, respectively. The

largest flood on record on the Guadalupe River at Victoria gaging station (drainage area of 5198 square miles) had a peak flow rate of 466,000 cubic feet per second (cfs) and occurred on October 20, 1998. As shown in Table 2.3.1-1, there are 4 years with flood peak discharges above 100,000 cfs and 16 years with flood peak discharges above 50,000 cfs (for the period of record water years 1935–2007). The annual mean flow rate at the Victoria gaging station is 1978 cfs. The largest flood on record on the San Antonio River at Goliad (drainage area 3921 square miles) had a peak flow rate of 138,000 cfs and occurred on September 23, 1967. As shown in Table 2.3.1-2, there are 3 years with flood peak discharges above 50,000 cfs and 12 years with flood peak discharges above 25,000 cfs for the period of record (water years 1914, 1925–1929, 1935, and 1939–2007). The annual mean flow rate of the San Antonio River at Goliad is 781 cfs (USGS 2008B and USGS 2008C).

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.

Coleto Creek is a tributary of the Guadalupe River, with its confluence located downstream of Victoria, Texas and upstream of the VCS site. Annual peak discharges at the USGS gaging station on Coleto Creek near Victoria, Texas, a short distance downstream of the Coleto Creek Dam, are shown in Table 2.3.1-3. Flows after 1981 on Coleto Creek are regulated by Coleto Creek Dam and reservoir. The reservoir is primarily used as a cooling pond for the Coleto Creek Power coal-fired power plant and water releases are based on both inflows to the reservoir and plant water needs. After the reservoir was built, the stream gage data at the Coleto Creek gage near Victoria, Texas, showed several instances of minimum daily flow that were near zero (USGS 2008D). The largest flood on record for Coleto Creek downstream of Coleto Creek Dam (drainage area 514 square miles) had a peak flow rate of 236,000 cfs in 1967. As shown in Table 2.3.1-3, there are 3 years with flood peak discharges above 50,000 cfs and 13 years with flood peak discharges above 25,000 cfs for the period of record (water years 1939–1954 and 1979–2007). The annual mean flow rate at Coleto Creek Dam is 117 cfs. (USGS 2008D). The flood of record at Coleto Creek occurred outside the period of record. However, high water marks measured during the 1967 flood were used with the gage information to estimate the peak flow during this flood (USGS 2008D).

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 2.3.1-4 and 2.3.1-5 (TCEQ 2008) provide detailed information on the dams associated with each of these storage reservoirs. The locations of the storage reservoirs are shown in Figure 2.3.1-3 for the Guadalupe River basin and Figure 2.3.1-4 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. As can be seen in Tables 2.3.1-4 and 2.3.1-5, most of the storage capacity is provided in Canyon Lake Dam and Medina Lake Dam, which are located in the upper portions of the Guadalupe and San Antonio River basins, respectively. The storage capacities of the dams in the lower reaches of both river basins are relatively small and provide either localized flood protection or local water storage.

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 feet/foot for the reach between the southern limit of the city of Victoria near the U.S. Highway 59 crossing to the Union Pacific Railroad crossing near the southern boundary of the site. This portion of the river is located on the San Marcos uplift, which is the reason for the steeper gradient (White and Calnan 1990). The stream channel 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 100-year floodplain as defined by the FEMA for the Guadalupe River as well as its tributaries near the site is presented in Figure 2.3.1-5 (FEMA 1998). The average width of the 100-year Guadalupe River floodplain near the site is approximately 3.2 miles. Although, the floodplain is wide at this location, ground elevations rise steeply from elevation 25 feet (NAVD 88) at the edge of the floodplain to elevation 70 to 75 feet (NAVD 88) along the eastern edge of the site.

Just downstream of the site, the Guadalupe River crosses over the Vicksburg Fault zone, which passes south of the site. After passing this geologic feature the river gradient becomes shallower and the floodplain wider. At the confluence with the San Antonio River upstream of the USGS gage near Tivoli, Texas, the river bed slope is essentially flat. Near Mission Lake, the floodplain is approximately 4.5miles wide. Also, the Lower Guadalupe Diversion Dam and saltwater barrier, commonly referred to as the fabridam, is located at river mile 10.2 near Tivoli, Texas. The purpose of the fabridam is to prevent saltwater intrusion into the freshwater supply and maintain an adequate water level in the river to allow diversion into a GBRA water supply canal, which is described in Subsection 2.3.1.1.7. The fabridam is designed to maintain upstream water levels at an elevation range between approximately 3.5 feet to 4.0 feet (NGVD 29) (GBRA 1994), which is equivalent to elevations 3.06 feet to 3.56 feet (NAVD 88) (USGS 2008). When upstream water levels lower 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 (GBRA 1994).

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 to the Port of Victoria turning basin. Although the canal is located in the Guadalupe River flood plain, it is not part of the drainage area for the Guadalupe River. A flood protection levee also runs parallel to the canal and is located between the canal and the river preventing overflows from the Guadalupe River into the Victoria Barge Canal during river flooding

events and overflow from the canal to the river during tidal flooding events. Additional short levees also exist in the Guadalupe River floodplain along the west bank of the river, between the river and the site. However, the FEMA Flood Insurance Rate Map (Figure 2.3.1-5) indicates that these levees do not provide protection for the 100-year flood (FEMA 1998).

Information on five USGS-maintained stream flow gage stations on the Guadalupe and San Antonio Rivers near the VCS site are shown in Table 2.3.1-6. 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 with a drainage area of approximately 62 square miles. More information on Kuy Creek is presented in Subsection 2.3.1.1.3. The locations of these gages as well as all other gages in the two river basins are shown in Figure 2.3.1-6. A stream gage on the Guadalupe River also exists at Bloomington, Texas, and its location is shown in Figure 2.3.1-6. However, this gage only records water level data and has a sporadic period of record. Thus, this gage was not included in Table 2.3.1-6. The stream gage at Tivoli does not provide accurate stream flow information for high flow data due to the flatness and width of the floodplain at that location and only sporadic data is available. Additionally, the drainage area at Victoria (5198 square miles) plus the drainage area for Coleto Creek (514 square miles) represents approximately 96% of the Guadalupe River watershed. Thus, for the purposes of assessing water availability from the Guadalupe River for VCS, flow data for the gage at Victoria and the gage at Coleto Creek are used.

The raw water makeup (RWMU) system intake location for VCS will be located downstream of the confluence of the San Antonio and Guadalupe Rivers, as described in Subsection 2.3.1.1.7, and flows from the San Antonio River are also available for plant use. Locations and descriptions of the intake and discharge facilities as well as pipelines for the proposed RWMU system are described in Sections 3.1 and 3.4. The most downstream gaging station on the San Antonio River is located at McFaddin. However, this gage has less than 2 years of data, which is not sufficient to provide a long-term analysis of water supply. The gaging station at Goliad with a drainage area of 3921 square miles represents approximately 94% of the San Antonio River watershed and is used in combination with the flows at Victoria and Coleto Creek to assess the flow available for use by the plant.

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 combination of the flows at these three stations provides a reasonable estimate of the flow available in the river where a diversion canal diverts water into the GBRA canal system and ultimately to the VCS intake area. Daily and monthly discharge data are available for a period of record from water years 1925 to 1928 and 1939 to 2007 for Goliad on the San Antonio River, and from water years 1935 to 2007 for Victoria on the Guadalupe River, and from water years 1981 to 2007 for Coleto Creek. Tables 2.3.1-7, 2.3.1-8, and 2.3.1-9 provide the monthly mean flow rates for each station's period of record. The mean daily flow rates for each station are presented in Tables 2.3.1-10, 2.3.1-11 and 2.3.1-12. The maximum daily-mean flow rates are presented in Tables 2.3.1-13, 2.3.1-14 and 2.3.1-15, while the minimum daily

mean flow rates are presented in Tables 2.3.1-16, 2.3.1-17 and 2.3.1-18 (USGS 2008B, USGS 2008C, and USGS 2008D).

Monthly flow data for the Victoria and Goliad stream gages during the three major statewide droughts from 1947 to 1948, 1950 to 1957, and 1960 to 1967 are highlighted in Tables 2.3.1-7 and 2.3.1-8 (USGS 2008A and USGS 2008B). Data is not available at Coleto Creek during these drought periods. Because the RWMU system intake is located downstream of the confluence of the San Antonio River, low flow data from the Victoria stream gage on the Guadalupe River and the Goliad stream gage on the San Antonio River are combined to estimate water availability during periods of drought. The minimum combined Victoria and Goliad stream gages 7-day low flow for the period of record is about 46 cfs, occurring in August of 1956. Using the combined Victoria and Goliad daily flow data, a frequency analysis was performed using a Log-Pearson Type 3 distribution. The results of this analysis indicate that the 10-year, 7-day low flow on the Guadalupe River downstream of the confluence with the San Antonio River would be about 222 cfs.

Blowdown from the cooling basin will be performed as needed to the Guadalupe River to maintain water chemistry control in the cooling basin. The blowdown discharge system will consist of a single 48-inch diameter pipe with multiple diffuser ports at the outfall in the Guadalupe River at the location shown in Figure 2.3.1-7. A bathymetric survey on the Guadalupe River at the proposed discharge location was conducted near the end of March 2008. Three river cross sections at and near the discharge location that depict the river bathymetry are shown in Figures 2.3.1-8 through 2.3.1-10, with Figure 2.3.1-8 located 250 feet upstream of the discharge location, Figure 2.3.1-9 near the proposed discharge location, and Figure 2.3.1-10 500 feet downstream of the discharge location. The cross sections indicate a fairly uniform width and depth for the river channel, with a width of about 120 feet and a depth of about 15 feet on the day of the survey.

The *Flood Insurance Study for the Unincorporated Areas of Victoria County, Texas* reports the peak discharges for various flood frequencies on the Guadalupe River on the confluence of Coleto Creek just downstream of Victoria, Texas (FEMA 1998). These values are presented in Table 2.3.1-19.

2.3.1.1.2 Linn Lake

Linn Lake is a perennial natural shallow retention area located on the western edge of the Guadalupe River floodplain at the base of the slopes leading to the floodplain along the eastern edge of the proposed VCS cooling basin, as shown in Figure 2.3.1-11. 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 flows. The lake also receives surface runoff from the eastern portion of the proposed VCS site through small surface 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.

2.3.1.1.3 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. Salinity concentrations in the upper bay system range from approximately 0.5 to 9.0 parts per thousand (ppt) and in the lower bay from approximately 6.0 to 26.0 ppt (White and Calnan 1990).

The Guadalupe River delta in the upper portions of the bay system is characterized by extensive brackish to fresh-water marshes. The delta has had a history of delta lobe growth, abandonment, and deterioration. Sedimentation in the delta is characterized by stream deposition in shallow relatively quiescent body of water. Average annual sediment loads from the Guadalupe and San Antonio Rivers have remained relatively unchanged since the 1940s when measurements began. The average annual suspended sediment load to the bay system has been estimated to be approximately 647 acre-feet (White and Calnan 1990).

2.3.1.1.4 Local Hydrologic Features

There are several intermittent or ephemeral streams traversing the existing site. The locations of these streams are shown in Figure 2.3.1-11. 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 external design basis flood, (i.e., excluding the local probable maximum precipitation [PMP] event), for the safety-related structures of VCS is a result of the flooding due to a postulated breaching of the embankments of the proposed VCS cooling basin and GWSR. The external design basis flood elevation as a result of the postulated embankment breach is 91.5 feet (NAVD 88). Flooding from the local PMP will also impact the site and is considered in establishing the plant site grade. The maximum flood elevation due to the local PMP is 94.0 feet (NAVD 88).

2.3.1.1.5 Wetlands

A wetland survey conducted for the VCS site indicated that prior to construction there are four depressional wetlands in the combined cooling basin/GSWR and power plant areas. These wetlands are designated as Wetlands A, B, C, and D in Figure 2.3.1-11. Their combined area is approximately 84.6 acres, with individual wetlands ranging in size from 6.0 acres (Wetland B) to 37.3 acres (Wetland D). All occupied slight topographic depressions with surface soils high in clay. Wetlands A and B have

surface outlets to ephemeral streams draining to Linn Lake and Dry Kuy Creek, respectively. Wetlands C and D do not have surface connections to streams.

There is also a band of mapped wetlands lying in the fringe of Linn Lake and Black Bayou near the eastern perimeter of the site. The zone varies in width from less than 100 feet adjacent to Linn Lake to more than 1000 feet in places along Black Bayou. The mapped wetlands, Linn Lake, and Black Bayou are all situated in the Guadalupe River floodplain and subject to inundation during flooding events along the river.

2.3.1.1.6 Guadalupe and San Antonio River Sediment Transport and Loading

Sediment data has been collected on the Guadalupe and San Antonio Rivers at the Victoria and Goliad gaging stations, respectively. These are the closest upstream stations from the intake location and are used to characterize the suspended sediment concentration for river water available for the VCS RWMU system intake.

The Victoria gaging station has data collected from 1973 through August 1994, with 158 total samples taken. Table 2.3.1-20 presents the suspended sediment concentration measurements for the Guadalupe River at Victoria. The average suspended sediment concentration for the data collected is 128 mg/l. However, this value is heavily influenced by a few high concentration measurements, as evidenced by the median value of 74.5 mg/l for the period of record. The maximum and minimum concentrations during the period of record were 1210 mg/l and 9 mg/l, respectively. (USGS 2008E)

The Goliad station has a period of record from October 1974 through August 1994 with 163 total samples taken. Table 2.3.1-21 presents the suspended sediment concentration measurements for the San Antonio River at Goliad. In general, the suspended sediment concentrations in the San Antonio River are higher than those of the Guadalupe River. The average suspended sediment concentration for the data collected is 260 mg/l. This value is also heavily influenced by a few high concentration measurements, as evidenced by the median value of 122 mg/l for the period of record. The maximum and minimum concentrations during the period of record were 2450 mg/l and 5 mg/l, respectively. (USGS 2008F)

The average annual suspended sediment load from the Guadalupe and San Antonio Rivers combined to the San Antonio Bay systems has been estimated to be approximately 647 acre-feet per year (White and Calnan 1990).

2.3.1.1.7 GBRA Calhoun Canal System Characteristics

The freshwater source for the RWMU system is a diversion and distribution canal system owned in part by the GBRA and shown in Figure 2.3.1-12. This system diverts water from the Guadalupe River immediately upstream of the Lower Guadalupe diversion dam and saltwater barrier, downstream of the confluence of the San Antonio River. The flow is diverted into a man-made canal on the west side of Green Lake. This canal discharges to Hog Bayou, a natural channel, then passes through Hog Bayou towards U.S. Highway 35. At U.S. Highway 35, the diverted flow enters another man-made diversion

canal that runs parallel to U.S. Highway 35 along the south side of Green Lake. The diverted flow then enters Goff Bayou where U.S. Highway 35 crosses Goff Bayou and flows southeast to three 78-inch diameter siphons under the Victoria Barge Canal (GBRA 1994). On the east side of the barge canal, the three siphons transition to two 96-inch underground intake pipelines that carry the diverted flow to the main pump station, which has a current capacity of 160,000 gpm (GBRA 1994). Flow from the main pump station is then discharged to the man-made Dow Canal located southwest of the Dow Chemical facility. The flow in this canal passes under U.S. Highway 185 through a group of parallel culverts. On the east side of U.S. Highway 185, the flow is carried by the Main Canal to the GBRA relift #1 pump station (GBRA 1994). The RWMU system intake and pumphouse will be located immediately downstream of the GBRA relift #1 pump station as shown in Figure 2.3.1-13. The main pump station and the Main Canal provide water to GBRA customers, including the Port Lavaca Water Treatment Plant. The RWMU system intake structure will be located on the GBRA Calhoun Canal, southeast of Dow Chemical's Seadrift plant, approximately 15 miles southeast of VCS.

A cross section of the Main Canal at the RWMU system intake location is shown in Figure 2.3.1-13. The minimum depth of water in front of the intake is 6.0 feet. Makeup water demands are described in Section 3.3 and the RWMU system intake and pumphouse are described in Section 3.4.

2.3.1.1.8 **References**

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Table 2.3.1-1
Annual Peak Discharges for the Guadalupe River at Victoria, Texas
USGS 08176500

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1935	Jun. 20, 1935	29.72	38,500	1971	Sep. 12, 1971	22.48	9,740
1936	Jul. 03, 1936	31.22	179,000	1972	May 16, 1972	30.37	58,500
1937	Oct. 04, 1936	26.77	17,200	1973	Jun. 17, 1973	29.33	33,100
1938	Apr. 30, 1938	28.75	25,400	1974	Oct. 16, 1973	28.98	25,200
1939	Jun. 06, 1939	14.52	4,940	1975	May 29, 1975	29.24	30,200
1940	Jul. 03, 1940	29.67	55,900	1976	Apr. 19, 1976	26.54	14,100
1941	May 03, 1941	29.73	58,000	1977	Apr. 24, 1977	30.09	54,500
1942	Jul. 09, 1942	29.8	56,000	1978	Sep. 14, 1978	25.64	12,700
1943	Oct. 21, 1942	18.8	7,710	1979	May 12, 1979	28.36	19,300
1944	Jun. 01, 1944	23.94	12,300	1980	May 19, 1980	24.68	11,600
1945	Apr. 06, 1945	28.57	22,000	1981	Sep. 02, 1981	31.1	105,000
1946	Sep. 03, 1946	27.7	17,900	1982	May 19, 1982	28.2	18,500
1947	Oct. 17, 1946	29.55	46,000	1983	Nov. 20, 1982	23.95	10,900
1948	May 28, 1948	17.5	6,970	1984	Oct. 21, 1983	11.7	3,280
1949	Apr. 30, 1949	28.53	20,600	1985	Apr. 21, 1985	23.85	10,600
1950	Oct. 28, 1949	24.95	13,300	1986	Nov. 29, 1985	26.29	13,700
1951	Jun. 08, 1951	23.96	12,300	1987	Jun. 07, 1987	30.45	83,400
1952	Sep. 16, 1952	29.46	28,400	1988	Nov. 28, 1987	13.24	3,900
1953	May 04, 1951	23.19	11,600	1989	May 21, 1989	13.89	4,280
1954	Oct. 26, 1953	19.68	8,560	1990	Sep. 12, 1990	15.61	5,230
1955	May 22, 1955	14.83	4,950	1991	Apr. 05, 1991	27.83	17,000
1956	May 18, 1956	7.46	1,730	1992	Dec. 25, 1991	30.13	61,500
1957	May 02, 1957	29.92	35,300	1993	Jun. 30, 1993	27.87	17,700
1958	Feb. 26, 1958	30.28	58,300	1994	May 19, 1994	26.04	13,300
1959	Apr. 15, 1959	22.33	10,100	1995	Oct. 19, 1994	29.37	39,600
1960	Jul. 01, 1960	29.06	23,700	1996	Sep. 22, 1996	22.71	9,760
1961	Jun. 22, 1961	30.35	55,800	1997	Apr. 04, 1997	29.07	32,700
1962	Nov. 17, 1961	23.11	10,800	1998	Oct. 13, 1997	28.3	20,600
1963	Feb. 21, 1963	13.22	4,100	1999	Oct. 20, 1998	34.04	466,000
1964	Nov. 11, 1963	16.19	5,720	2000	Jun. 12, 2000	17.54	6,220
1965	Feb. 21, 1965	27.3	15,000	2001	Sep. 03, 2001	29.36	39,300
1966	Dec. 08, 1965	21.99	9,790	2002	Jul. 10, 2002	30.32	71,700
1967	Sep. 21, 1967	30.67	70,000	2003	Nov. 08, 2002	29.99	58,500
1968	Jan. 25, 1968	29.72	44,300	2004	Jun. 15, 2004	27.48	16,100
1969	Apr. 13, 1969	27.13	15,200	2005	Nov. 26, 2004	30.9	102,000
1970	May 20, 1969	21.7	9,190	2006	Jul. 06, 2006	13.73	4,290
				2007	Jul. 03, 2007	29.33	38,600

Note: Flows for 1962 and later affected by regulation or diversion
Source: USGS 2008B

Table 2.3.1-2
Annual Peak Discharges for the San Antonio River at Goliad, Texas
USGS 08188500

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1914	Oct. 02, 1913	44.9	33,800	1970	Jun. 02, 1970	25.28	6,100
1925	Jul. 13, 1925	11.9	1,830	1971	Aug. 09, 1971	22.01	4,970
1926	Apr. 25, 1926	31	11,900	1972	May 15, 1972	34.16	12,800
1927	Apr. 16, 1927	22.5	5,410	1973	Jul. 24, 1973	34.53	14,900
1928	May 16, 1928	19	3,880	1974	Oct. 02, 1973	40.09	21,800
1929	Jan. 11, 1929	31.79	13,100	1975	May 28, 1975	27.48	8,660
1935	Jun. 15, 1935	44.9	33,800	1976	Apr. 18, 1976	29	9,780
1939	Jul. 12, 1939	11.22	1,900	1977	Apr. 25, 1977	36.07	15,900
1940	Jul. 02, 1940	31.37	11,600	1978	Nov. 05, 1977	23.99	6,770
1941	May 01, 1941	34.55	15,700	1979	Apr. 23, 1979	28.34	9,310
1942	Jul. 09, 1942	44.9	33,800	1980	Sep. 09, 1980	25.68	8,240
1943	Oct. 08, 1942	25.51	7,330	1981	Jun. 21, 1981	31.96	12,800
1944	May 30, 1944	29.01	9,880	1982	Oct. 31, 1981	24.49	7,460
1945	Apr. 03, 1945	21.84	5,170	1983	Sep. 21, 1983	23.43	6,960
1946	Sep. 01, 1946	41.66	25,500	1984	Nov. 08, 1983	14.94	3,120
1947	Oct. 02, 1946	42.67	29,400	1985	Jul. 07, 1985	21.44	5,990
1948	Aug. 28, 1948	29.41	10,200	1986	Jun. 10, 1986	29.45	10,700
1949	Apr. 28, 1949	33.76	14,100	1987	Jun. 07, 1987	43.08	33,200
1950	Oct. 27, 1949	24.04	6,420	1988	Jul. 24, 1988	11.08	1,850
1951	Sep. 14, 1951	26.9	8,370	1989	Jun. 17, 1989	11.3	1,920
1952	Sep. 14, 1952	39.82	23,900	1990	Jul. 21, 1990	27.66	9,480
1953	May 20, 1953	28.76	8,560	1991	Apr. 06, 1991	25.92	8,330
1954	May 27, 1954	12.77	2,050	1992	Dec. 25, 1991	41.58	27,500
1955	Sep. 02, 1955	13.83	2,320	1993	Jun. 30, 1993	35.37	16,200
1956	May 16, 1956	14.33	2,420	1994	May 18, 1994	28.71	10,200
1957	May 02, 1957	31.56	10,300	1995	Oct. 18, 1994	28.5	10,100
1958	Feb. 25, 1958	36.21	16,000	1996	Sep. 26, 1996	13.09	2,460
1959	Nov. 01, 1958	22.82	5,220	1997	Jun. 28, 1997	31.78	12,600
1960	Jun. 29, 1960	23.28	5,440	1998	Mar. 19, 1998	18.78	4,610
1961	Oct. 29, 1960	31.62	11,300	1999	Oct. 22, 1998	51.78	59,200
1962	Jun. 03, 1962	23.16	5,660	2000	Jun. 14, 2000	16.82	4,070
1963	Apr. 30, 1963	10.36	1,680	2001	Sep. 02, 2001	41.97	27,200
1964	Aug. 10, 1964	20.03	4,360	2002	Jul. 09, 2002	52.81	70,600
1965	May 24, 1965	30.79	10,600	2003	Oct. 28, 2002	36.13	18,000
1966	Dec. 06, 1965	18.52	3,880	2004	Jun. 14, 2004	31.43	13,000
1967	Sep. 23, 1967	53.7	138,000	2005	Nov. 27, 2004	40.42	23,400
1968	Jan. 24, 1968	41.98	25,900	2006	May 08, 2006	12.04	2,280
1969	Feb. 17, 1969	24.93	6,380	2007	Aug. 23, 2007	38.52	20,800

Note: All discharges affected by regulation or diversion
Source: USGS 2008C

Table 2.3.1-3
Annual Peak Discharges for the Coleto Creek near Victoria, Texas
USGS 08177500

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1939	Jul. 12, 1939	11.4	8,820	1985	Jul. 04, 1985	16.35	9,590
1940	Jun. 30, 1940	22.05	39,200	1986	Jun. 13, 1986	8.17	1,090
1941	Nov. 25, 1940	24.25	48,200	1987	Jun. 11, 1987	19.15	15,100
1942	Jul. 06, 1942	20.75	34,300	1988	Nov. 25, 1987	5.32	231
1943	May 31, 1943	6.76	2,530	1989	Apr. 30, 1989	4.23	37
1944	Mar. 18, 1944	13.08	12,200	1990	Jul. 17, 1990	20.86	19,200
1945	Apr. 20, 1945	7.09	2,700	1991	Apr. 05, 1991	28	37,000
1946	May 23, 1946	12.02	10,000	1992	Apr. 17, 1992	27.68	41,700
1947	Oct. 16, 1946	31.64	89,000	1993	May 05, 1993	23.27	25,900
1948	May 24, 1948	8.78	4,260	1994	May 14, 1994	14	6,020
1949	Apr. 26, 1949	6.89	2,700	1995	Oct. 18, 1994	28.41	44,700
1950	Oct. 26, 1949	6.43	2,290	1996	Aug. 30, 1996	4.95	23
1951	Sep. 13, 1951	11.6	9,440	1997	Apr. 04, 1997	32.05	50,100
1952	May 28, 1952	15.18	17,300	1998	Oct. 13, 1997	26.03	28,500
1953	Aug. 30, 1953	13.73	14,400	1999	Oct. 18, 1998	23.25	22,400
1954	May 25, 1954	3.33	731	2000	Jun. 12, 2000	6.75	504
1967	1967[a]	42	236,000	2001	Sep. 01, 2001	22.39	20,200
1979	May 11, 1979	N/A	15,500	2002	Dec. 02, 2001	17.97	11,500
1980	Jan. 20, 1980	15.72	8,550	2003	Oct. 25, 2002	19.97	15,800
1981	Sep. 01, 1981	19.73	16,500	2004	May 14, 2004	18.52	13,200
1982	Oct. 31, 1981	27.02	39,100	2005	Nov. 21, 2004	28.93	41,700
1983	Nov. 19, 1982	19.5	15,900	2006	Jun. 01, 2006	4.94	117
1984	Mar. 12, 1984	18.82	14,400	2007	Jul. 02, 2007	21.67	19,300

a. Data not based on specific date. High water marks measured during the flood were used with gage information to estimate the peak flow during this flood.

N/A: Data not available
Note: Discharges for 1981 and after are affected by regulation or diversion
Source: USGS 2008D

Table 2.3.1-4 (Sheet 1 of 2)
Guadalupe River Basin Dams (storage greater than 3000 acre-feet)

No.	NAT ID	Dam Name	County	Lat (deg)	Long (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	N/A
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	N/A
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	N/A
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	N/A
26	TX06328	UPPER SAN MARCOS RIVER WS SCS SITE 2	HAYS	29.9333	-97.9617	1985	51	1,465	3,034	726.7

Table 2.3.1-4 (Sheet 2 of 2)
Guadalupe River Basin Dams (storage greater than 3000 acre-feet)

No.	NAT ID	Dam Name	County	Lat (deg)	Long (deg)	Year	Dam Height (ft)	Dam Length (ft)	Max Storage (ac-ft)	Effective Top of Dam (ft NGVD 29)
27	TX06329	UPPER SAN MARCOS RIVER WS SCS SITE 4	HAYS	29.8850	-98.0317	1985	100	1,365	5,972	889.8
28	TX06432	UPPER SAN MARCOS RIVER WS SCS SITE 3	HAYS	29.9067	-97.9450	1991	60	1,630	4,323	N/A
29	TX07247	UPPER SAN MARCOS RIVER WS NRCS SITE 5	HAYS	29.8683	-97.9681	1989	71	2,950	7,329	667.2

Source: TCEQ 2007
N/A: Data not available

Table 2.3.1-5 (Sheet 1 of 2)
San Antonio River Basin Dams (storage greater than 3000 acre-feet)

No.	NAT ID	Dam Name	County	Lat (deg)	Long (deg)	Year	Dam Height (ft)	Dam Length (ft)	Max Storage (ac-ft)	Effective Top of Dam (ft NGVD 29)
1	TX01432	VICTOR BRAUNIG DAM	BEXAR	29.2400	-98.3717	1963	76	9,638	32,324	515
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	TX01453	MITCHELL LAKE DAM	BEXAR	29.2700	-98.4733	1967	10	3,500	5,000	530
5	TX01459	CALAVERAS CREEK WS SCS SITE 6 DAM	BEXAR	29.3800	-98.2917	1957	43	2,463	4,801	556
6	TX01461	MARTINEZ CREEK WS SCS SITE 1 DAM	BEXAR	29.4717	-98.3283	1964	38	2,172	3,509	681
7	TX01464	MARTINEZ CREEK WS SCS SITE 6A DAM	BEXAR	29.4783	-98.2900	1966	34	2,420	5,200	631
8	TX01467	SALADO CREEK WS SCS SITE 8 DAM	BEXAR	29.6450	-98.4767	1973	61	1,675	7,100	1,077
9	TX01468	SALADO CREEK WS SCS SITE 4 DAM	BEXAR	29.6233	-98.5200	1972	57	1,760	30,798	1,053
10	TX01469	SALADO CREEK WS SCS SITE 2 DAM	BEXAR	29.6634	-98.5792	1971	65	2,200	4,317	1,162
11	TX01787	MEDINA LAKE DAM	MEDINA	29.5400	-98.9333	1913	165	1,550	327,250	1,076
12	TX01788	MEDINA DIVERSION LAKE DAM	MEDINA	29.5100	-98.9000	1913	51	450	4,500	928
13	TX02028	HONDO CREEK WS SCS SITE 1 DAM	KARNES	28.7483	-97.8033	1968	41	3,250	6,288	N/A
14	TX02031	ESCONDIDO CREEK WS SCS SITE 11 DAM	KARNES	28.8600	-97.8450	1958	37	2,823	7,523	325
15	TX02034	ESCONDIDO CREEK WS SCS SITE 3 DAM	KARNES	28.7717	-97.9283	1956	41	2,310	3,180	425
16	TX02035	ESCONDIDO CREEK WS SCS SITE 4 DAM	KARNES	28.8150	-97.9017	1956	32	2,900	3,743	334
17	TX02040	ESCONDIDO CREEK WS SCS SITE 9 DAM	KARNES	28.8667	-97.9983	1957	30	2,674	4,330	419
18	TX02042	ESCONDIDO CREEK WS SCS SITE 13 DAM	KARNES	28.8133	-97.8767	1973	36	4,000	4,060	319
19	TX04208	SALADO CREEK WS SCS SITE 12 DAM	BEXAR	29.6267	-98.3917	1974	70	3,250	7,425	946
20	TX04313	OLMOS DAM	BEXAR	29.4733	-98.4733	1926	68	1,941	14,240	N/A
21	TX04315	ESCONDIDO CREEK WS SCS SITE 12 DAM	KARNES	28.8300	-97.9217	1974	28	2,667	3,388	342
22	TX04364	SALADO CREEK WS SCS SITE 13A DAM	BEXAR	29.6050	-98.3950	1976	43	1,690	3,026	N/A
23	TX04481	BOERING CITY LAKE DAM	KENDALL	29.8217	-98.7667	1978	87	6,130	15,668	1,546
24	TX04655	UPPER CIBOLO CREEK WS SCS SITE 3 DAM	KENDALL	29.7783	-98.7833	1980	76	2,436	4,732	1,584
25	TX04716	SALADO CREEK WS SCS SITE 1 DAM	BEXAR	29.6633	-98.6000	1975	80	2,640	8,680	1,162
26	TX04717	SALADO CREEK WS SCS SITE 5 DAM	BEXAR	29.6383	-98.5117	1976	64	3,200	5,807	1,099
27	TX04760	SALADO CREEK WS SCS SITE 11 DAM	BEXAR	29.6017	-98.4317	1979	65	1,775	6,318	893
28	TX05798	PANNA MARIA TAILINGS POND DAM	KARNES	28.9600	-97.9367	1978	60	9,810	4,598	375
29	TX06398	SALADO CREEK WS SCS SITE 7 DAM	BEXAR	29.5583	-98.5033	1987	47	22,640	7,016	N/A
30	TX06600	SALADO CREEK WS SCS SITE 10 DAM	BEXAR	29.5958	-98.4375	1994	66	1,264	4,054	N/A

Table 2.3.1-5 (Sheet 2 of 2)
San Antonio River Basin Dams (storage greater than 3000 acre-feet)

No.	NAT ID	Dam Name	County	Lat (deg)	Long (deg)	Year	Dam Height (ft)	Dam Length (ft)	Max Storage (ac-ft)	Effective Top of Dam (ft NGVD 29)
31	TX06646	ECLETO CREEK WS NRCS SITE 9A DAM	DE WITT	29.0008	-97.7083	1993	30	3,183	4,100	373
32	TX06912	ECLETO CREEK WS SCS SITE 4 DAM	KARNES	29.0778	-97.8492	1994	28	2,886	3,910	341
33	TX07211	SALADO CREEK WS NRCS SITE 15R DAM	BEXAR	29.5504	-98.4500	2004	49	6,536	8,704	773
34	TX07263	ECLETO CREEK WS NRCS SITE 3 DAM	WILSON	29.1767	-97.8632	2000	31	2,700	3,340	404

N/A: Data not available
Source: TCEQ 2007

Table 2.3.1-6
USGS Stream Gages near VCS Units 1 and 2

Gage No.	Name	River	Lat (deg)	Long (deg)	County	Drainage Area (square mile)	Period of Record From Year	Years of Record	Historical Annual Mean Flow Rate(cfs)		
									Max.	Min.	Ave.
08176500	Victoria	Guadalupe	28.79	-97.01	Victoria	5198	1935	73	6993	132	1978
08177500	Victoria	Coleto	28.73	-97.14	Victoria	514	1939	46	302	2	117
08188500	Goliad	San Antonio	28.65	-97.38	Goliad	3921	1924	76	3289	98	781
08188570	McFaddin	San Antonio	28.53	-97.04	Refugio	4134	2006	1	N/A	N/A	N/A
08188800	Tivoli	Guadalupe	28.50	-96.88	Refugio	10,128	2000	0	N/A	N/A	N/A

Note: No complete years of data are available at Tivoli
N/A: Data not available
Sources: USGS 2008A, USGS 2008B, USGS 2008C, USGS 2008D, USGS 2008E

Table 2.3.1-7 (Sheet 1 of 3)
Monthly Mean Flows for the Guadalupe River at Victoria, Texas
USGS 08176500

Year	Monthly mean in cfs											
	January	February	March	April	May	June	July	August	September	October	November	December
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
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

Table 2.3.1-7 (Sheet 2 of 3)
Monthly Mean Flows for the Guadalupe River at Victoria, Texas
USGS 08176500

Year	Monthly mean in cfs											
	January	February	March	April	May	June	July	August	September	October	November	December
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
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

Table 2.3.1-7 (Sheet 3 of 3)
Monthly Mean Flows for the Guadalupe River at Victoria, Texas
USGS 08176500

Year	Monthly mean in cfs											
	January	February	March	April	May	June	July	August	September	October	November	December
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			
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

Note: Shaded months depict periods of extended drought

Table 2.3.1-8 (Sheet 1 of 3)
Monthly Mean Flows for the San Antonio River at Goliad, Texas
USGS 08188500

Year	Monthly mean in cfs											
	January	February	March	April	May	June	July	August	September	October	November	December
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	N/A	121	844	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1939	N/A	N/A	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
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

Table 2.3.1-8 (Sheet 2 of 3)
Monthly Mean Flows for the San Antonio River at Goliad, Texas
USGS 08188500

Year	Monthly mean in cfs											
	January	February	March	April	May	June	July	August	September	October	November	December
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	288.8
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
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

Table 2.3.1-8 (Sheet 3 of 3)
Monthly Mean Flows for the San Antonio River at Goliad, Texas
USGS 08188500

Year	Monthly mean in cfs											
	January	February	March	April	May	June	July	August	September	October	November	December
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	242.7	360.5	478.1	724.3	515.3	140.4	1,603	389.5	432.3	333.5	365.3	278.8
1991	755.4	1,026	395.9	1,772	822.7	527.8	478.9	289	379.4	266.8	328	4,628
1992	2,869	7,682	4,379	4,488	6,169	5,759	1,456	937.8	728.5	542.1	1,256	876.5
1993	796	920.3	817.9	687.5	3,403	3,037	1,179	419	355.9	462.9	479.1	391.1
1994	449	473.9	863.9	629.8	2,216	534.1	269.2	250.4	457.8	1,244	449.9	502.2
1995	494.8	392.5	645.9	456.2	393.8	738.6	733.3	231.9	424.9	264.9	252.8	329.9
1996	287.8	248.1	250.4	205.1	184.3	203.6	160.1	216	747.8	189.8	235.2	291.6
1997	253.7	297.4	384.5	1,227	853.3	3,623	1,425	319.8	286.2	560.8	368.3	468.2
1998	503.9	1,113	1,053	514.3	241.7	166.6	162.7	699.7	671.3	7,543	2,050	984.5
1999	747.1	588.3	667.4	561.4	573.9	937.6	493.6	259.2	215.9	232.8	277.8	286.2
2000	371.7	393.6	336.7	425.7	495.5	796.7	198.7	136.6	209.7	738	2,747	672.8
2001	863.6	639.3	755.7	889.4	961.3	451.1	201	667	6,176	728.6	1,496	1,474
2002	713.1	533.7	480.7	964.2	382.4	269	15,330	1,392	3,056	4,731	3,805	2,186
2003	1,457	1,540	1,251	824.9	525.9	673.1	965.2	430.6	1,553	816.7	604.6	553.7
2004	587.2	650.8	719.3	2,411	2,460	2,928	2,630	946.7	813.3	1,327	5,914	1,923
2005	1,246	1,568	2,059	905.8	837.8	763.4	490	420.1	471.6	398.1	322.7	420
2006	397.2	273.1	375.5	261.6	453.1	228.5	239.7	136.9	449.2	284	291	351.8
2007	874.8	341.5	2,551	1,675	1,650	1,135	7,235	5,736	2,417			
Mean of Monthly Discharge	598	695	589	788	1,050	1,150	904	485	1,010	887	751	585

N/A = data not available
Note: Shaded months depict periods of extended drought

Table 2.3.1-9 (Sheet 1 of 2)
Monthly Mean Flows for Coleto Creek Near Victoria, Texas
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
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

Table 2.3.1-9 (Sheet 2 of 2)
Monthly Mean Flows for Coleto Creek Near Victoria, Texas
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
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

Table 2.3.1-10
Mean Daily Flows for the Guadalupe River at Victoria, Texas, USGS Gage 08176500

Day of Month	Mean of Daily Mean Values for Each Day of Record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1,790	1,700	2,180	1,630	2,900	2,730	2,600	1,200	1,760	1,720	1,750	1,680
2	1,770	1,530	1,890	1,690	3,360	2,750	3,030	1,170	2,770	1,290	1,940	1,610
3	1,720	1,500	1,760	1,860	3,540	2,700	4,420	1,160	2,970	1,180	2,260	1,570
4	1,580	1,530	1,650	2,050	3,280	2,740	3,880	1,150	2,470	1,180	2,170	1,520
5	1,450	1,720	1,610	2,100	2,980	2,820	3,100	1,150	1,760	1,080	2,030	1,610
6	1,420	1,960	1,670	1,980	2,890	3,440	2,580	1,190	1,380	1,010	2,030	1,620
7	1,430	2,250	1,750	1,850	2,810	3,990	2,530	1,160	1,280	1,110	2,040	1,700
8	1,460	2,420	1,950	1,930	2,850	3,750	2,440	1,150	1,300	1,240	2,410	1,790
9	1,450	2,190	2,040	2,010	2,910	3,280	2,760	1,120	1,380	1,280	2,390	1,820
10	1,430	1,970	1,810	1,910	2,870	2,970	3,090	1,120	1,450	1,300	1,850	1,750
11	1,520	1,790	1,590	1,970	2,740	2,790	2,740	1,110	1,610	1,330	1,570	1,570
12	1,610	1,780	1,550	2,130	2,880	2,730	2,270	1,070	1,870	1,460	1,550	1,530
13	1,760	1,800	1,490	2,020	2,780	2,700	1,990	1,040	1,730	1,570	1,590	1,650
14	1,730	1,790	1,770	1,900	2,880	2,960	1,800	1,040	1,960	1,590	1,650	1,830
15	1,780	1,820	1,980	1,840	3,120	2,970	1,720	1,050	2,020	1,550	1,640	1,800
16	1,770	1,780	2,200	1,910	3,000	2,830	1,750	1,050	1,870	1,880	1,660	1,670
17	1,730	1,770	2,420	2,000	2,810	2,800	1,790	1,050	1,780	2,050	1,750	1,660
18	1,560	1,830	2,230	2,160	2,640	2,780	1,720	1,020	1,530	2,100	1,860	1,730
19	1,630	1,810	2,140	2,200	2,890	2,760	1,640	1,050	1,480	2,890	1,830	1,740
20	1,860	1,810	2,080	2,270	2,770	2,890	1,630	1,080	1,540	6,570	1,780	1,690
21	2,040	1,920	2,010	2,470	2,500	2,720	1,580	1,070	1,910	5,390	1,770	1,680
22	2,110	2,020	1,880	2,340	2,330	3,040	1,470	1,050	1,970	3,610	1,870	1,720
23	1,960	2,030	1,780	2,340	2,540	2,850	1,460	1,070	1,960	2,770	1,910	1,740
24	1,930	2,120	1,760	2,450	2,790	2,540	1,450	1,110	2,010	2,360	1,910	1,830
25	2,220	2,540	1,800	2,320	2,710	2,260	1,490	1,110	1,860	2,220	2,690	2,260
26	2,200	2,950	1,850	2,400	2,380	2,280	1,580	1,080	1,680	2,450	3,150	2,200
27	2,020	2,710	1,740	2,430	2,300	2,410	1,570	1,090	1,630	2,330	2,930	1,990
28	1,860	2,500	1,660	2,460	2,510	2,300	1,450	1,060	1,530	2,250	2,670	1,890
29	1,690	2,810	1,660	2,570	2,720	2,250	1,410	1,110	1,660	2,160	2,330	1,790
30	1,660		1,710	2,650	2,740	2,420	1,390	1,230	1,840	1,890	1,950	1,760
31	1,710		1,700		2,700		1,280	1,360		1,730		1,830

Table 2.3.1-11
Mean Daily Flows for the San Antonio River at Goliad, Texas, USGS Gage 08188500

Day of Month	Mean of daily mean values for each day of record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	528	552	639	615	976	1,080	1,110	465	1,240	912	891	516
2	524	533	554	676	1,010	1,120	982	413	1,310	1,080	873	486
3	527	563	502	682	1,070	1,150	915	412	1,140	1,030	832	521
4	492	610	489	670	1,120	1,170	813	420	903	754	780	511
5	484	728	494	629	1,050	1,370	808	428	726	534	809	527
6	506	860	546	673	1,050	1,450	953	452	641	492	915	529
7	509	898	580	703	1,030	1,350	1,180	469	648	577	1,060	562
8	494	894	623	695	978	1,330	1,430	524	781	655	1,090	550
9	489	823	616	649	970	1,310	1,820	584	863	649	834	533
10	471	708	597	626	930	1,250	1,750	540	940	552	567	496
11	479	621	556	687	894	1,050	1,380	459	1,110	687	574	491
12	523	596	531	656	1,040	1,120	1,050	482	1,290	816	568	491
13	577	599	504	591	1,020	1,250	906	481	1,260	768	572	496
14	604	580	606	576	967	1,400	853	409	1,270	748	598	533
15	583	570	685	548	1,120	1,300	692	375	1,060	706	588	515
16	563	597	800	563	1,250	1,220	663	357	808	742	600	506
17	510	662	792	644	1,160	1,170	703	393	752	904	558	545
18	499	639	636	752	1,140	1,110	715	452	783	1,020	561	608
19	528	605	666	877	1,160	967	734	474	756	1,030	690	566
20	645	566	638	837	1,220	972	765	565	849	871	730	547
21	708	572	638	854	983	965	800	557	861	1,180	783	651
22	701	678	616	909	885	1,090	789	584	963	1,480	804	656
23	764	767	662	936	998	1,090	779	580	2,210	1,310	701	647
24	867	810	545	1,040	1,020	897	810	511	1,710	1,040	703	781
25	834	852	516	1,170	1,010	839	807	410	1,160	972	887	900
26	776	906	528	1,130	1,060	877	753	405	959	962	941	913
27	691	906	501	1,060	1,090	1,010	656	445	858	1,100	926	813
28	655	797	475	1,070	1,030	1,130	628	516	786	1,120	852	663
29	684	661	530	1,040	1,070	1,190	604	483	759	1,060	660	563
30	676		582	1,080	1,080	1,230	597	540	823	918	581	503
31	637		615		1,060		566	844		829		507

Table 2.3.1-12
Mean Daily Flows for Coleto Creek near Victoria, Texas, USGS Gage 08177500

Day of Month	Mean of daily mean values for each day of record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	14	79	36	44	65	46	51	7.8	768	4.6	231	4.5
2	21	87	37	272	127	40	431	8	189	4.4	68	106
3	5.9	78	21	598	219	79	277	7.4	101	4.4	33	73
4	9.4	205	16	1,060	118	180	233	7.4	123	4.5	141	28
5	10	106	5.8	847	124	311	313	13	105	9.3	367	15
6	23	25	96	296	710	66	254	6.7	74	146	146	27
7	6.8	12	131	125	93	164	71	11	57	105	84	19
8	39	7.4	46	53	58	59	38	4.2	37	16	13	34
9	38	13	32	19	77	54	44	12	62	12	13	29
10	11	40	23	88	135	72	21	6.5	54	17	19	35
11	31	159	11	175	46	391	6.6	4.9	395	98	17	51
12	39	25	323	116	78	609	7.8	5.8	332	173	14	92
13	104	20	147	95	67	439	7.5	5.8	72	528	218	53
14	49	12	459	52	526	374	7.5	4.4	43	50	548	54
15	11	61	313	16	267	66	116	5.4	118	10	199	45
16	51	83	246	6.2	131	37	531	19	274	14	222	29
17	129	17	318	296	185	62	590	7.5	188	87	70	17
18	69	11	156	373	371	51	79	4.1	108	974	193	19
19	28	44	84	22	87	91	39	4	104	1,130	227	25
20	22	48	118	47	83	537	70	3.9	98	295	175	7
21	17	78	97	25	113	333	66	3.8	66	170	712	30
22	16	151	26	24	22	1,030	19	3.9	24	65	283	573
23	8	104	139	23	164	178	6.1	4	5.2	179	152	132
24	56	191	94	21	183	74	5.4	4.6	4.8	188	114	38
25	24	469	23	39	122	76	61	3.9	4.5	299	44	37
26	40	474	105	241	52	298	119	4.4	4.3	97	20	11
27	248	228	33	110	44	172	51	8	6.2	51	16	24
28	183	92	20	13	39	72	17	4.7	4.6	15	5.2	19
29	47	14	12	7.3	106	110	5.8	9.5	4.6	24	4.9	9.9
30	26		29	19	116	98	13	9.4	4.6	5.7	7.3	8.6
31	11		223		71		27	524		601		33

Table 2.3.1-13
Maximum of the Daily Mean Flows for the Guadalupe River at Victoria, Texas, USGS Gage 08176500

Day of Month	Max. of daily mean values for each day of record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	14,500	23,500	21,300	8,660	22,800	15,300	22,300	8,080	22,300	22,600	15,800	13,000
2	10,500	10,600	16,900	10,300	30,800	20,200	39,800	7,270	77,600	10,900	24,000	10,100
3	9,510	7,430	17,900	12,700	49,700	17,000	129,000	7,680	86,900	14,300	36,200	9,340
4	9,150	10,500	10,500	22,500	30,600	14,300	122,000	8,210	61,400	16,700	27,100	9,290
5	9,130	14,100	7,540	21,300	25,400	20,000	75,200	8,390	35,300	8,920	17,400	9,490
6	9,290	17,500	10,500	19,000	26,400	61,800	44,400	8,580	14,500	4,580	16,900	9,370
7	9,590	34,100	14,600	14,500	30,200	80,700	30,000	8,190	7,280	5,050	22,700	10,900
8	9,980	45,100	27,600	15,800	30,000	66,100	26,600	7,820	8,040	7,570	48,800	13,600
9	9,630	33,300	30,300	16,300	24,400	47,200	42,800	7,580	8,010	9,040	48,700	18,200
10	8,790	23,200	20,900	10,300	18,500	31,500	67,800	7,400	8,960	9,980	30,900	19,800
11	8,670	15,600	9,860	11,000	24,100	30,500	59,400	7,300	9,140	6,760	11,600	12,500
12	10,400	10,400	7,600	14,000	24,600	29,200	42,900	7,200	16,200	17,000	6,280	8,640
13	10,400	9,550	8,270	15,900	20,600	21,100	29,000	7,070	18,500	20,700	13,600	11,600
14	11,200	10,900	12,800	11,500	21,400	35,800	20,300	6,970	25,500	22,500	21,200	14,100
15	9,850	12,200	17,500	10,200	44,900	37,800	14,400	6,900	18,000	23,900	21,700	11,500
16	11,500	10,000	20,500	10,800	52,200	35,800	15,600	7,050	25,300	24,900	20,500	12,100
17	12,000	9,170	26,400	14,600	35,400	31,900	19,100	7,120	23,700	26,000	22,900	12,000
18	7,810	10,700	15,200	20,600	23,900	26,600	13,300	7,270	12,100	20,800	25,200	11,900
19	8,460	11,300	12,300	18,200	17,700	27,100	11,100	7,730	7,100	33,200	20,300	12,400
20	9,940	13,300	11,400	19,900	21,300	36,200	11,800	7,840	8,940	307,000	13,500	15,300
21	11,000	14,700	13,300	20,600	22,000	28,300	12,000	7,810	34,500	235,000	25,000	15,900
22	15,500	12,600	12,100	20,200	17,300	48,000	10,000	7,380	35,400	115,000	31,400	14,400
23	17,600	17,800	10,200	36,000	21,100	43,600	11,500	7,190	41,400	75,400	30,500	17,200
24	26,100	17,800	8,000	50,100	24,700	27,500	15,500	7,060	51,200	52,900	29,200	21,000
25	41,000	29,800	8,450	32,000	15,400	14,300	20,300	6,950	42,500	34,200	64,500	52,700
26	30,400	54,000	7,900	19,900	13,700	15,600	28,200	6,880	28,300	25,600	90,400	54,600
27	19,900	41,400	7,980	15,600	14,600	15,700	27,400	6,820	20,600	22,000	67,900	38,200
28	14,200	36,600	7,890	16,700	22,000	13,500	20,500	6,880	18,800	19,000	45,800	26,700
29	15,000	32,500	8,190	21,800	29,000	15,400	18,900	6,980	22,000	22,400	24,900	20,800
30	18,000		8,710	24,400	25,000	21,400	16,800	8,340	26,300	19,500	15,200	18,800
31	24,200		8,980		21,200		11,200	10,100		16,800		18,200

Table 2.3.1-14
Maximum of the Daily Mean Flows for the San Antonio River at Goliad, Texas, USGS Gage 08188500

Day of Month	Max. of daily mean values for each day of record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2,280	5,590	7,230	4,730	15,000	13,000	10,200	8,260	23,600	17,000	7,180	3,530
2	2,110	3,500	4,720	7,100	10,200	10,100	11,300	4,890	26,500	27,800	7,430	3,240
3	1,910	4,220	3,000	7,030	9,380	9,270	8,800	4,150	22,700	25,500	5,850	3,790
4	1,800	7,510	2,790	8,740	9,200	12,200	9,320	3,680	16,800	14,900	5,900	3,210
5	1,870	10,300	2,770	5,530	11,900	18,400	11,400	3,620	14,100	7,160	8,010	3,030
6	2,450	12,600	5,380	7,130	13,200	27,400	15,600	2,930	11,100	3,070	10,900	3,540
7	2,780	14,600	9,220	7,250	10,000	32,800	26,000	3,640	10,700	5,030	14,200	3,810
8	2,340	16,900	12,000	6,690	9,420	32,000	40,100	4,730	14,000	7,130	16,600	3,720
9	2,030	16,100	12,700	6,360	9,740	29,000	62,000	5,680	12,800	6,420	10,500	2,300
10	1,490	12,700	11,400	3,760	9,220	26,300	60,800	5,080	13,100	3,830	3,730	2,960
11	2,580	9,100	8,630	5,280	7,980	23,900	46,300	2,910	23,200	5,480	2,880	2,880
12	5,250	6,660	6,150	4,110	9,130	21,100	35,100	4,260	28,600	11,900	3,770	3,620
13	6,170	5,400	4,900	3,760	9,650	19,700	25,000	5,510	24,000	11,900	4,980	4,290
14	5,120	4,640	5,840	4,070	11,000	24,300	16,500	2,920	23,400	7,820	4,540	5,670
15	6,620	4,170	12,000	3,330	12,500	25,900	11,100	1,750	15,800	7,310	6,190	3,750
16	4,800	4,470	16,600	4,060	12,700	24,000	11,700	1,800	6,130	7,490	4,900	2,710
17	1,800	6,160	15,000	6,530	11,600	22,200	13,000	4,110	5,180	14,900	3,700	5,170
18	1,620	6,160	4,360	9,480	9,640	20,600	14,800	8,190	5,780	19,000	4,210	7,130
19	2,120	5,240	4,150	11,800	15,100	16,500	13,500	9,410	7,680	13,200	7,640	3,170
20	4,690	3,350	3,550	11,200	20,300	13,200	11,100	11,600	7,070	10,900	10,400	4,210
21	7,020	2,720	5,470	11,800	12,000	12,500	9,290	14,700	11,200	34,100	13,300	8,170
22	9,030	5,570	6,280	8,610	9,660	12,400	11,000	19,100	28,800	55,800	14,700	8,660
23	14,900	9,780	10,200	11,300	10,400	10,300	13,100	20,200	121,000	43,300	11,000	11,100
24	24,900	12,400	2,290	14,800	10,500	7,660	14,700	15,000	84,200	29,500	9,140	16,400
25	22,200	15,500	2,550	15,200	11,000	7,730	14,800	6,530	42,900	17,000	12,400	25,100
26	17,700	14,300	2,520	10,700	13,200	9,860	14,200	4,380	25,300	11,000	19,500	25,800
27	12,200	13,900	2,470	12,300	12,900	11,800	12,800	3,800	17,100	13,700	22,600	18,300
28	7,030	11,400	2,370	13,800	10,200	12,600	13,300	9,070	12,300	17,100	16,500	13,000
29	10,100	5,860	2,500	11,400	9,610	13,300	14,700	6,460	8,710	16,900	6,520	8,640
30	11,700		2,720	14,400	11,300	15,600	15,400	6,580	10,300	10,500	4,010	3,450
31	10,400		5,360		13,200		14,100	12,700		7,500		2,570

Table 2.3.1-15
Maximum of the Daily Mean Flows for Coleto Creek near Victoria, Texas, USGS Gage 08177500

Day of Month	Max. of daily mean values for each day of record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	127	1,890	343	930	841	282	1,160	95	15,300	19	6,000	15
2	300	1,300	262	6,560	2,320	340	10,600	101	4,430	19	729	2,590
3	18	1,450	261	15,200	4,910	1,330	6,430	92	1,810	19	425	1,270
4	115	5,050	120	27,500	2,470	2,460	3,740	91	2,560	19	3,470	624
5	135	2,330	19	15,300	2,720	4,710	7,070	156	2,460	83	8,550	111
6	280	290	2,350	2,720	14,500	1,260	5,730	70	1,750	3,400	1,930	457
7	42	94	2,180	1,750	1,960	2,510	1,110	172	1,330	2,370	1,240	343
8	554	60	776	505	569	616	363	7.6	857	287	160	511
9	600	141	303	166	1,430	814	617	212	1,560	150	154	377
10	112	696	373	1,860	2,370	1,180	344	42	1,350	189	161	527
11	665	3,710	99	2,900	778	8,430	26	21	9,240	1,440	210	820
12	343	201	4,670	2,280	1,510	9,000	75	51	8,220	4,190	147	1,490
13	1,310	188	1,540	1,320	918	6,790	68	52	1,520	13,400	5,690	1,030
14	722	161	6,960	770	9,390	4,750	67	20	375	1,190	14,500	1,330
15	150	1,000	3,420	228	3,020	1,130	2,640	42	1,260	161	4,380	625
16	692	1,310	1,750	17	2,290	716	6,720	406	5,380	174	5,180	507
17	2,220	266	6,350	7,780	3,100	1,250	10,400	102	3,600	2,210	853	296
18	626	182	3,330	9,780	4,740	372	850	13	2,180	14,700	2,870	217
19	325	1,040	1,660	377	1,140	1,770	404	9	2,300	16,600	4,960	341
20	240	685	1,570	1,000	1,220	13,900	1,220	8.3	1,800	6,890	4,080	75
21	151	1,270	2,350	490	2,330	7,090	1,500	7.1	1,540	3,160	18,600	408
22	221	1,900	454	315	215	23,200	365	7	395	508	6,990	10,600
23	58	1,370	2,750	430	3,510	3,040	34	11	24	3,100	3,620	1,870
24	623	2,910	2,070	352	2,580	635	20	28	25	4,300	2,580	720
25	235	6,410	178	538	1,660	560	1,520	9.8	21	7,260	876	398
26	697	6,210	2,150	3,530	735	3,290	3,090	24	20	1,240	366	105
27	6,420	2,920	235	1,800	407	2,710	1,270	123	56	456	282	340
28	3,040	1,280	151	146	331	959	340	29	20	135	16	148
29	654	59	85	35	1,990	2,130	41	155	20	333	16	81
30	176		152	132	1,740	1,190	234	85	20	14	79	87
31	142		5,690		918		608	11,400		15,800		553

Table 2.3.1-16
Minimum of the Daily Mean Flows for the Guadalupe River at Victoria, Texas, USGS Gage 08176500

Day of Month	Min. of daily mean values for each day of record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	127	132	181	113	103	71	47	41	92	22	46	50
2	121	119	188	168	138	71	47	43	81	22	44	50
3	128	147	161	148	106	68	47	44	68	23	46	53
4	119	231	181	127	95	64	47	43	68	24	95	48
5	118	171	181	111	98	59	46	37	66	23	95	46
6	118	126	181	106	106	62	44	29	66	24	100	46
7	116	113	188	111	116	62	44	35	61	30	79	48
8	132	126	174	102	128	61	43	40	66	32	66	48
9	119	111	162	95	106	62	40	37	61	30	54	56
10	113	142	165	94	95	62	40	36	61	25	47	58
11	103	132	174	90	84	66	50	30	66	25	43	53
12	118	116	119	182	79	62	50	25	74	22	48	47
13	108	133	145	210	84	62	76	30	69	20	47	54
14	105	121	134	154	84	59	90	36	58	25	44	52
15	103	239	157	116	90	56	76	37	48	49	54	56
16	116	239	161	94	174	53	71	35	44	54	59	56
17	105	248	181	87	188	56	56	30	41	29	54	50
18	97	231	122	87	328	48	47	25	44	95	56	105
19	150	181	164	82	286	56	40	17	44	91	58	168
20	113	168	154	82	254	56	43	14	44	91	50	144
21	105	208	160	82	188	53	47	25	44	95	43	76
22	121	194	164	79	138	52	41	30	37	95	41	174
23	134	248	160	79	103	58	37	29	36	98	41	174
24	106	231	158	90	87	73	44	29	37	97	48	130
25	110	181	142	81	90	68	47	28	37	94	44	106
26	128	194	158	162	84	61	52	32	35	84	41	188
27	105	208	119	160	89	58	58	52	30	73	39	201
28	113	181	151	188	79	54	53	53	24	64	43	188
29	108	231	168	155	79	50	44	53	19	58	46	181
30	130		134	138	78	47	37	52	19	53	41	165
31	174		113		71		37	87		50		161

Table 2.3.1-17
Minimum of the Daily Mean Flows for the San Antonio River at Goliad, USGS Gage 08188500

Day of Month	Min. of daily mean values for each day of record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	81	103	78	63	57	28	6.8	25	37	62	62	76
2	81	102	76	60	57	49	12	23	47	70	66	78
3	81	105	84	58	56	44	19	21	48	44	63	78
4	88	103	84	53	51	23	21	16	48	48	58	78
5	87	108	94	66	45	23	21	18	48	89	62	78
6	84	103	89	78	41	20	20	22	48	72	62	78
7	81	103	78	75	40	14	21	15	46	69	65	78
8	84	86	75	69	40	14	21	16	48	68	63	78
9	92	86	80	69	43	16	25	21	48	56	66	78
10	89	99	76	103	44	24	23	19	47	49	70	74
11	83	97	76	105	59	20	20	16	47	47	78	76
12	83	94	81	89	55	7.2	26	17	54	46	78	65
13	86	102	83	76	56	5	55	18	49	46	78	53
14	84	112	78	78	52	2.1	65	19	46	63	78	52
15	91	108	84	72	66	5	63	16	60	62	78	55
16	89	94	95	69	90	3.4	66	16	65	74	72	65
17	84	84	92	68	90	2.3	51	18	65	67	66	69
18	86	84	89	62	81	9.8	42	20	86	61	66	79
19	94	94	86	62	71	24	34	21	74	61	78	82
20	87	95	78	55	86	35	22	27	74	55	78	84
21	84	89	86	55	93	56	19	24	63	61	76	87
22	107	89	92	59	86	46	27	22	55	61	76	86
23	97	83	105	57	76	56	35	43	62	61	75	82
24	97	87	94	60	63	58	23	37	59	62	75	86
25	97	89	84	63	59	60	23	43	52	60	76	89
26	94	92	86	63	58	43	27	43	48	60	69	92
27	97	84	84	71	54	28	32	37	46	59	70	91
28	108	84	83	65	83	22	25	44	39	65	78	89
29	102	87	76	60	62	16	25	37	39	62	75	92
30	92		78	56	32	8.2	39	37	51	56	76	88
31	103		76		28		34	20		59		83

Table 2.3.1-18
Minimum of the Daily Mean Flows for Coleto Creek near Victoria, Texas, USGS Gage 08177500

Day of Month	Min. of daily mean values for each day of record in, cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.9	0.2	2.4	2	2.2	0.17	0	0	0.71	0.58	1.7	0.71
2	1.9	0.2	2.2	2.1	1.2	0.13	0.02	0	0.79	0.57	1.8	1.5
3	2	0.18	0	2	1.1	0.09	0.02	0	1	0.56	1.8	1.7
4	1.5	0.19	0	1.9	1.1	0.06	0.01	0	1	0.53	2.1	1.7
5	0.8	2.2	0	2	1.9	0.05	0	0	0.98	0.51	2.2	1.4
6	0.72	2	0	1.9	0	0.04	0	0	0.66	0.51	1.9	1
7	0.68	1.8	0	1.9	0	0.03	0	0	0.66	1.6	2	0.92
8	0.7	1.9	0	2	1.3	0.44	0	0	0.66	0.67	1.8	1.6
9	0.71	1.8	2.1	2	2.3	0.07	0	0.01	0.65	0.52	1.7	1.6
10	0.7	1.8	2.1	2	2	0.03	0	0.01	0.66	0.47	1.6	1.6
11	0.69	1.8	2.1	2	2	0.03	0	0.02	1.2	0.43	1.5	1.5
12	2	2	2	1.8	2	0.02	0	0.02	1.2	0.41	1.4	1.5
13	2	2	1.9	1.7	2	0.02	0	0.02	1.3	0.41	1.4	1.5
14	2	1.9	1.9	1.8	2	0.02	0	0.02	1.3	0.42	1.4	1.5
15	1.9	1.9	1.8	1.8	1.6	0.02	0	0.03	1.5	0.4	1.4	1.8
16	0.43	1.9	1.9	1.7	0.89	0.02	0.17	0.03	1.4	0.39	1.5	1.9
17	0.27	1.9	1.9	1.6	0.66	0.01	0.02	0.03	1.3	0.39	1.5	1.1
18	0.65	1.9	2	1.5	0.64	0.01	0.01	0.03	1.4	0.38	1.6	1.8
19	0.6	1.9	2	1.5	0.55	0	0	0.03	1.3	0.41	1.5	2
20	1.9	1.9	2.1	1.3	0.47	0	0	0.05	1.3	0.45	1.5	0.58
21	1.7	1.9	2.2	1.3	0.41	0	0	0.07	1.4	0.41	1.4	1.2
22	0.32	1.6	2.1	1.3	0.37	0.01	0	0.09	1.3	0.43	1.3	0.75
23	0.19	1.6	2.1	1.2	0.35	0	0	0.11	1.3	1.5	1.3	0.72
24	0.2	1.8	2	1.2	0.33	0	0	0.14	1.2	1.5	1.5	1.9
25	0.2	1.9	2.1	1	0.31	0	0	0.17	0.96	1.5	1.1	2
26	0.19	1.9	2.2	0.95	0.29	0.01	0	0.2	0.75	1.5	0.83	2.1
27	0.17	1.8	2.3	1	0.27	0.01	0.01	0.23	0.67	1.5	0.71	1.2
28	0.18	1.9	2.2	0.95	0.24	0	0.01	0.32	0.65	1.4	0.71	0.93
29	0.18	2.2	2.1	1.1	0.2	0	0	0.36	0.62	1.5	0.77	0.7
30	0.16		1.9	2.5	0.17	0	0	0.73	0.6	1.6	0.69	0.74
31	0.19		2		0.2		0	0.71		1.6		0.63

Table 2.3.1-19
Guadalupe River Frequency Peak Discharges 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: FEMA 1998

Table 2.3.1-20
Suspended Sediment Concentrations for the Guadalupe River at Victoria, Texas USGS Gage 08176500

Date	Concentration (mg/l)	Date	Concentration (mg/l)	Date	Concentration (mg/l)	Date	Concentration (mg/l)
1/8/1973	34	6/24/1976	56	10/2/1979	79	5/8/1985	144
2/14/1973	52	7/21/1976	129	11/6/1979	83	7/10/1985	192
3/12/1973	67	8/19/1976	67	12/12/1979	65	10/10/1985	64
4/17/1973	709	9/23/1976	52	1/17/1980	77	1/16/1986	46
6/25/1973	281	10/21/1976	319	2/12/1980	63	4/23/1986	110
7/26/1973	272	11/19/1976	79	3/11/1980	51	9/3/1986	41
8/29/1973	94	12/16/1976	205	4/8/1980	53	10/23/1986	114
9/25/1973	66	1/13/1977	55	5/6/1980	75	2/11/1987	52
10/24/1973	137	2/17/1977	90	6/11/1980	99	6/23/1987	331
11/13/1973	128	3/17/1977	66	7/9/1980	63	8/19/1987	135
12/11/1973	38	4/14/1977	81	8/7/1980	72	10/14/1987	55
1/15/1974	310	5/12/1977	221	9/10/1980	1210	3/1/1988	75
2/20/1974	32	6/9/1977	77	10/15/1980	54	6/29/1988	72
3/19/1974	40	7/14/1977	57	11/13/1980	32	8/10/1988	153
4/23/1974	35	8/18/1977	86	12/9/1980	16	11/9/1988	15
5/21/1974	88	9/15/1977	110	1/7/1981	35	3/8/1989	21
6/25/1974	52	10/20/1977	90	2/4/1981	45	6/15/1989	96
7/23/1974	48	11/10/1977	270	3/5/1981	59	8/16/1989	37
8/28/1974	31	12/8/1977	62	4/9/1981	134	10/17/1989	45
9/24/1974	89	1/26/1978	30	5/15/1981	102	3/6/1990	49
10/23/1974	26	2/16/1978	39	6/22/1981	255	5/24/1990	15
11/14/1974	123	3/16/1978	28	7/17/1981	193	9/5/1990	34
12/11/1974	574	4/24/1978	431	8/21/1981	146	10/30/1990	20
1/30/1975	22	5/22/1978	13	9/18/1981	135	3/6/1991	44
2/20/1975	379	6/12/1978	205	11/19/1981	112	5/21/1991	85
3/27/1975	67	7/17/1978	42	2/10/1982	57	9/5/1991	75
4/23/1975	170	8/22/1978	295	3/30/1982	96	10/23/1991	33
5/22/1975	602	9/26/1978	352	5/3/1982	55	2/12/1992	311
6/18/1975	168	10/17/1978	32	7/26/1982	103	4/7/1992	241
7/17/1975	498	11/7/1978	187	9/1/1982	74	8/28/1992	90
8/20/1975	40	12/20/1978	21	10/14/1982	78	10/15/1992	108
9/18/1975	19	1/16/1979	350	1/12/1983	33	3/9/1993	69
10/23/1975	18	2/21/1979	78	4/12/1983	89	5/3/1993	84
11/20/1975	24	3/20/1979	73	8/23/1983	64	8/20/1993	59
12/10/1975	11	4/10/1979	162	10/12/1983	21	11/15/1993	88
1/22/1976	9	5/9/1979	223	1/17/1984	26	3/25/1994	60
2/26/1976	25	6/5/1979	195	4/11/1984	73	5/17/1994	409
3/25/1976	29	7/12/1979	141	7/11/1984	62	8/25/1994	35
4/29/1976	327	7/31/1979	299	10/17/1984	608		
5/27/1976	317	8/29/1979	64	1/23/1985	147		

Table 2.3.1-21
Suspended Sediment Concentrations for the San Antonio River at Goliad, Texas USGS Gage 08188500

Date	Concentration (mg/l)	Date	Concentration (mg/l)	Date	Concentration (mg/l)	Date	Concentration (mg/l)
10/24/1974	102	3/15/1978	78	4/10/1981	81	12/14/1987	87
11/14/1974	145	4/25/1978	2450	5/14/1981	186	3/1/1988	62
12/12/1974	885	5/23/1978	295	6/23/1981	262	4/12/1988	103
1/30/1975	111	6/28/1978	87	7/16/1981	380	6/28/1988	104
2/21/1975	250	7/19/1978	84	8/20/1981	179	8/9/1988	89
3/27/1975	160	8/23/1978	181	9/18/1981	361	11/8/1988	63
4/24/1975	138	9/28/1978	265	11/16/1981	149	1/26/1989	145
5/22/1975	231	10/18/1978	243	3/29/1982	80	3/7/1989	71
6/18/1975	322	11/8/1978	2350	5/3/1982	51	5/10/1989	146
7/17/1975	187	12/19/1978	46	7/26/1982	104	6/13/1989	66
8/21/1975	95	1/17/1979	358	8/31/1982	85	8/15/1989	135
9/18/1975	700	2/22/1979	125	10/13/1982	1460	10/17/1989	93
10/22/1975	92	3/21/1979	1380	1/10/1983	57	3/6/1990	486
11/20/1975	71	4/10/1979	260	2/22/1983	142	5/23/1990	5
12/10/1975	54	5/8/1979	100	4/11/1983	138	7/11/1990	80
1/21/1976	67	5/9/1979	390	7/11/1983	176	9/4/1990	90
2/25/1976	78	6/6/1979	706	10/11/1983	66	10/29/1990	78
3/24/1976	398	6/6/1979	77	1/16/1984	105	1/31/1991	141
4/28/1976	493	7/11/1979	124	2/28/1984	63	3/6/1991	83
5/26/1976	475	7/30/1979	106	4/9/1984	83	5/21/1991	184
6/23/1976	137	8/1/1979	442	7/9/1984	78	7/9/1991	540
7/21/1976	417	8/28/1979	148	8/21/1984	186	9/5/1991	425
8/18/1976	152	8/28/1979	68	10/17/1984	1840	10/23/1991	88
9/22/1976	740	10/3/1979	67	1/22/1985	189	12/18/1991	384
10/20/1976	701	11/5/1979	57	3/11/1985	70	2/12/1992	580
11/18/1976	163	12/5/1979	54	5/7/1985	86	4/8/1992	487
12/15/1976	564	1/15/1980	66	7/8/1985	647	6/11/1992	523
1/12/1977	145	2/13/1980	55	8/12/1985	138	8/29/1992	151
2/16/1977	226	3/10/1980	15	10/9/1985	98	10/15/1992	69
3/16/1977	122	4/9/1980	113	1/14/1986	56	1/11/1993	87
4/13/1977	169	5/5/1980	459	2/25/1986	38	3/9/1993	87
5/11/1977	355	6/9/1980	110	4/23/1986	66	5/3/1993	235
6/8/1977	276	7/9/1980	70	7/16/1986	208	7/12/1993	1520
7/13/1977	109	8/5/1980	101	9/3/1986	121	8/18/1993	248
8/17/1977	100	9/9/1980	905	10/21/1986	234	11/15/1993	86
9/14/1977	112	10/14/1980	50	12/8/1986	47	1/18/1994	98
10/19/1977	65	11/12/1980	38	2/10/1987	201	3/24/1994	205
11/9/1977	1240	12/10/1980	66	4/14/1987	89	5/16/1994	685
12/8/1977	61	1/8/1981	60	6/23/1987	793	7/12/1994	76
1/25/1978	67	2/2/1981	79	8/18/1987	125	8/25/1994	68
2/16/1978	130	3/3/1981	69	10/13/1987	85		

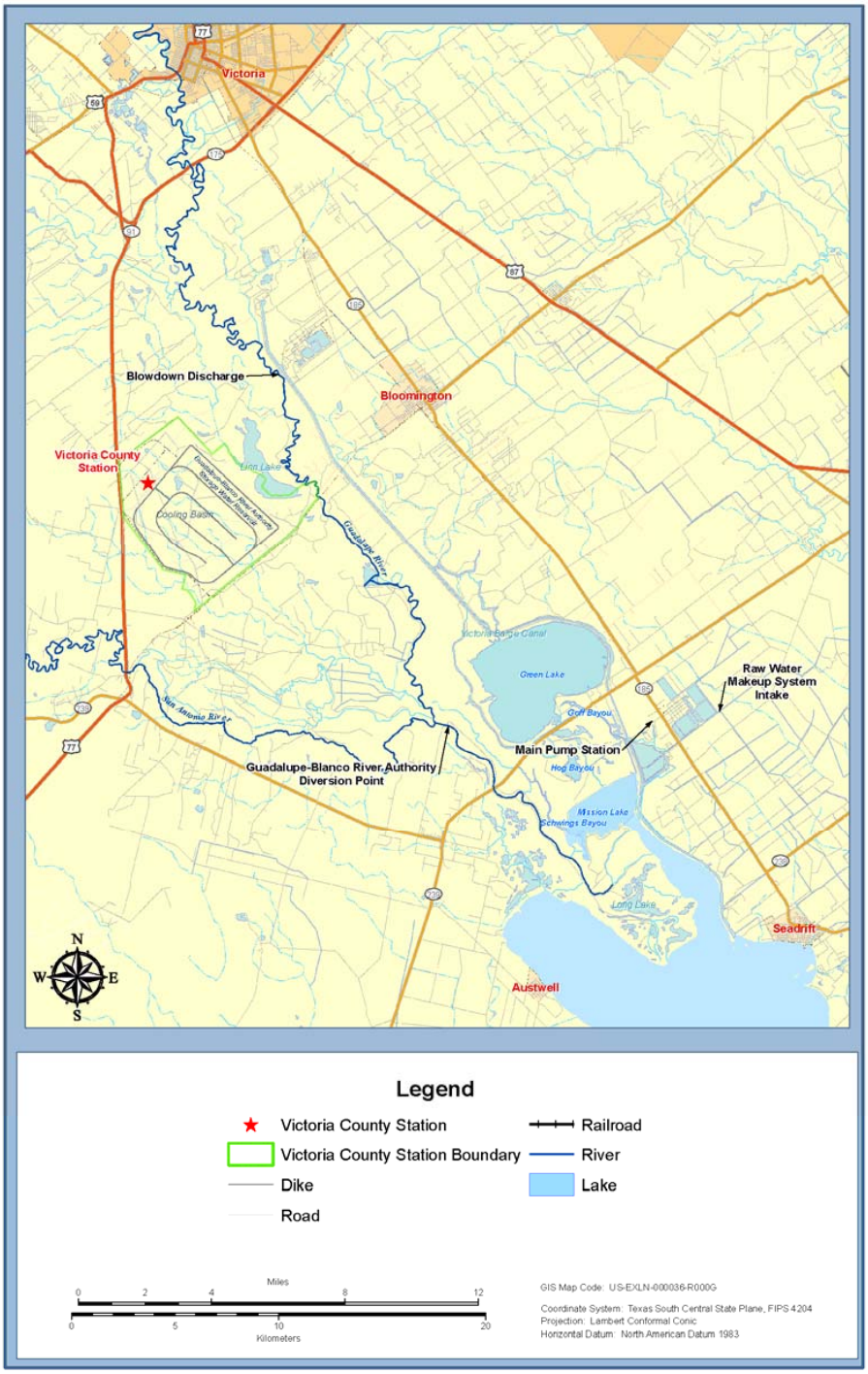

Figure 2.3.1-1 Victoria County Station Location Map

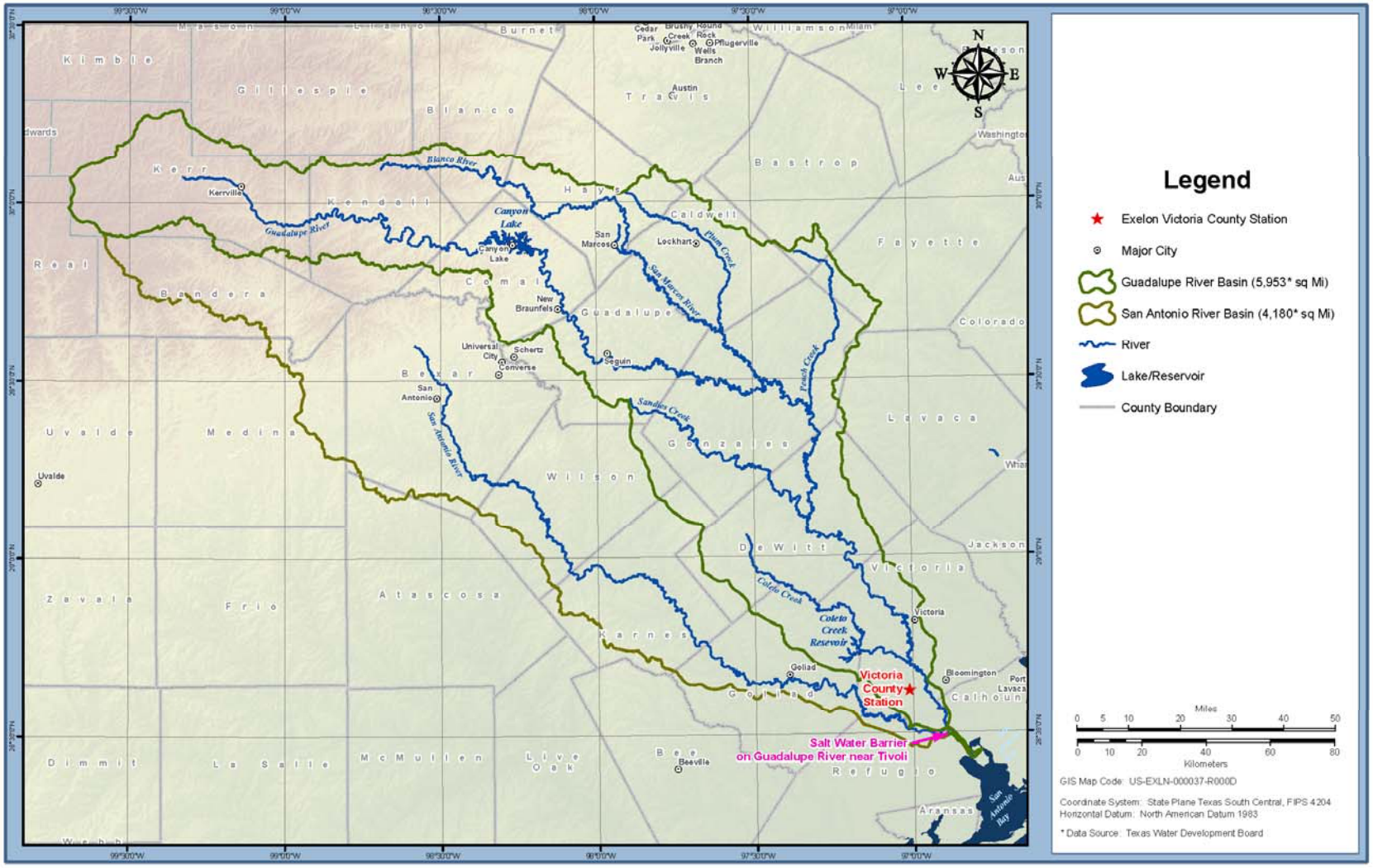

Figure 2.3.1-2 Guadalupe and San Antonio River Basin Watersheds

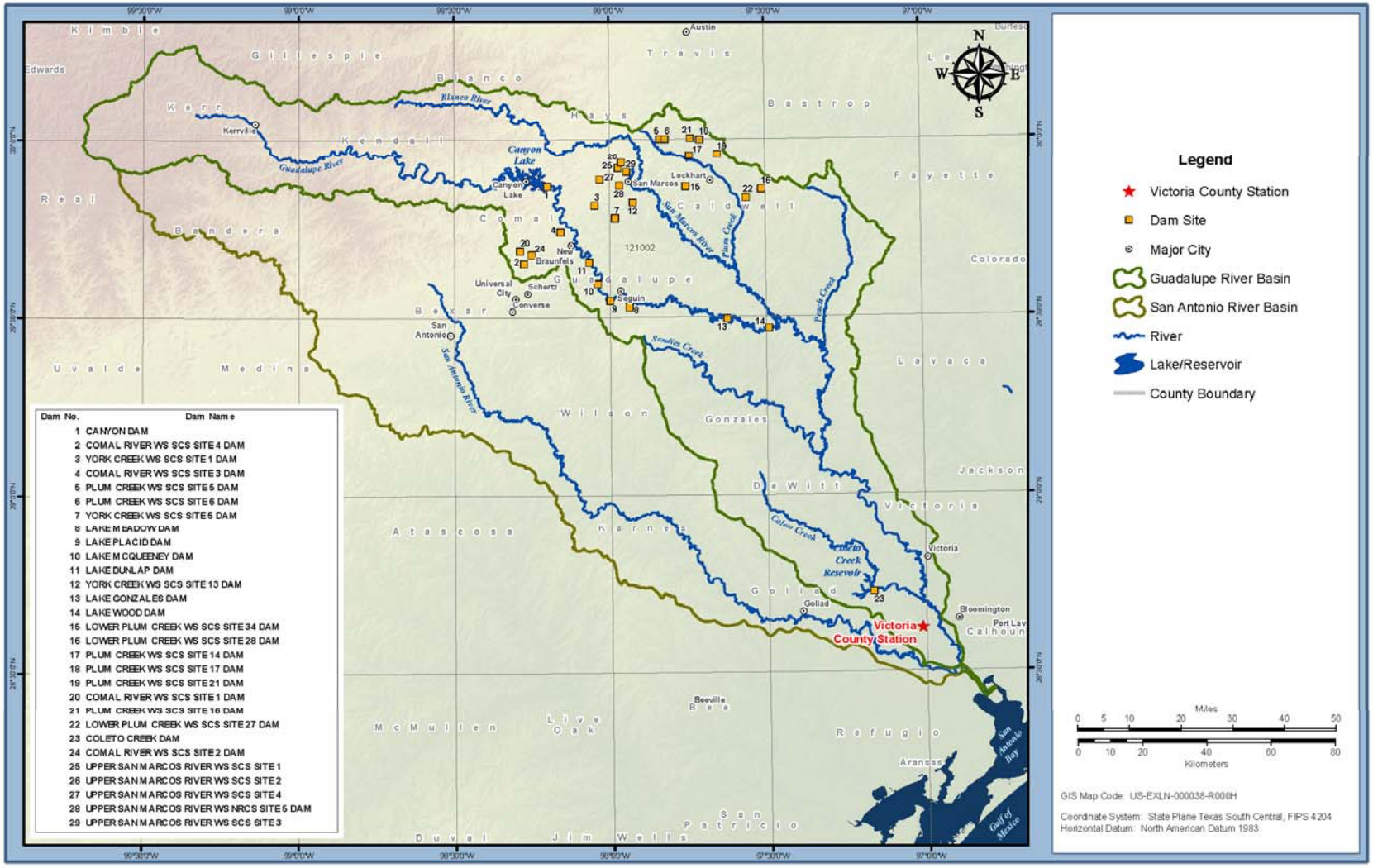

Figure 2.3.1-3 Guadalupe River Basin Dams

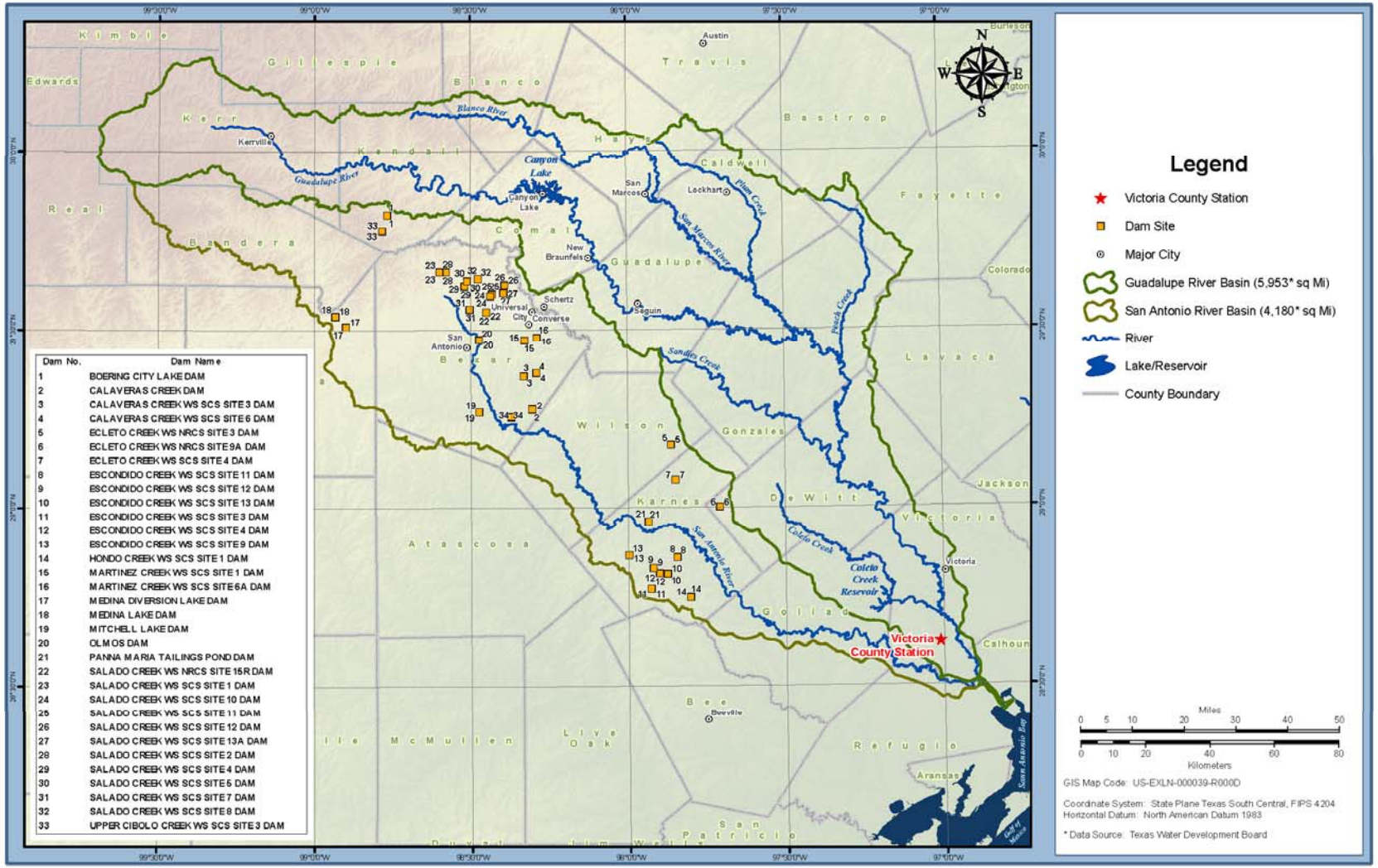

Figure 2.3.1-4 San Antonio River Basin Dams

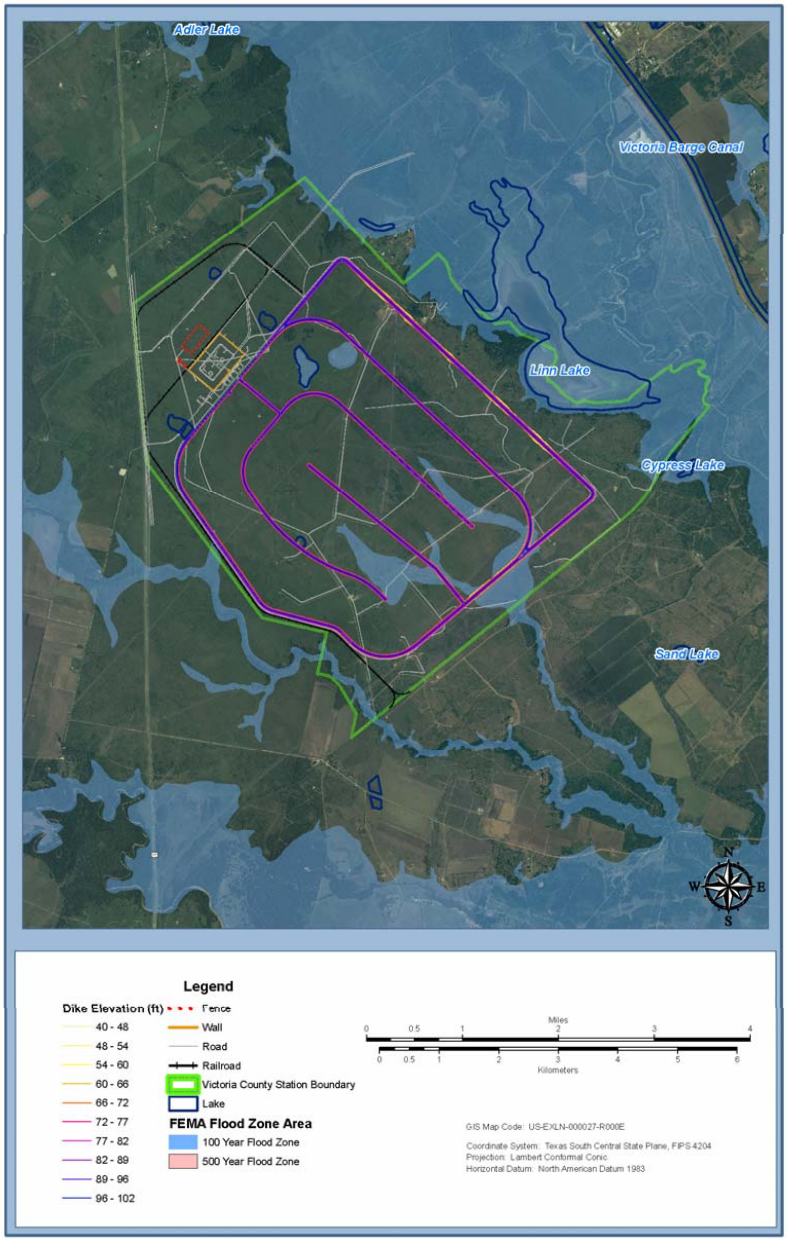

Figure 2.3.1-5 VCS Site Floodplain Map

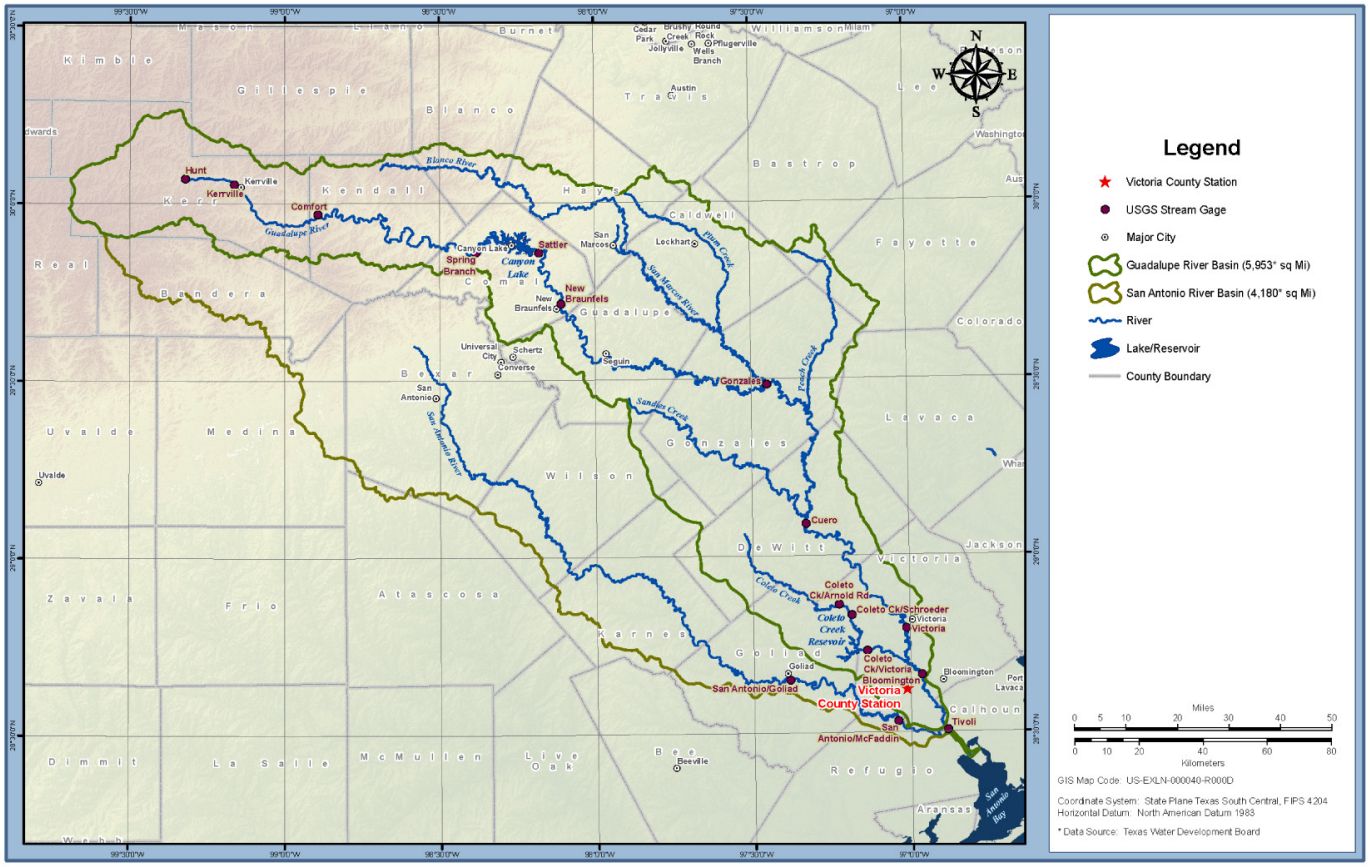

Figure 2.3.1-6 Guadalupe and San Antonio River Basins: Stream Gages

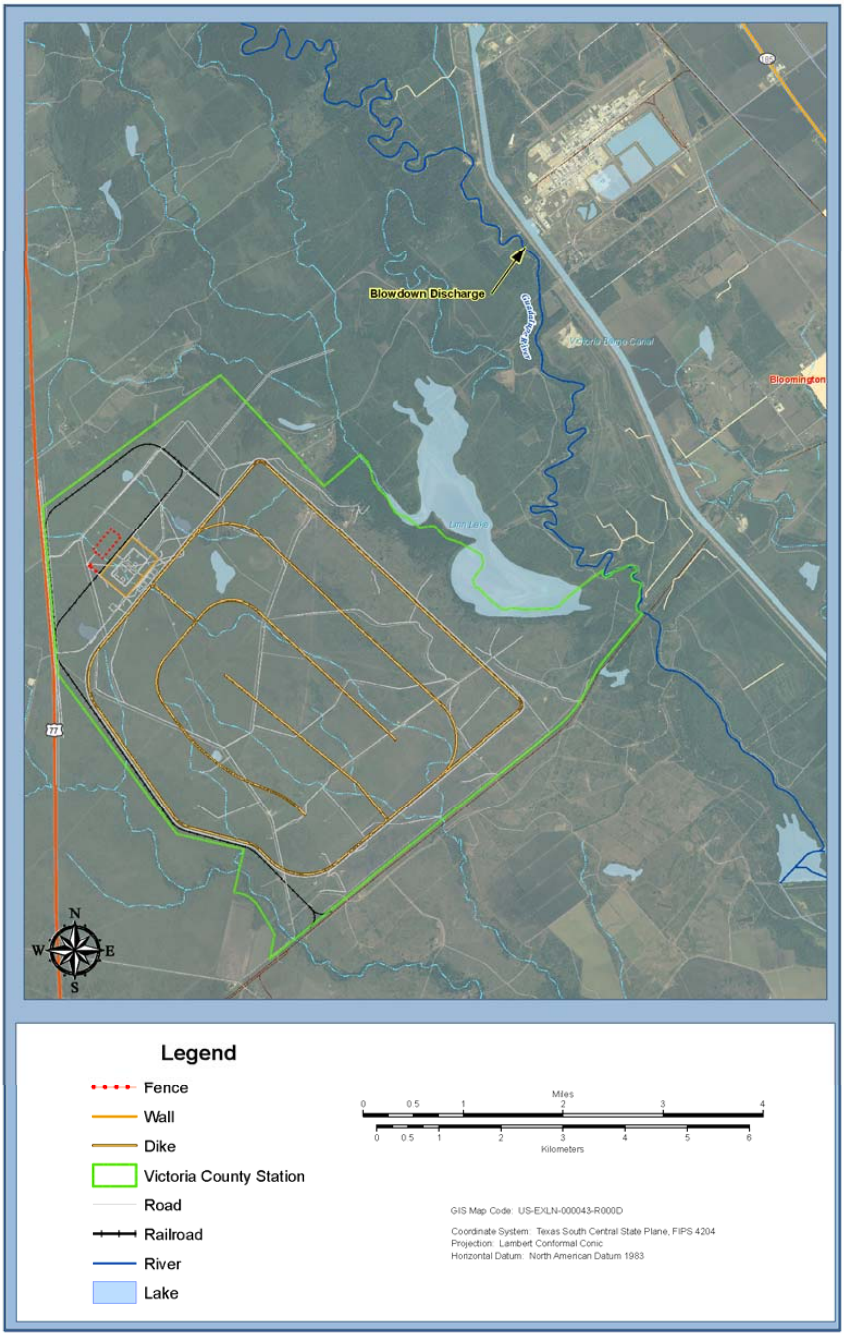

Figure 2.3.1-7 Victoria County Station Blowdown Discharge Location Map

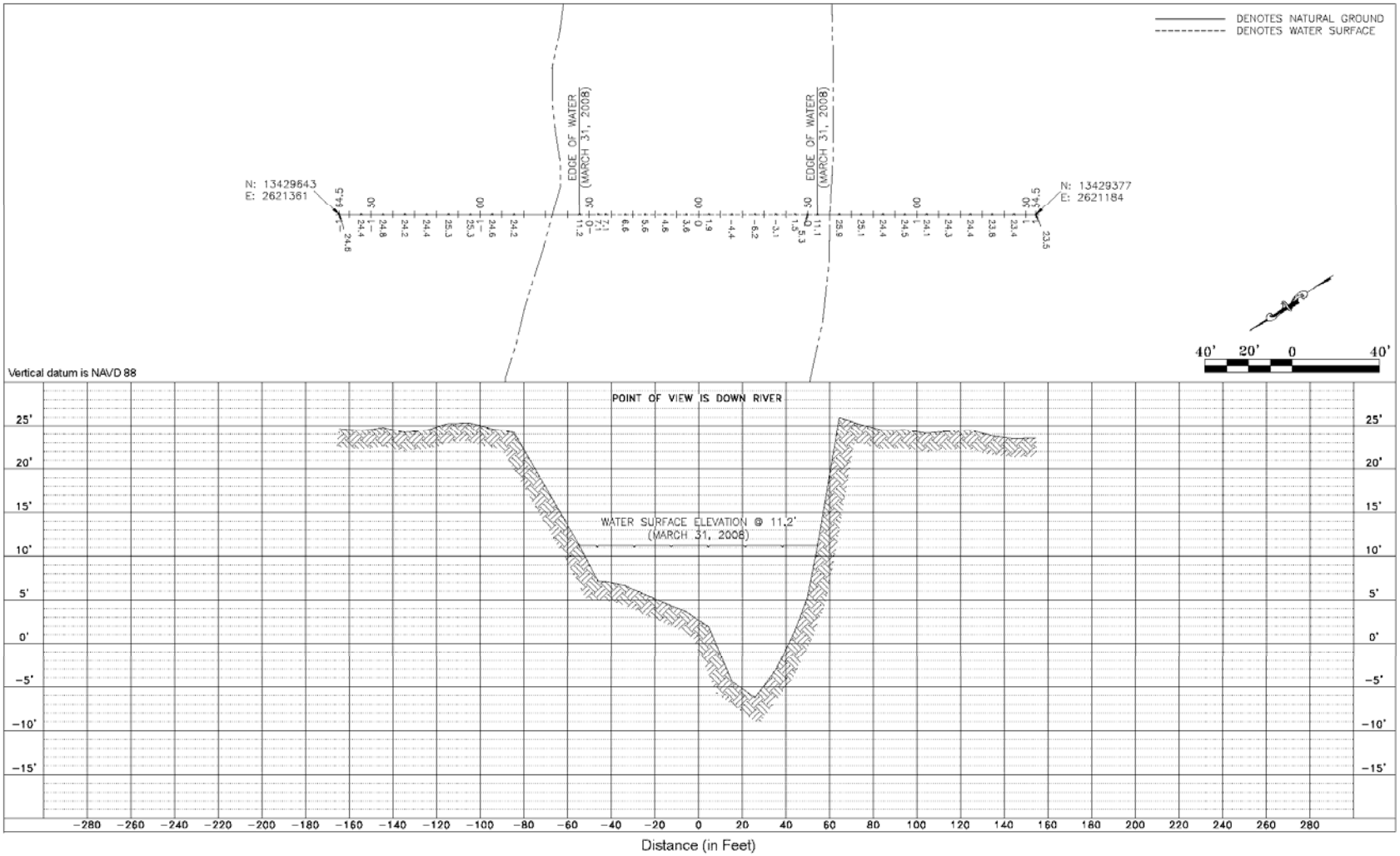

Figure 2.3.1-8 Guadalupe River Bathymetry—250 Feet Upstream of Blowdown Discharge Location

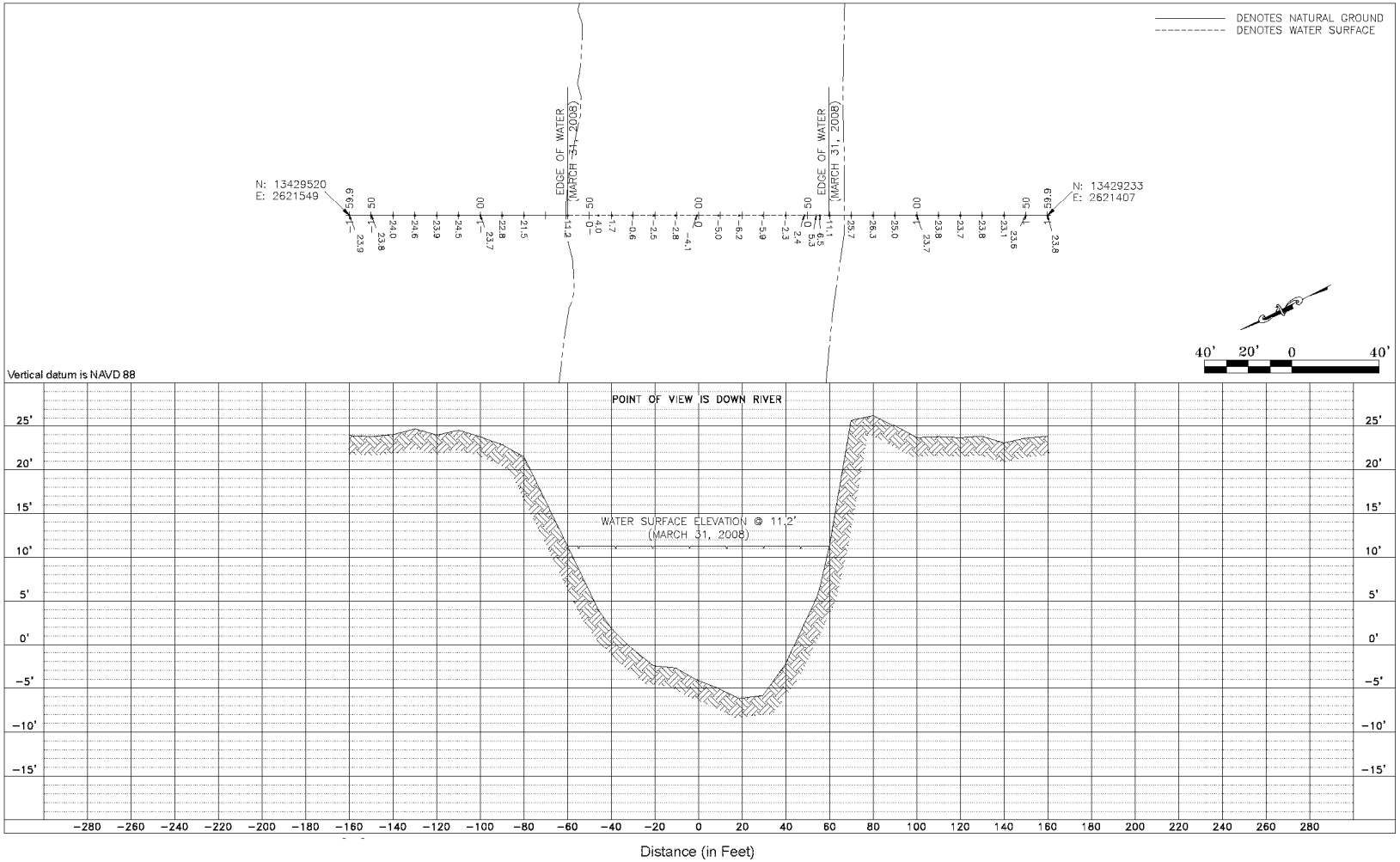

Figure 2.3.1-9 Guadalupe River Bathymetry—Near Blowdown Discharge Location

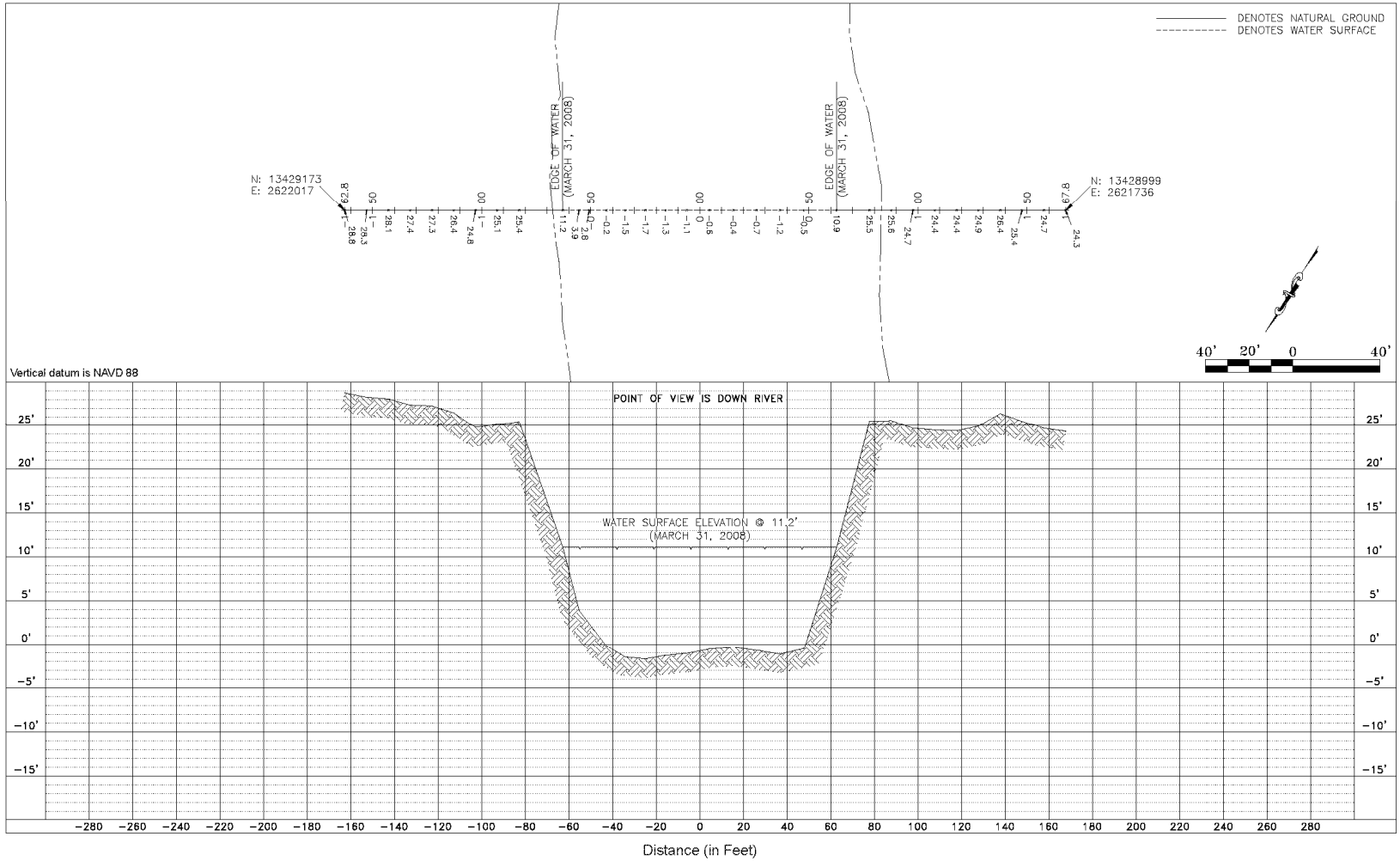

Figure 2.3.1-10 Guadalupe River Bathymetry – 500 Feet Downstream of Blowdown Discharge Location

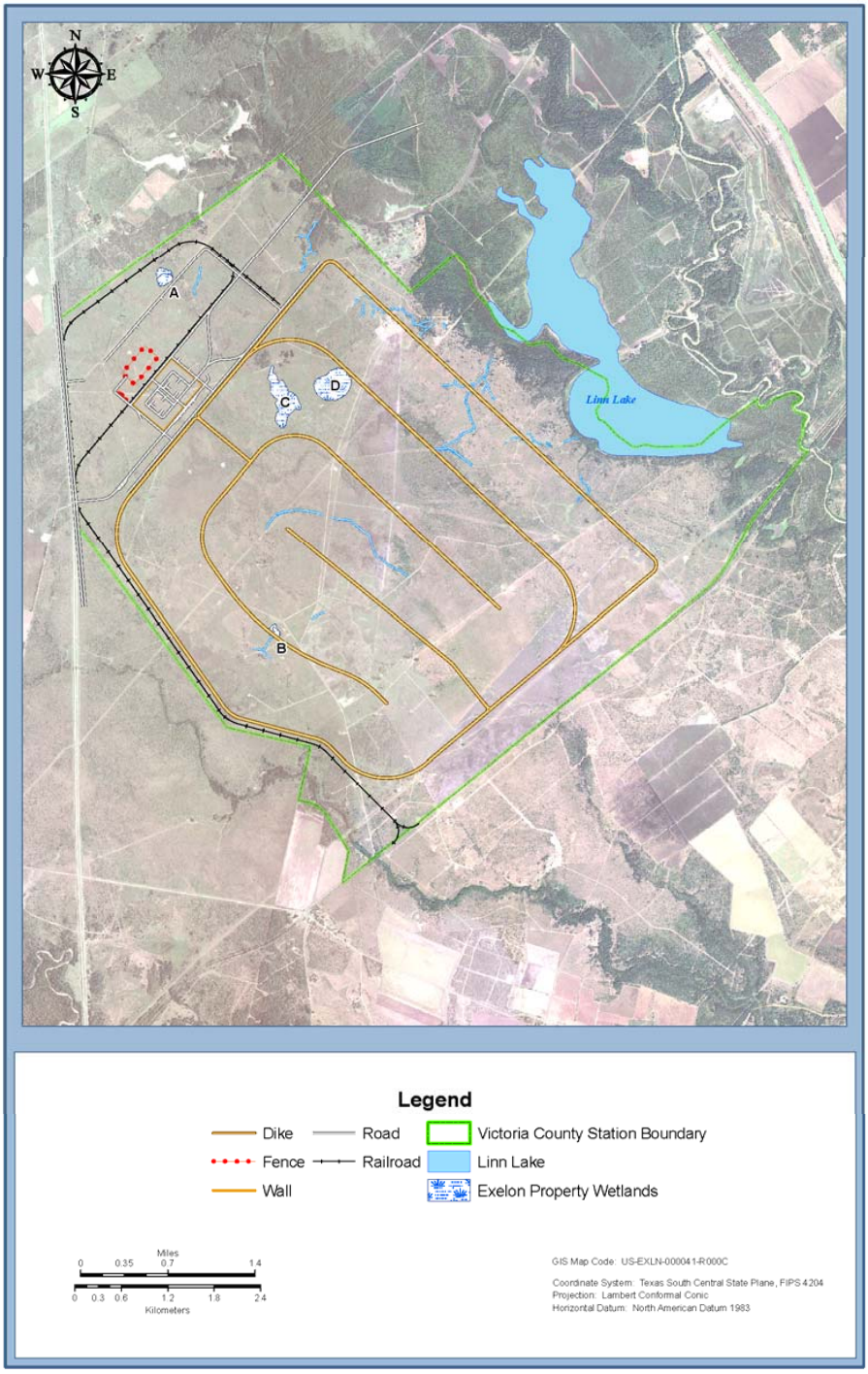

Figure 2.3.1-11 Existing Streams and Wetlands

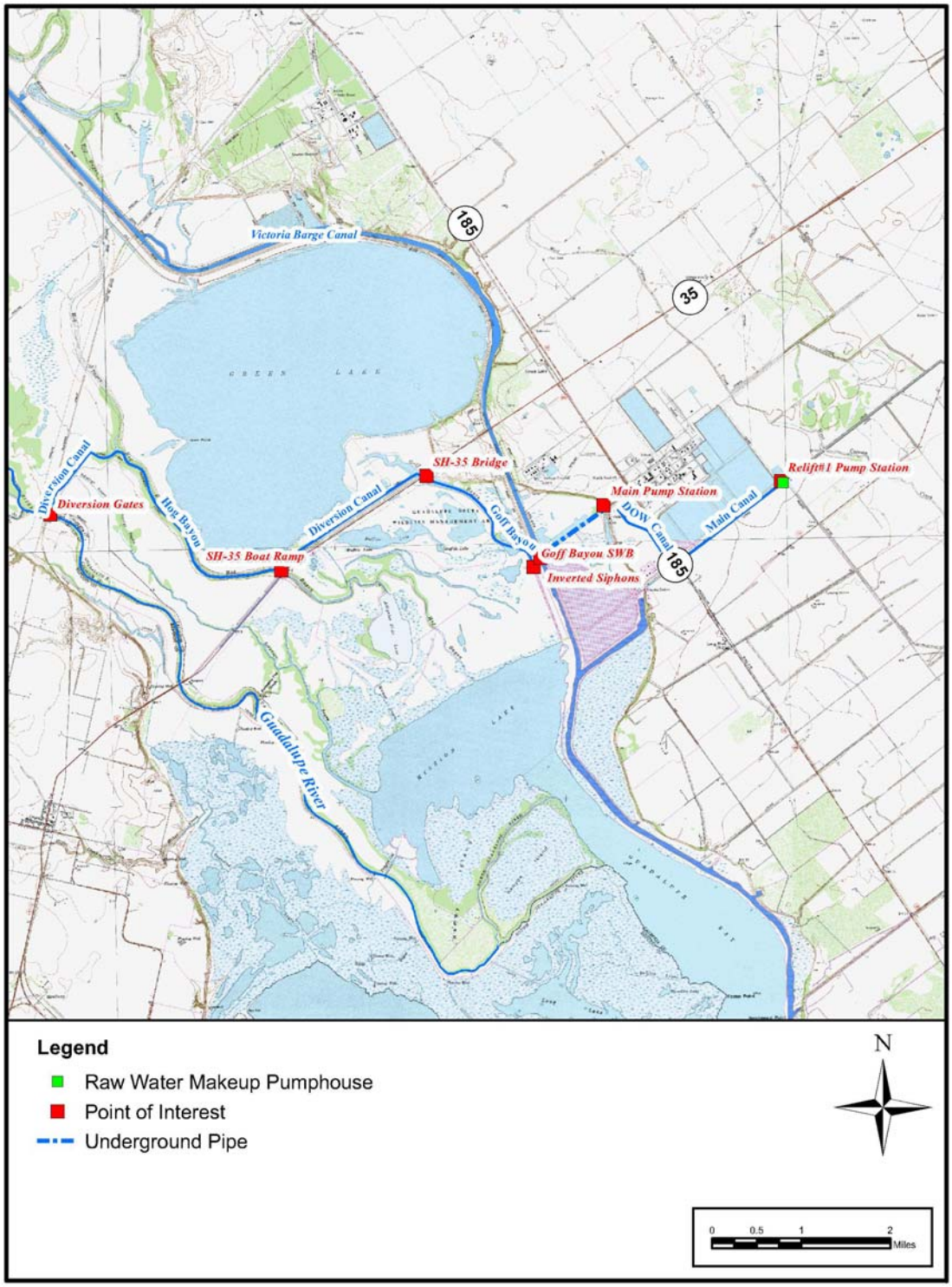

Figure 2.3.1-12 Victoria County Station, Raw Water Makeup (RWMU) System Intake Location Map (Calhoun Canal System)

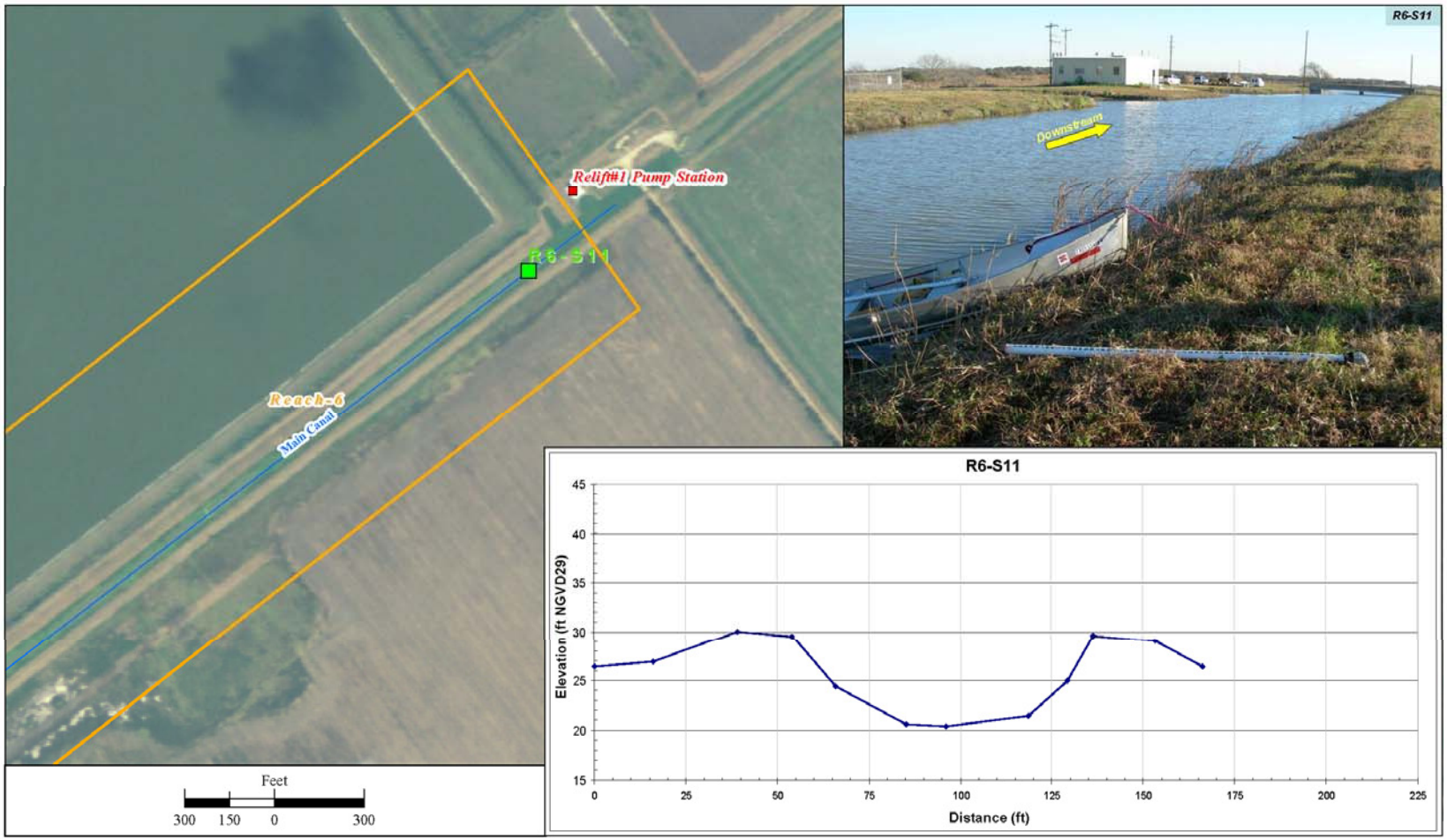

Figure 2.3.1-13 Raw Water Makeup System (RWMU) Intake Location, Main Canal Surveyed Cross Section (R6-S11)

2.3.1.2 Groundwater

Regional and plant-specific data on the physical and hydrologic characteristics of the groundwater resources at, and in the vicinity of, the VCS site are summarized in this section to provide the basic data for an evaluation of impacts on the aquifers of the area.

The VCS site covers an area of approximately 11,500 acres and is located on the coastal plain of southeastern Texas in Victoria County, south of the city of Victoria, Texas. The approximately 6200 acre water impoundments will be the predominant feature at the VCS site. The impoundments will be fully enclosed with a compacted earth embankment dam and will encompass most of the southern and central portion of the site.The impoundments will consist of an approximately 4900-acre VCS cooling basin and an approximately 1300-acre Guadalupe-Blanco River Authority (GBRA) storage water reservoir (GSWR). VCS Units 1 and 2 will be built on the northern portion of the VCS site, adjacent to the northern embankment of the VCS cooling basin.

2.3.1.2.1 Description and Onsite Use

This section contains a description of the regional and local physiography and geomorphology, groundwater aquifers, geologic formations, and groundwater sources and sinks. Regional and onsite uses of groundwater are described in Subsection 2.3.2, including groundwater production and groundwater flow requirements of the VCS site.

2.3.1.2.1.1 Site and Regional Physiography and Geomorphology

The VCS site is located in Victoria County, Texas, approximately 21 miles north of San Antonio Bay. The closest community is McFaddin, which is located approximately 4 miles from Units 1 and 2 and approximately 1 mile southwest of the VCS site boundary. The closest major city is Victoria, located approximately 13 miles north of the VCS site (Figure 2.3.1-14).

The VCS site and surrounding region are situated in the Coastal Prairies sub-province of the Gulf Coastal Plains physiographic province. The Coastal Prairies sub-province forms a broad band of nearly flat prairies along the Texas Gulf Coast (Figure 2.3.1-15). Ground surface elevation varies from approximately 0 feet (NAVD 88) along the coast to approximately 300 feet (NAVD 88) along the western boundary of the sub-province (Bureau of Economic Geology 1996).

Victoria County is located on the gently rolling plains of South Texas. The ground surface elevation varies from approximately 100 feet (NAVD 88) in the moderately dissected upland to the west to approximately 0 feet (NAVD 88) to the east at the Victoria Barge Canal. Regional surface slopes vary from approximately 0% to 8%, with more pronounced slopes near surface water bodies (Uddameri Jan 2008).

The VCS site is located on a relatively flat plain west of the Guadalupe River valley, downstream (south) of the city of Victoria, Texas. The topographic features of the VCS site (Figure 2.3.1-16) are as follows:

- Gently sloping plains cover the majority of the VCS site. The plains exhibit approximately 20 feet of natural relief in the distance between the northwestern and southeastern property boundaries. Ground surface elevation ranges from approximately 85 feet (NAVD 88) on the northwest side of the VCS site to approximately 65 feet (NAVD 88) on the southeast side of the VCS site, except where the site drops down to the Guadalupe River along its eastern most boundary. The planned post construction ground surface elevation for the power block buildings on the northwest side of the VCS site is approximately 95 feet (NAVD 88).
- A 50- to 65-foot escarpment is located to the northeast of the GSWR and separates Linn Lake on the east from the higher elevations of the VCS site. The emergency spillway for the GSWR would be directed to Linn Lake, which is at an elevation of approximately 15 feet (NAVD 88), and would flow from there into the Guadalupe River near the southeastern most site boundary (Figure 2.3.1-16).
- Kuy Creek is generally classified as a perennial stream. However, field observations made during the site subsurface investigation and in support of groundwater modeling activities indicate that the upper reaches of Kuy Creek adjacent to the VCS cooling basin are ephemeral. A gully associated with Kuy Creek is located to the southwest of the VCS cooling basin. The emergency spillway for the VCS cooling basin would discharge to the associated gully that discharges to Kuy Creek.
- A gully associated with Dry Kuy Creek, an ephemeral stream, is located at the south-southeastern boundary of the VCS site and extends to the northwest, into the site area to be enclosed by the VCS cooling basin and the GSWR.
- There are several unnamed ephemeral streams located throughout the site. Most are tributaries to Dry Kuy Creek; the others flow to Linn Lake to the east or Kuy Creek to the southwest. Dry Kuy Creek flows southeast into Kuy Creek, which drains into the San Antonio River. The San Antonio River flows southeasterly, converging with the Guadalupe River southeast of the site boundaries.
- The drainage pattern at the VCS site is generally dendritic, with the local tributaries draining either to the Guadalupe or San Antonio rivers and then to San Antonio Bay.
- Additional landforms present at the VCS site include fluvial terraces, river paleochannels, point bars, natural levees, backswamp deposits, relict barrier islands/dunes, and younger alluvial and man-made (fill) deposits. These landforms are consistent with the morphostratigraphy associated with the Beaumont Formation.

2.3.1.2.1.2 Regional Groundwater Aquifers

The geologic materials underlying the Coastal Prairies sub-province consist of deltaic sands and muds (Ryder 1996). The VCS site is underlain by a thick wedge of southeasterly dipping sedimentary deposits of Oligocene through Holocene age. The site overlies what has been referred to as the “Coastal Lowland Aquifer System” (Ryder 1996). This aquifer system contains numerous local aquifers in a thick

sequence of mostly unconsolidated Coastal Plain sediments of alternating and interfingering beds of clay, silt, sand, and gravel. The sediments reach thicknesses of thousands of feet and contain groundwater that ranges from fresh to saline. Groundwater is used for municipal, industrial, and irrigation needs (Ryder 1996).

The lithology of the aquifer system is generally sand, silt, and clay and reflects three depositional environments: continental (alluvial plain), transitional (delta, lagoon, and beach), and marine (continental shelf). The depositional basin thickens towards the Gulf of Mexico, resulting in a wedge-shaped configuration of hydrogeologic units. Numerous oscillations of ancient shorelines resulted in a complex, overlapping mixture of sand, silt, and clay (USGS 1996).

As part of the U.S. Geological Survey's (USGS) Regional Aquifer-System Analysis (RASA) program, the aquifer system was subdivided into five permeable zones and two confining units. The term "Gulf Coast Aquifer" (Figure 2.3.1-17) is generally used in Texas to describe the composite of the sands, silts, and clays of the Coastal Lowland Aquifer System as shown in Figure 2.3.1-18 (Baker Jul 1979).

The terms Gulf Coast Aquifer and the Coastal Lowlands Aquifer System are synonymous as shown in Figure 2.3.1-18. Hydrogeologic cross sections of the Coastal Lowlands Aquifer System and the Gulf Coast Aquifer are shown in Figures 2.3.1-19 and 2.3.1-20, respectively. The Gulf Coast Aquifer nomenclature will be used to describe the hydrogeologic units at the VCS site.

The Gulf Coast aquifer is subdivided into four major hydrogeologic units based on sedimentary formations and hydraulic properties. These include, from deepest to shallowest:

- The Catahoula Confining System, which includes the Frio Formation, Anahuac Formation, and the Catahoula Tuff or Sandstone (Chowdhury et al. Feb 2006).
- The Jasper aquifer, which consists of the Oakville Sandstone and the Fleming Formation. The upper part of the Fleming Formation forms the Burkeville confining system (Chowdhury et al. Feb 2006).
- The Evangeline aquifer, which consists of the Goliad Sand.
- The Chicot aquifer, which consists of the Willis Formation, Lissie Formation (undifferentiated Bentley and Montgomery Formations), Beaumont Formation and surficial alluvial deposits (Chowdhury et al. Feb 2006).

The base of the Gulf Coast aquifer is identified as either its contact with the top of the Eocene/Oligocene Vicksburg-Jackson Confining Unit or the approximate depth where the concentration of total dissolved solids (TDS) in groundwater exceeds 10,000 milligrams per liter (mg/L). The base of the aquifer varies in elevation from approximately 300 feet (NAVD 88) near the updip limit to approximately –6000 feet (NAVD 88) midway between the updip limit and the coastline (Ryder 1996).

The Gulf Coast aquifer is recharged by the infiltration of precipitation that falls on topographically high aquifer outcrop areas in the northern and western portion of the province. Discharge occurs by

evapotranspiration, loss of water to streams and rivers as base flow, upward leakage to shallow aquifers in low lying coastal areas or in the Gulf of Mexico, and pumping (Ryder 1996).

Groundwater in the Gulf Coast aquifer is generally under confined conditions, except for shallow zones in outcrop. In the shallow zones, the specific yield for sandy deposits generally ranges from 10% to 30%. For confined aquifers, the storage coefficient (defined in Subsection 2.3.1.2.2.3.1) is estimated to range from 1×10^{-4} to 1×10^{-3} (Ryder 1996).

The productivity of the aquifer system is directly related to the thickness of the sands in the aquifer system that contain freshwater. The thickness of the aggregated sand within the aquifer ranges from 0 feet at the updip limit of the aquifer system to as much as 2000 feet in the east. Estimated values of transmissivity are reported to range from approximately 5000 to 35,000 feet^2/day (37,000 to 261,800 gallons per day per foot or "gpd/ft") (Ryder 1996).

Groundwater quality in the Gulf Coast aquifer in the vicinity of Victoria County is generally characterized as good northeast of the San Antonio River but declines to the southwest due to increased chloride concentrations and salt water intrusion near the coast (Chowdhury et al. Feb 2006). The Gulf Coast aquifer has not been declared a sole source aquifer (SSA) by the EPA (U.S. EPA Jan 2008). A SSA is defined as the sole or principal source of drinking water that supplies 50% or more of drinking water for an area, with no reasonably available alternative source should the aquifer become contaminated. Figure 2.3.1-21 shows the location of SSAs in EPA Region 6 which encompasses the VCS site. The nearest Texas SSA is the Edwards I and II aquifer system, which is located approximately 150 miles northwest of the VCS site (U.S. EPA 2008).

The identified SSAs are beyond the boundaries of the local and regional hydrogeologic systems associated with the VCS site. Therefore, the VCS site is not expected to impact the SSAs.

2.3.1.2.1.3 Local Hydrogeology

Victoria County covers an area of approximately 893 square miles and is bounded by Jackson County to the east, DeWitt County to the north, Goliad County to the west, and Calhoun and Refugio Counties to the south. Much of the land use in Victoria County is agriculture (26% rangeland and 42% cropland and pasture) or urban development (3.5%). Surface water covers only a small portion of the land surface in Victoria County (0.01% bays and estuaries, 0.13% streams and canals and 0.21% reservoirs and lakes), which highlights the importance of groundwater for stock watering, irrigation, and water supply in the area (Uddameri Jan 2008).

Groundwater usage in Victoria County is under the jurisdiction of the Victoria County Groundwater Conservation District (VCGCD). The VCGCD is currently in the process of formulating rules and a groundwater management plan as described in Subsection 2.3.2.1. The estimated groundwater usage in Victoria County in 1997 was approximately 27,500 acre-feet per year (24.5 million gallons per day [mgd]). Groundwater demand has subsequently decreased because the city of Victoria shifted to using surface water for most of its needs in 2000. Current groundwater usage is estimated to be approximately 20,000 acre-feet per year (17.8 mgd). The estimated surface water usage in Victoria

County in 1997 was approximately 29,000 acre-feet per year (25.9 mgd), with the largest user group being manufacturing (Uddameri Jan 2008).

As described in Subsection 2.3.1.1, the Guadalupe and San Antonio Rivers, Linn Lake, San Antonio Bay, and Kuy Creek are the major surface water bodies in Victoria County. Many ephemeral streams are also present in Victoria County, with stream flow largely influenced by precipitation. Victoria County is situated in a humid, subtropical climate characterized by mild winters and hot summers and is subject to tropical disturbances from the Gulf of Mexico (Uddameri Jan 2008).

A water balance in Victoria County was performed using the average annual precipitation in Victoria County from 1951 to 1980, which was approximately 39 inches, and the corresponding average annual runoff, which was approximately 7 inches. The remaining 32 inches of precipitation evaporated, was transpired by plants, or percolated into the subsurface to recharge the shallow aquifers (Ryder 1996).

The surficial soils in Victoria County tend to limit recharge because they are composed of low-permeability silt and clay intermingled with sand. Recharge in Victoria County is estimated to range from 10,000 acre-feet per year to 30,000 acre-feet per year (8.9 to 26.8 mgd). The northwestern portions of Victoria County exhibit more porous soils and receive higher precipitation, making them more suitable for recharge to the shallow aquifers in the vicinity of the VCS site (Uddameri Jan 2008).

The principal aquifers in Victoria County are the Chicot and Evangeline aquifers, which extend to elevations of approximately –300 feet and –1000 feet (NAVD 88), respectively, in the vicinity of the VCS site, as shown on Figure 2.3.1-20. Regional groundwater flow is generally to the southeast from the recharge areas in the northwestern parts of Victoria County toward the Gulf of Mexico (Figure 2.3.1-22). Groundwater flow is described in more detail in Subsection 2.3.1.2.2.2

The Goliad Sand of the Evangeline aquifer and the Willis Formation, Lissie Formation, Beaumont Formation and Holocene alluvium of the Chicot aquifer are the primary stratigraphic units at the VCS site and surrounding area. The following sections describe the pertinent details of these geologic units.

2.3.1.2.1.3.1 Goliad Sand

The Pliocene Goliad Sand consists of whitish- to pinkish-gray, coarse-grained sediments, including cobbles, clay balls, and wood fragments at the base of the formation. The upper part of the Goliad Sand consists of finer-grained sands cemented together with caliche. The sands of the Goliad Sand are interbedded with grayish clays, which are locally marly. The presence of caliche, gravel, and irregular bedding are indicative of a high-energy fluvial depositional environment in the early Pliocene, followed by periods of semi-aridity later in the Pliocene. The top of the Goliad Sand forms the hydrologic boundary between the Evangeline and Chicot aquifers (Chowdhury and Turco Feb 2006).

2.3.1.2.1.3.2 Willis Formation

The Pleistocene Willis Formation consists of reddish, gravelly, unfossiliferous coarse sand. Sediments of the Willis Formation are fluvial and deltaic deposits in coarsening-upward sequences, indicative of delta-front facies (Chowdhury and Turco Feb 2006).

2.3.1.2.1.3.3 Lissie Formation

The Pleistocene Lissie Formation consists of reddish, orange, and gray, fine- to coarse-grained, cross-bedded sands. The sediments of the Lissie Formation represent sand, silt and mud deposited on flood plains or in river deltas. The undifferentiated Lissie Formation is considered equivalent in age to the Bentley and Montgomery Formations. However, the heterogeneity of the sediments, discontinuity of the beds, and the general absence of index fossils and diagnostic electrical log signatures make correlation of the lithologic units difficult. The undifferentiated Lissie Formation and the Bentley Formation are generally considered the base of the Pleistocene, while the Montgomery Formation is occasionally included in the younger Beaumont Formation (Chowdhury and Turco Feb 2006).

2.3.1.2.1.3.4 Beaumont Formation

The Pleistocene Beaumont Formation consists of poorly bedded, marly, reddish-brown clay interbedded with lenses of sand. Sediments of the Beaumont Formation represent natural levees and deltas deposited largely by rivers and, to a lesser extent, water from shallow-marine and lagoonal bays and embayments. The clays of the Beaumont Formation retard any significant infiltration of rainwater (Chowdhury and Turco Feb 2006).

A total of 11 sand layers and 9 clay layers were identified at the VCS site based on the results of the geotechnical investigation described in detail in FSAR Subsection 2.5.4. The interbedded sands and clays found at the VCS site are consistent with the Beaumont Formation.

2.3.1.2.1.3.5 Holocene Alluvium

The Holocene alluvium consists of fluvial basin and flood plain deposits. The fluvial basin deposits consist of terrace gravels, buried sand deposits, and point bar deposits with grain sizes ranging from clay to gravel. The flat-lying floodplain deposits consist of sand and gravel in the lower part and silt and clay in the upper part. Holocene alluvium occurs in a relatively narrow band surrounding the rivers. The alluvial deposits are typically coarser-grained than the materials found in the Beaumont Formation. Because the alluvial materials are deposited in a channel incised into the Beaumont Formation, it is likely that the alluvium is in contact with the shallow aquifer units in the Beaumont Formation.

The Holocene alluvium occurs locally, cannot be correlated on a regional scale, and is typically included in the Chicot aquifer. The Holocene alluvium exhibits the largest outcrop area of the stratigraphic units in the Texas Gulf Coast and provides a direct hydraulic connection between surface water and groundwater in some cases (Chowdhury and Turco Feb 2006).

2.3.1.2.1.4 Site Specific Hydrogeology

A subsurface investigation was conducted at the VCS site between October 2007 and February 2008 to evaluate soil and groundwater conditions to depths of approximately 600 feet below ground surface (bgs). Subsurface information was collected from more than 200 geotechnical borings, geologic/geophysical borings, cone penetrometer tests (CPTs), shallow test pits, groundwater observation and test wells, and borehole permeameter tests.

Sixty-four groundwater investigation wells were installed within the confines of the VCS site. These included:

- Twenty-seven groundwater observation well pairs (or 54 individual observation wells) installed throughout the site. These wells were completed to depths ranging from approximately 45 to 155 feet bgs and were installed to provide an adequate distribution for determining groundwater flow directions and hydraulic gradients beneath the site. Well pairs were selected to determine vertical gradients between the aquifer subunits. Field hydraulic conductivity tests (slug tests) were conducted in each observation well.
- Two aquifer pumping test well clusters, each consisting of one test well (pumping well) and four water level observation wells. A shallow test well to a depth of approximately 80 feet bgs and a deep test well to a depth of approximately 180 feet bgs were installed. Aquifer pumping tests were conducted at each location.
- Borehole permeameter tests were conducted at 16 borehole locations located within the footprint of the VCS cooling basin and GSWR. Permeameter tests were conducted at a depth of 5 and 10 feet bgs per borehole location.

Well installations began in October 2007 and were completed in February 2008. Monthly water level monitoring began in October 2007 with the installation of the first set of wells. Water level monitoring is being conducted in 62 of the 64 wells installed (excluding the two pumping test wells). Monthly groundwater level measurements collected from the VCS wells between October 2007 and June 2008 are described in the following subsections.

Three aquifer systems were identified at the VCS site based on the subsurface investigation. These include:

- The Shallow aquifer consists of sand layers occurring from existing ground surface to a depth of approximately 120 feet bgs. The Shallow aquifer is further subdivided into the Upper Shallow (from approximately 50 to 80 feet bgs) and Lower Shallow (from 90 to 120 feet bgs) aquifers based on observation well screen intervals. The Upper Shallow and Lower Shallow aquifers are interpreted as components of the Chicot Aquifer.
- The Deep aquifer consists of sand layers occurring from approximately 130 to 280 feet bgs. The Deep aquifer is also interpreted as a component of the Chicot Aquifer.
- The Evangeline aquifer consists of sand layers at depths greater than 500 feet bgs. Observation wells were not installed in the Evangeline aquifer because the groundwater investigation at the VCS site was focused on shallow groundwater conditions.

The Upper Shallow, Lower Shallow and Deep aquifer designations are informal and are based primarily on the hydrogeologic conditions encountered during the subsurface site investigation and the resulting screen intervals of the observation wells. These designations do not necessarily represent hydrologic boundaries.

Figure 2.3.1-23 shows the locations of observation wells used to characterize the Upper Shallow, Lower Shallow and Deep aquifers at the VCS site. Table 2.3.1-22 presents the construction information for the observation wells. The observation wells at the VCS site are named in four series, which represent the location and screen intervals of the observation wells as follows:

- OW identifies groundwater observation wells. TW identifies aquifer pumping tests wells.
  - OW-00 series wells represent the first set of exploratory borings and observation wells installed at the VCS site. With the exception of OW-07U/L, OW-08U/L and OW-10U/L, the remaining OW-00 wells are located in the VCS cooling basin and GSWR area.
  - OW-2100 series wells, with the exception of OW-2185U/L, are located in the VCS Unit 1 facility area.
  - OW-2200 series wells are located in the VCS Unit 2 facility area.
  - OW-2300 series wells identify wells located outside of the power block area. With the exception of OW-2301U/L, OW-2307U/L, OW-2324U/L and OW-2348U/L, these wells are located in the VCS cooling basin and GSWR area.
- A “U” suffix in the observation well name indicates the shallower well of the well pair. The observation well is screened in either the Upper Shallow or Lower Shallow aquifer.
- An “L” suffix in the observation well name indicates the deeper well of the well pair. The observation well is screened in either the Lower Shallow or Deep aquifer.

Correlation between the well identification and hydrogeologic units is presented as follows:

Groundwater Observation Wells

Upper Shallow	Lower Shallow	Deep
OW-01U	OW-01L	–
OW-02U	OW-02L	–
OW-03U	OW-03L	–
OW-04U	OW-04L	–
OW-05U	–	OW-05L
OW-06U	OW-06L	–
OW-07U	–	OW-07L
–	OW-08U	OW-08L
OW-09U	–	OW-09L
OW-10U	–	OW-10L
OW-2150U	–	OW-2150L
OW-2169U	OW-2169L	–
OW-2181U	OW-2181L	–
OW-2185U	OW-2185L	–
OW-2253U	–	OW-2253L
–	OW-2269U	OW-2269L

Groundwater Observation Wells

Upper Shallow	Lower Shallow	Deep
OW-2284U	OW-2284L	–
OW-2301U	–	OW-2301L
–	OW-2302U	OW-2302L
OW-2304U	OW-2304L	–
OW-2307U	OW-2307L	–
–	OW-2319U	OW-2319L
–	OW-2320U	OW-2320L
–	OW-2321U	OW-2321L
–	OW-2324U	OW-2324L
–	OW-2348U	OW-2348L
OW-2352U	OW-2352L	–

Aquifer Pumping Test Well Clusters

Upper Shallow	Lower Shallow	Deep
TW-2320U	–	–
OW-2320-U1	–	–
OW-2320-U2	–	–
OW-2320-U3	–	–
OW-2320-U4	–	–
–	–	TW-2359L
OW-2359-U1	–	OW-2359-L1
–	–	OW-2359-L2
–	–	OW-2359-L3

The results of the geotechnical investigation pertaining to the hydrogeology of the VCS site are described in more detail in Subsection 2.3.1.2.2.3.2. The results of the groundwater investigation are described in more detail in Subsection 2.3.1.2.2.2 through Subsection 2.3.1.2.2.4. The soil boring logs and soil testing data are included in FSAR Subsection 2.5.4 appendices.

2.3.1.2.2 Groundwater Sources

This section contains a description of the historic groundwater levels, groundwater flow direction(s) and gradients, seasonal and long-term variations of groundwater levels, horizontal and vertical permeability and total and effective porosity of the geologic formations beneath the site, reversibility of groundwater flow, the effects of water use on gradients and groundwater levels beneath the site, and groundwater recharge areas. This information has been organized into four subcategories as follows: (1) groundwater flow directions, (2) temporal groundwater trends, (3) aquifer properties, and (4) hydrogeochemical characteristics.

2.3.1.2.2.1 Groundwater Flow Directions

The natural regional flow pattern in the Chicot and Evangeline aquifers is from recharge areas, where the sand layers outcrop at the surface, to discharge areas, which are either at the Gulf of Mexico or the Guadalupe River valley alluvium (for the Chicot Aquifer). The outcrop areas for the Chicot Aquifer sands are considered to be northern Victoria County and those areas north and west of the county. The outcrop areas for the Evangeline Aquifer are considered to be in areas north and west of Victoria County. In the outcrop areas, precipitation falling on the ground surface can infiltrate directly into the sands and recharge the aquifer. Superimposed on this simplistic flow pattern is the influence of pumping within the aquifer. Concentrated pumping areas can alter or reverse the regional flow pattern.

The Holocene alluvium receives recharge from infiltration of precipitation and groundwater flow from the Shallow aquifer sands in the Beaumont Formation. In the vicinity of the site area, flow paths in the alluvium are considered to be short due to the limited surface area. Discharge from the Holocene alluvium contributes to the base flow of the main rivers in the area.

Regional groundwater flow in the Chicot and Evangeline aquifers is generally to the south and east toward the Gulf of Mexico, based on gaging data collected by the TWDB between 2001 and 2005 (Chowdhury et al. Feb 2006). As depicted in Figure 2.3.1-22, localized pumping has caused a decline in water level in some parts of the Gulf Coast aquifer, such as Harris and Kleberg Counties. This pumping has created large cones of depression in these areas, which divert groundwater flow from the Gulf of Mexico to the pumping centers.

As described in Subsection 2.3.1.2.1.4, groundwater observation well pairs were installed at 27 locations (54 individual wells) to investigate groundwater flow directions and horizontal and vertical hydraulic gradients at the VCS site. In addition, the four pumping test observation wells for each of the two test well locations (additional eight wells) were added to the observation well network resulting in 62 groundwater-level monitoring wells.

Monthly groundwater level measurements have been collected from the newly installed observation wells since October 2007 when the first set of wells were installed. By February 2008, all of the site investigation wells had been installed and the first complete set of groundwater levels was collected. Water level measurements from October 2007 through June 2008 are presented on Table 2.3.1-23. Groundwater level measurements collected from the observation wells at the VCS site on February 18, 2008 and May 23, 2008 were used to develop potentiometric surface maps for the Upper Shallow, Lower Shallow and Deep aquifers at the VCS site (Figure 2.3.1-24). The groundwater flow direction at the VCS site in the three aquifers is generally to the east northeast toward the Guadalupe River valley.

The potentiometric surface maps are used to estimate hydraulic gradients at the site. For each map, a flow line is drawn from a contour line of higher groundwater elevation on the western side of the VCS site to a contour line of lower groundwater elevation on the eastern side of the site. The hydraulic gradient along these flow lines is estimated by dividing the change in hydraulic head along the flow line by the length of the flow line. The Upper Shallow aquifer potentiometric surfaces for the February 18,

2008 and May 23, 2008 gaging events correspond to hydraulic gradients of approximately 0.0028 and 0.0015 feet/foot, respectively. The Lower Shallow aquifer potentiometric surfaces for the February 18, 2008 and May 23, 2008 gaging events correspond to hydraulic gradients of approximately 0.0016 feet/foot, respectively. The Deep aquifer potentiometric surfaces for the February 18, 2008 and May 23, 2008 gaging events correspond to hydraulic gradients of approximately 0.0014 and 0.0012 feet/foot, respectively.

The vertical hydraulic gradient (i) is calculated by dividing the difference in hydraulic head between observation wells by the length of the vertical flow path. The vertical flow path length is assumed to be from the midpoint elevation of the upper observation well screen to the midpoint elevation of the lower observation well screen. Table 2.3.1-24 presents the estimated vertical hydraulic gradients. Gaging data collected from most of the observation well pairs indicates a downward flow potential between the Upper Shallow, Lower Shallow, and Deep aquifers zones in the Chicot aquifer. The estimated downward vertical hydraulic gradients at the VCS site range from approximately 0 to 0.19 feet/feet. The following well pairs exhibit an upward gradient: OW-10U/L, OW-2320U/L, and OW-2359U1/L1. Well pairs exhibiting periodic upward gradients are: OW-09U/L and OW-2321U/L. (OW-02U/L, OW-06U/L, OW-7U/L, OW-2348U/L, and OW-2253UL also exhibit periodic upward gradients but these data points have been flagged as suspect readings. The wells exhibiting upward vertical gradients are, in general, located in the eastern section of the site but other wells in the eastern section of the site exhibit a downward gradient, possibly suggesting the influences of heterogeneous conditions.

2.3.1.2.2.2 Temporal Groundwater Trends

As depicted in Figure 2.3.1-25, groundwater levels in Victoria County were on the decline from the 1950s to 2000, until the city of Victoria switched to surface water for much of its needs (Uddameri Jan 2008). Data obtained from the TWDB for three observation wells (well numbers 7924702, 7932602 and 8017502; TWDBb Dec 2007) located near the VCS site was selected to prepare the regional hydrographs shown on Figure 2.3.1-25. Gaging data from these wells was used in the temporal groundwater analysis based on their proximity to the wells at the VCS site.

Well 8017502 is located approximately 6.3 miles northeast of the VCS site and is screened in the Goliad Sand of the Evangeline aquifer to a depth of 1026 feet below ground surface. Historical gaging data from this well indicates that between 1958 and 2000 a decrease in groundwater level occurred. Since 2000, the groundwater level has recovered and has surpassed the 1958 level. As described in Subsection 2.3.1.2.1.3, this coincides with the city of Victoria switching to surface water for much of its needs.

Well 7932602 is located approximately 5.5 miles south of the VCS site and is screened in the Lissie Formation of the Chicot Aquifer to a depth of 595 feet below ground surface (TWDBb Dec 2007). As with well 8017502, historical gaging data from this well indicates that between 1958 and 2000 a decrease in groundwater level occurred. Since 2000, the groundwater level has recovered and has surpassed the 1958 level.

Well 7924702 is located approximately 6.0 miles northwest of the VCS site and is screened in the Chicot aquifer to a depth of 180 feet below ground surface (TWDBb Dec 2007). This well exhibits a generally decreasing water level over the period of record for the well. Groundwater gaging data was not available from this well from 1998 to 2003. Therefore, the relationship, if any, of the decrease in groundwater level in this well to the city of Victoria switching to surface water for its needs in 2000 is unclear.

Figure 2.3.1-26 presents the hydrographs for the first set of the observation wells installed at the VCS site. The hydrographs represent water level measurements in these wells from October 2007 to June 2008. Review of the data suggests that there are several suspect water level readings that deviate from the general water level trend. These suspect readings may result from misreading of the water level device or from conditions in the well that may produce false readings, such as water condensate droplets in the well casing. Excluding the suspect water level measurements, three trends are apparent: (1) A downward trend in water level elevations since October 2007, (2) a rise in water level elevations during the winter months followed by decreasing water level elevations thereafter, (3) or a rather stable water level with minor fluctuations. These hydrographs indicate short-term temporal variations on the order of 1 to 2 feet. As described in Subsection 2.3.1.2.2.1, most of the observation well clusters exhibit a downward vertical hydraulic gradient between aquifer zones with a few of the well pairs exhibiting an upward vertical hydraulic gradient, such as OW-10U/L.

The groundwater potentiometric head beneath the VCS site power block area ranges between elevations of approximately 39 and 48 feet (NAVD 88) (Table 2.3.1-23).

2.3.1.2.2.3 Aquifer Properties

The properties of the aquifers at the VCS site are divided into hydrogeologically- and geotechnically-derived aquifer parameters and are described in detail in Subsections 2.3.1.2.2.3.1 and 2.3.1.2.2.3.2. The hydrogeologically-derived aquifer parameters include transmissivity, storativity and hydraulic conductivity. The geotechnically derived aquifer parameters include bulk density, porosity, and permeability (hydraulic conductivity) from grain size and Guelph permeameter tests.

2.3.1.2.2.3.1 Hydrogeological Parameters

Hydrogeologic field tests conducted at the VCS site included aquifer pumping tests and well slug tests. Aquifer pumping tests were conducted at the VCS site in February 2008 at test well clusters TW-2320 (Upper Shallow aquifer) and TW-2359 (Deep aquifer). Each test consisted of a test well (TW) and four adjacent observation wells. Nearby observation well pairs installed to monitor site groundwater levels were also monitored during the tests. The information obtained during the testing was used to evaluate the transmissivity and storativity of the aquifers.

- Transmissivity is defined as the rate at which a fluid of a specified density and viscosity is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient. Transmissivity is a function of the properties of the fluid, the porous medium, and the thickness of the porous medium.

- Storativity (Storage Coefficient) is defined as the volume of water released from or taken into storage per unit surface area of the aquifer per unit change in head (Fetter 1988).
- Hydraulic conductivity is defined as the coefficient of proportionality that describes flow per unit time under a unit hydraulic gradient through a unit area of a porous medium and is a function of the properties of the fluid and the porous medium (Fetter 1988). Hydraulic conductivity can be calculated by dividing the transmissivity by the saturated aquifer thickness.

The results of the February 2008 pumping tests are summarized in Table 2.3.1-25. The tests were interpreted using the AQTESOLV™ for Windows version 4.5 software (Duffield 2007) using the Theis and Cooper-Jacob methods incorporated in the software.

The Upper Shallow aquifer pumping test was conducted in the vicinity of observation test well cluster OW-2320, which is located in the approximate center of the cooling basin area. The test well cluster consisted of test well TW-2320U (pumping well) and four observation wells (OW-2320U1 through OW-2320U2), located at distances of approximately 15 to 50 feet from the test wells. Pressure transducers equipped with data loggers were used to measure water level drawdown in the test well and the observation wells and during recovery (completion of pumping). TW-2320U was pumped at a rate of approximately 3.2 gpm for 48 hours. Based on the results presented in Table 2.3.1-25, a transmissivity of approximately 420 feet^2/day, a storage coefficient of approximately 1.4×10^{-5} to 2.0×10^{-5}, and a hydraulic conductivity of approximately 60 feet/day are presented for the aquifer zone at this location.

The Deep aquifer pumping test was located near the northeastern corner of the cooling basin between observation well clusters OW-06, OW-07, and OW-10. The test well cluster consisted of the test well TW-2359L and four observation wells (OW-2359L1 through OW-2320L3 screened in the Deep aquifer and OW-2359U1 screened in the Upper Shallow aquifer). TW-2359L was pumped at a rate of approximately 21 gpm for 24 hours. Based on the results presented in Table 2.3.1-25, a transmissivity of approximately 1810 to 2320 feet^2/day, a storage coefficient of approximately 2.7×10^{-4} to 5.1×10^{-4}, and a hydraulic conductivity of approximately 90 to 116 feet/day (average of 103 feet/day) are presented for the aquifer zone at this location.

Hydraulic conductivity can also be determined from the slug test method, which evaluates the aquifer response to an instantaneous change in water level in a test well. A disadvantage of the slug test method is that it measures hydraulic conductivity only in the immediate vicinity of the test well. However, because the slug test requires minimal equipment and can be performed rapidly, slug tests can be performed in many wells, allowing a determination of spatial variability in hydraulic conductivity.

Slug tests were conducted in 54 observation wells at the VCS site between January 15, 2008 and February 16, 2008. Test results are presented in Table 2.3.1-26. The test results were interpreted using the AQTESOLV™ for Windows version 4.5 software (Duffield 2007). The minimum, maximum and geometric mean hydraulic conductivity values from slug tests for the Upper Shallow, Lower Shallow and Deep aquifer zones at the VCS site are as follows:

Aquifer Zone	Minimum (feet/day)	Maximum (feet/day)	Geometric Mean (feet/day)
Upper Shallow	0.05	87.14	12.29
Lower Shallow	0.01	233.90	24.76
Deep	0.63	147.80	9.60

The data presented in Table 2.3.1-26 suggests large variations in the materials tested, indicative of heterogeneous conditions. The slug test results for the Upper Shallow, Lower Shallow and Deep aquifer zones of the Chicot aquifer were contoured to evaluate spatial trends (Figure 2.3.1-27). The contour maps depict areas of increased hydraulic conductivity in both the Upper and Lower Shallow aquifer zones. The increased hydraulic conductivity zone in the Upper Shallow aquifer zone trends north to south from OW-07U to OW-2304U. The area of increased hydraulic conductivity in the Lower Shallow aquifer zone trends northwest to southeast parallel to Linn Lake between OW-2307L and OW-2348U. An isolated area of increased hydraulic conductivity is also present in the Lower Shallow aquifer zone in the vicinity of OW-2320U. The Deep aquifer zone exhibits a general increase in hydraulic conductivity from west to east across the VCS site and does not appear to have any particular zones of increased hydraulic conductivity.

2.3.1.2.2.3.2 Geotechnical Parameters

The geotechnical investigation component of the subsurface investigation program at the VCS site included the collection of soil samples for field and laboratory determination of soil properties. A summary of the test results related to VCS site hydrogeology, including bulk density, and porosity is presented in Table 2.3.1-27.

Bulk density values for the samples analyzed range from approximately 85 pcf to 127 pcf. The geometric mean bulk density values for the layers analyzed ranges from 99 pcf to 114 pcf.

The permeability (hydraulic conductivity) of the vadose zone was calculated using two methods: (1) through the Guelph permeameter test or (2) through the Hazen approximation using grain size data.

The Guelph permeameter is a constant-head permeameter designed for in situ use in the field. The Guelph permeameter tests were conducted at 16 locations at depths of 5 and 10 feet bgs for a total of 32 tests. The results of the Guelph permeameter tests are summarized in Table 2.3.1-28.

Sands with a D_{10} grain size between 0.1 and 3.0 millimeters can be estimated using the Hazen approximation. This formula is based on empirical studies for the design of sand filters for drinking water. The formula is developed for use in well-sorted sand and application to more poorly-sorted materials will result in over-prediction of permeability (Fetter 1988). A summary of the results of the grain size permeability analyses is presented in Table 2.3.1-29.

Based on the results of the hydraulic conductivity testing, the hydraulic conductivity values derived from grain size, Guelph permeameter tests, aquifer pumping tests and slug tests at the VCS site are within

the range of regional hydraulic conductivity values described in Subsection 2.3.1.2.3.2. Results of the statistical analysis also indicate that the slug tests have the greatest range of hydraulic conductivity.

Porosity is defined as the percentage of rock or soil that is void of material. The effective porosity (or specific yield) is the porosity available for fluid flow and is some fraction of porosity (Fetter 1988). In general terms, the effective porosity of sands or gravels approximates porosity, while the effective porosity of silts and clays is much less than the porosity. Site-specific porosity values for the samples analyzed range from approximately 27% to 50%. The geometric mean porosity values for the layers analyzed ranges from 31% to 43% (Table 2.3.1-29).

Figure 2.3.1-28 (Davis and DeWiest 1966) is a graph that shows the relationship between porosity, specific yield, and specific retention for various median grain sizes and sorting conditions. By interpolating from this graph the effective porosity at the VCS site is estimated to be approximately 22 to 35% for sands (effective porosity is 80% of total porosity) and 19% to 26% for clays (effective porosity is 60% of total porosity).

2.3.1.2.2.4 Hydrogeochemical Characteristics

Regional hydrogeochemical data available for observation wells within 7.5 miles of the VCS site was obtained from TWDBb Dec 2007 and is presented in Table 2.3.1-30. The analytical data was compared with EPA Primary and Secondary Drinking Water Standards (U.S. EPA), and exceedances are identified on the table. The principal exceedances were for total dissolved solids and chloride (Secondary Drinking Water Standards). The data indicates that the highest concentrations of total dissolved solids and chlorides are generally present in the Lissie Formation of the Chicot aquifer.

The VCS site-specific hydrogeochemical data is presented in Table 2.3.1-31, and include 20 samples from the Chicot aquifer. The analytical data was compared with EPA Primary and Secondary Drinking Water Standards and the exceedances are identified in the table. The principal exceedances at the VCS site were total dissolved solids and chloride. The data indicates that total dissolved solids exceedances are present in the Upper Shallow, Lower Shallow and Deep aquifers at the VCS site. Chloride exceedances are present primarily in the Deep aquifer but are also locally present in the Upper Shallow and Lower Shallow aquifers.

Variations in chemical composition can be used to define hydrochemical facies in the groundwater system. The hydrochemical facies are classified by the dominant cations and anions in a groundwater sample. These facies may be shown graphically on a trilinear diagram (Fetter 1988). A trilinear diagram showing the regional and VCS site-specific geochemical data is presented in Figure 2.3.1-29. As depicted in Figure 2.3.1-29, the hydrochemical facies of the Chicot aquifer varies between the Shallow and Deep aquifers. The Shallow aquifer exhibits a range of anions from bicarbonate to chloride, with no dominant cation type. The Deep aquifer, however, exhibits a predominantly calcium-chloride hydrochemical facies. The hydrochemical facies of the Evangeline aquifer is dominated by the sodium cation, with a range of anions from bicarbonate to chloride.

The San Antonio River near McFaddin does not exhibit a dominant cation or anion facies. However, the Guadalupe River at Victoria exhibits a calcium-bicarbonate hydrochemical facies. The difference in facies between the two rivers may be attributed to the proximity of the sampling location on the Guadalupe River to the waste water treatment facility in Victoria.

Comparison of historical and more recent regional hydrogeochemical data presented in Table 2.3.1-30 indicates a general temporal consistency in groundwater chemistry for the individual aquifers present in the site area. This suggests that long-term variations in groundwater chemistry are not likely to occur at the VCS site.

2.3.1.2.3 **Subsurface Pathways**

This section presents the development of a groundwater flow model that was used to represent the subsurface pathways at the VCS site. Subsection 5.2.1.2.2 presents an analysis of a liquid effluent release at VCS using this model.

2.3.1.2.3.1 Groundwater Flow Model

The groundwater flow model is executed under the Groundwater Modeling System (GMS) version 6.5 (Aquaveo 2008). The program consists of a series of pre- and post-processors that feed information to various numerical groundwater flow models developed by others. The groundwater flow model selected for VCS uses a three-dimensional finite-difference groundwater flow model known as MODFLOW-2000 (Harbaugh et al. 2000). This model consists of a main program that directs the execution of the simulation and a series of user selectable packages or modules that: (1) simulate groundwater flow using block-centered (BCF), hydrogeologic unit (HUF), or layer property (LPF) finite-difference approaches, (2) control the solution of the finite-difference equations to represent the system (GMG, LMG, PCG2, SIP1, or SOR1), and (3) simulate boundary conditions, including drains (DRN1), evapotranspiration (EVT1), general head boundaries (GHB1), horizontal flow barriers (HFB1), lakes (LAK3), recharge (RCH1), rivers (RIV1), specified head boundaries (CHD1), streams (STR1), and wells (WEL1). A detailed description of the results of the model are included in Subsection 5.2.1.2.2.

Figure 2.3.1-30 presents a plan view of the model area showing the boundary conditions for the model. The model area was established to take advantage of natural boundary conditions in the site area. Figure 2.3.1-31 is a generalized cross-section running from southwest to northeast across the model area. The section shows the influence of the San Antonio and Guadalupe Rivers and Kuy Creek on the local groundwater flow system. The section also shows the distribution of the seven stratigraphic layers used in the model and their relationship to the geotechnical units and hydrogeologic units. Comparison with site groundwater level measurements plotted on the section shows that layer 1 (“Sand 1” aquifer) is unsaturated in the preconstruction groundwater flow system.

As described in Subsection 2.3.1.2.2.2, the general conceptual model for groundwater flow is from southwest to northeast across the VCS site. It should be noted that although the Guadalupe River is located near the center of the river valley, groundwater discharge is interpreted to occur on the west side of the valley into Linn Lake and a series of sloughs that run along the west side of the valley.

2.3.1.2.3.2 Preconstruction Model Results

Model calibration involved adjustment of input parameters to obtain the best match between observed and simulated groundwater levels resulting in the lowest water balance error. The input parameter with the most uncertainty is the recharge rate because this value is based on regional observations rather than site-specific measurements.

The February 2008 groundwater level elevation data was used in the model to provide starting heads and as calibration targets for model calibration. Figure 2.3.1-24, Sheets 1, 2, and 3 present the potentiometric surface maps for the Upper Shallow, Lower Shallow, and Deep Aquifers for February 2008 measurements. These maps show groundwater flow generally west to east across the VCS site reflecting the influence of the Guadalupe River. The February 2008 data was selected for model calibration because the groundwater level measurements are generally representative of the period of record, and because the number of observations is higher than in prior months.

The results of the calibrated preconstruction model are as follows:

- The best fit to the observed data (February 18, 2008 water level measurements) occurred using a stream channel recharge rate of 0.000055 feet/day, combined with a localized recharge rate of 0.0004 feet/day for the areas interpreted as former stream channels;
- Flow from drains in Kuy and Dry Kuy Creeks = 80 gpm
- Constant head cell outflow into the Guadalupe River Valley = 2870 gpm
- Constant head cell outflow from the San Antonio River Valley = 1720 gpm
- Flow from Sand 1 drains simulating valley wall seeps = 0 gpm
- Seepage from cooling basin through river boundary = 0 gpm

Additional description of the model results is presented in Subsection 5.1.2.

2.3.1.2.4 **References**

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Table 2.3.1-22 (Sheet 1 of 3)
Observation Well Construction Details

Well Number[a]	Hydrogeologic Unit	Northing (ft)[b]	Easting (ft)[b]	Top of Casing Elevation (ft NAVD 88)[b]	Well Diameter (in)	Well Depth (ft bgs)	Top of Screen (ft bgs) [c]	Bottom of Screen (ft bgs) [c]	Top of Screen (ft NAVD 88)[c]	Bottom of Screen (ft NAVD 88) [c]	Top of Filter Pack (ft bgs)	Bottom of Filter Pack (ft bgs)
OW-01L	Lower Shallow	13404252.09	2606686.52	73.74	2	111	100	110	–26.26	–36.26	95	113
OW-01U	Upper Shallow	13404253.64	2606666.85	73.65	2	61	50	60	23.65	13.65	45	63
OW-02L	Lower Shallow	13411520.51	2607869.30	76.53	2	109	98	108	–21.47	–31.47	93	112
OW-02U	Upper Shallow	13411502.39	2607862.19	76.74	2	64	53	63	23.74	13.74	48	66
OW-03L	Lower Shallow	13414918.69	2609286.61	76.67	2	98	87	97	–10.33	–20.33	82	100
OW-03U	Upper Shallow	13414934.48	2609294.86	77.05	2	54	43	53	34.05	24.05	38	56
OW-04L	Lower Shallow	13414268.74	2607440.23	80.67	2	111	100	110	–19.33	–29.33	95	113
OW-04U	Upper Shallow	13414280.51	2607428.57	81.08	2	86	75	85	6.08	-3.92	70	88
OW-05L	Deep	13414774.22	2605813.28	79.90	2	131	120	130	–40.10	–50.10	115	135
OW-05U	Upper Shallow	13414770.21	2605832.08	79.55	2	57	46	56	33.55	23.55	41	60
OW-06L	Lower Shallow	13415889.64	2604964.90	81.55	2	96	85	95	–3.45	–13.45	80	99
OW-06U	Upper Shallow	13415875.58	2604966.94	80.77	2	64	53	63	27.77	17.77	48	66
OW-07L	Deep	13418420.52	2606531.28	79.04	4	124	113	123	–33.96	–43.96	108	127
OW-07U	Upper Shallow	13418421.40	2606542.01	79.02	2	64	53	63	26.02	16.02	48	66
OW-08L	Deep	13415818.85	2598942.49	84.07	4	138	127	137	–42.93	–52.93	122	140
OW-08U	Lower Shallow	13415801.21	2598934.58	83.88	2	101	90	100	–6.12	–16.12	85	103
OW-09L	Deep	13414937.42	2604893.58	80.00	2	121	110	125	–30.00	–45.00	105	125
OW-09U	Upper Shallow	13414956.05	2604894.51	79.24	2	61	50	60	29.24	19.24	45	61
OW-10L	Deep	13418486.44	2604760.99	79.88	2	138	127	137	–47.12	–57.12	122	141
OW-10U	Upper Shallow	13418474.37	2604768.43	79.53	2	59	48	58	31.53	21.53	43	62
OW-02150L	Deep	13412552.91	2599585.12	82.45	2	151.15	140	150	–57.55	–67.55	135	152
OW-2150U	Upper Shallow	13412568.08	2599582.77	82.78	2	66.15	55	65	27.78	17.78	50	67
OW-2169L	Lower Shallow	13412356.74	2599930.20	81.72	2	101	90	100	–8.28	–18.28	85	102
OW-2169U	Upper Shallow	13412343.77	2599945.85	81.77	2	66	55	65	26.77	16.77	50	67
OW-2181L	Lower Shallow	13412138.42	2600071.96	81.32	2	101	90	100	–8.68	–18.68	85	102
OW-2181U	Upper Shallow	13412147.38	2600052.86	81.31	2	51	40	50	41.31	31.31	35	52

Table 2.3.1-22 (Sheet 2 of 3)
Observation Well Construction Details

Well Number[a]	Hydrogeologic Unit	Northing (ft)[b]	Easting (ft)[b]	Top of Casing Elevation (ft NAVD 88)[b]	Well Diameter (in)	Well Depth (ft bgs)	Top of Screen (ft bgs) [c]	Bottom of Screen (ft bgs) [c]	Top of Screen (ft NAVD 88)[c]	Bottom of Screen (ft NAVD 88) [c]	Top of Filter Pack (ft bgs)	Bottom of Filter Pack (ft bgs)
OW-2185L	Lower Shallow	13412314.47	2600815.69	81.36	2	101	90	100	–8.64	–18.64	85	102
OW-2185U	Upper Shallow	13412328.07	2600801.11	81.45	2	76	65	75	16.45	6.45	60	77
OW-2253L	Deep	13413591.55	2600474.37	82.66	2	146	135	145	–52.34	–62.34	130	147
OW-2253U	Upper Shallow	13413584.76	2600494.74	82.82	2	66	55	65	27.82	17.82	50	67
OW-2269L	Deep	13413123.29	2600574.23	82.55	2	141.15	130	140	–47.45	–57.45	125	143
OW-2269U	Lower Shallow	13413110.10	2600589.08	82.43	2	91.15	80	90	2.43	–7.57	75	92
OW-2284 L	Lower Shallow	13413063.71	2600939.04	82.74	2	111.06	100	110	–17.26	–7.26	95	112
OW-2284 U	Upper Shallow	13413055.14	2600956.60	82.62	2	76.07	65	75	17.62	7.62	60	77
OW-2301 L	Deep	13414429.77	2596268.29	83.19	2	141	130	140	–46.81	–56.81	125	142
OW-2301 U	Upper Shallow	13414430.08	2596288.46	83.27	2	61	50	60	33.27	23.27	45	62
OW-2302 L	Deep	13407382.11	2598388.94	81.95	2	151	140	150	–58.05	–68.05	135	152
OW-2302 U	Lower Shallow	13407361.50	2598388.47	81.99	2	96	85	95	–3.01	–13.01	80	97
OW-2304 L	Lower Shallow	13396528.12	2608678.06	69.73	2	96	85	95	–15.27	–25.27	80	97
OW-2304 U	Upper Shallow	13396542.39	2608679.35	70.10	2	51	40	50	30.10	20.10	35	52
OW-2307 L	Lower Shallow	13420879.09	2603152.12	78.56	2	111	100	110	–21.44	–31.44	95	112
OW-2307 U	Upper Shallow	13420896.73	2603164.23	78.59	2	66	52	62	26.59	16.59	47	64
OW-2319 L	Deep	13403611.30	2603051.83	76.05	2	156	145	155	–68.95	–78.95	140	157
OW-2319 U	Lower Shallow	13403590.40	2603046.21	75.97	2	96	85	95	–9.03	–19.03	80	97
OW-2320 L	Deep	13407580.88	2606834.36	73.19	2	151	140	150	–66.81	–76.81	135	152
OW-2320 U	Lower Shallow	13407569.51	2606849.70	73.50	2	111	100	110	–26.50	–36.50	95	112
OW-2321 L	Deep	13410955.46	2610027.59	73.54	2	151	140	150	–66.46	–76.46	135	152
OW-2321 U	Lower Shallow	13410943.58	2610040.96	73.27	2	111	100	110	–26.73	–36.73	95	112
OW-2324 L	Deep	13416300.52	2612217.00	26.27	2	126	115	125	–88.73	–98.73	110	127
OW-2324 U	Lower Shallow	13416316.54	2612203.23	26.17	2	46	35	45	–8.83	–18.83	30	47
OW-2348 L	Deep	13409617.75	2621644.36	52.70	2	145	134	144	–81.30	–91.30	129	146
OW-2348 U	Lower Shallow	13409636.31	2621660.58	52.12	2	81	70	80	–17.88	–27.88	65	82
OW-2352 L	Lower Shallow	13402468.45	2617518.54	64.60	2	91	80	90	–15.40	–25.40	75	92

Table 2.3.1-22 (Sheet 3 of 3)
Observation Well Construction Details

Well Number[a]	Hydrogeologic Unit	Northing (ft)[b]	Easting (ft)[b]	Top of Casing Elevation (ft NAVD 88)[b]	Well Diameter (in)	Well Depth (ft bgs)	Top of Screen (ft bgs) [c]	Bottom of Screen (ft bgs) [c]	Top of Screen (ft NAVD 88)[c]	Bottom of Screen (ft NAVD 88) [c]	Top of Filter Pack (ft bgs)	Bottom of Filter Pack (ft bgs)
OW-2352 U	Upper Shallow	13402470.61	2617538.69	64.47	2	56	45	55	19.47	9.47	40	57
TW-2320	Upper Shallow	13407428.59	2607105.51	72.72	6	82	55[4]	80[4]	17.72[d]	–7.28[d]	50	82
OW-2320 U1	Upper Shallow	13407445.66	2607080.05	72.90	2	81	60	80	12.90	–7.10	55	82
OW-2320 U2	Upper Shallow	13407436.76	2607093.25	72.92	2	81	60	80	12.92	–7.08	55	82
OW-2320 U3	Upper Shallow	13407448.17	2607121.37	72.84	2	81	60	80	12.84	–7.16	55	82
OW-2320 U4	Upper Shallow	13407466.49	2607138.42	72.91	2	81	60	80	12.91	–7.09	55	82
TW-2359	Deep	13417241.41	2605450.48	79.88	6	182	150	180	–70.12	–100.12	145	182
OW-2359 L1	Deep	13417263.65	2605470.56	79.36	2	176	155	175	–75.64	–95.64	150	177
OW-2359 L2	Deep	13417259.76	2605433.37	78.93	2	176	155	175	–76.07	–96.07	150	177
OW-2359 L3	Deep	13417278.58	2605416.18	78.83	2	176	155	175	–76.17	–96.17	150	177
OW-2359 U1	Upper Shallow	13417252.64	2605460.64	79.29	2	96	85	95	–5.71	–15.71	80	97

bgs = below ground surface
OW = Observation Well
TW = Aquifer Test Well
[a]"L" suffix wells are the lower well in well pair, installed in Lower Shallow or Deep aquifer zones. "U" suffix wells are the upper well in well pairs, installed in Upper Shallow or Lower Shallow aquifer zones.
[b]Coordinates based on the North American Datum of 1927 (NAD 27) and elevations based on National American Vertical Datum of 1988 (NAVD 88).
[c]Observation well screens are 0.020 in slot width.
[d]Well screen interval contains a 5-ft casing blank at 65 to 70 feet bgs.

Table 2.3.1-23 (Sheet 1 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
OW-01L	73.74	Lower	25-Oct-07	12:28	42.39	31.35
—	—	—	17-Nov-07	9:37	42.39	31.35
—	—	—	18-Dec-07	16:33	42.51	31.23
—	—	—	30-Jan-08	9:16	42.77	30.97
—	—	—	18-Feb-08	10:20	42.94	30.80
—	—	—	31-Mar-08	10:51	42.99	30.75
—	—	—	26-Apr-08	14:12	42.41[c]	31.33
—	—	—	23-May-08	12:31	43.32	30.42
—	—	—	17-Jun-08	11:24	43.57	30.17
OW-01U	73.65	Upper	25-Oct-07	12:33	41.46	32.19
—	—	—	17-Nov-07	9:34	41.45	32.20
—	—	—	18-Dec-07	16:30	41.56	32.09
—	—	—	30-Jan-08	9:14	41.97	31.68
—	—	—	18-Feb-08	10:19	42.19	31.46
—	—	—	31-Mar-08	10:50	42.18	31.47
—	—	—	26-Apr-08	14:11	41.91[c]	31.74
—	—	—	23-May-08	12:28	42.52	31.13
—	—	—	17-Jun-08	11:20	42.72	30.93
OW-02L	76.53	Lower	25-Oct-07	12:16	51.36	25.17
—	—	—	17-Nov-07	9:26	51.21	25.32
—	—	—	18-Dec-07	16:20	51.12	25.41
—	—	—	30-Jan-08	9:30	51.21	25.32
—	—	—	18-Feb-08	10:48	51.31	25.22
—	—	—	31-Mar-08	10:29	51.32	25.21
—	—	—	26-Apr-08	12:54	50.81[c]	25.72
—	—	—	23-May-08	11:37	51.66	24.87
—	—	—	17-Jun-08	10:26	51.87	24.66
OW-02U	76.74	Upper	25-Oct-07	12:19	51.49	25.25
—	—	—	17-Nov-07	9:29	51.35	25.39
—	—	—	18-Dec-07	16:22	51.19	25.55
—	—	—	30-Jan-08	9:28	51.25	25.49
—	—	—	18-Feb-08	10:46	51.35	25.39
—	—	—	31-Mar-08	10:28	51.29	25.45
—	—	—	26-Apr-08	12:56	51.46	25.28
—	—	—	23-May-08	11:30	51.58	25.16
—	—	—	17-Jun-08	10:24	51.80	24.94
OW-03L	76.67	Lower	25-Oct-07	12:02	55.63	21.04
—	—	—	17-Nov-07	9:15	55.73	20.94

Table 2.3.1-23 (Sheet 2 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	18-Dec-07	16:13	55.88	20.79
—	—	—	30-Jan-08	9:39	56.17	20.50
—	—	—	18-Feb-08	10:55	56.31	20.36
—	—	—	31-Mar-08	10:20	56.47	20.20
—	—	—	26-Apr-08	12:46	56.69	19.98
—	—	—	23-May-08	11:19	56.69	19.98
—	—	—	17-Jun-08	10:17	57.11	19.56
OW-03U	77.05	Upper	25-Oct-07	12:06	55.96	21.09
—	—	—	17-Nov-07	9:18	55.04	22.01
—	—	—	18-Dec-07	16:16	DRY	NA
—	—	—	30-Jan-08	9:40	DRY	NA
—	—	—	18-Feb-08	10:53	DRY	NA
—	—	—	31-Mar-08	10:19	DRY	NA
—	—	—	26-Apr-08	12:45	DRY	NA
—	—	—	23-May-08	11:23	DRY	NA
—	—	—	17-Jun-08	10:19	DRY	NA
OW-04L	80.67	Lower	25-Oct-07	11:55	56.69	23.98
—	—	—	17-Nov-07	9:07	56.61	24.06
—	—	—	18-Dec-07	16:09	56.54	24.13
—	—	—	30-Jan-08	9:49	56.75	23.92
—	—	—	18-Feb-08	11:02	56.91	23.76
—	—	—	31-Mar-08	10:10	56.98	23.69
—	—	—	26-Apr-08	12:41	57.22	23.45
—	—	—	23-May-08	11:10	57.22	23.45
—	—	—	17-Jun-08	10:06	57.57	23.10
OW-04U	81.08	Upper	25-Oct-07	11:49	56.15	24.93
—	—	—	17-Nov-07	9:04	56.02	25.06
—	—	—	18-Dec-07	16:07	56.06	25.02
—	—	—	30-Jan-08	9:47	56.20	24.88
—	—	—	18-Feb-08	11:00	56.32	24.76
—	—	—	31-Mar-08	10:09	56.44	24.64
—	—	—	26-Apr-08	12:39	56.70	24.38
—	—	—	23-May-08	11:12	56.70	24.38
—	—	—	17-Jun-08	10:08	57.03	24.05
OW-05L	79.9	Deep	17-Nov-07	8:57	53.02	26.88
—	—	—	18-Dec-07	16:03	52.97	26.93
—	—	—	30-Jan-08	9:58	53.05	26.85
—	—	—	18-Feb-08	11:08	53.21	26.69
—	—	—	31-Mar-08	10:04	53.25	26.65

Table 2.3.1-23 (Sheet 3 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	26-Apr-08	12:34	53.52	26.38
—	—	—	23-May-08	11:04	53.52	26.38
—	—	—	17-Jun-08	10:06	53.93	25.97
OW-05U	79.55	Upper	25-Oct-07	11:44	52.71	26.84
—	—	—	17-Nov-07	9:00	52.48	27.07
—	—	—	18-Dec-07	16:02	52.31	27.24
—	—	—	30-Jan-08	9:56	52.33	27.22
—	—	—	18-Feb-08	11:06	52.45	27.10
—	—	—	31-Mar-08	10:03	52.50	27.05
—	—	—	26-Apr-08	12:36	52.75	26.80
—	—	—	23-May-08	11:02	52.75	26.80
—	—	—	25-Oct-07	0.48	53.17	26.73
—	—	—	17-Jun-08	10:03	53.06	26.49
OW-06L	81.55	Lower	25-Oct-07	11:12	54.46	27.09
—	—	—	17-Nov-07	8:47	54.25	27.30
—	—	—	18-Dec-07	15:50	53.86[c]	27.69
—	—	—	30-Jan-08	10:15	54.22	27.33
—	—	—	18-Feb-08	11:23	54.34	27.21
—	—	—	31-Mar-08	9:55	54.41	27.14
—	—	—	26-Apr-08	12:21	54.22[c]	27.33
—	—	—	23-May-08	10:48	54.82	26.73
—	—	—	17-Jun-08	9:55	55.02	26.53
OW-06U	80.77	Upper	25-Oct-07	11:18	53.59	27.18
—	—	—	17-Nov-07	8:49	53.38	27.39
—	—	—	18-Dec-07	15:51	53.20	27.57
—	—	—	30-Jan-08	10:12	53.23	27.54
—	—	—	18-Feb-08	11:22	53.35	27.42
—	—	—	31-Mar-08	9:53	53.43	27.34
—	—	—	26-Apr-08	12:23	53.66	27.11
—	—	—	23-May-08	10:45	53.66	27.11
—	—	—	17-Jun-08	9:53	54.02	26.75
OW-07L	79.04	Deep	25-Oct-07	11:00	57.78	21.26
—	—	—	17-Nov-07	8:39	57.88	21.16
—	—	—	18-Dec-07	15:50	53.86[c]	25.18
—	—	—	30-Jan-08	10:25	58.17	20.87
—	—	—	18-Feb-08	11:50	58.33	20.71
—	—	—	31-Mar-08	9:20	58.41	20.63
—	—	—	26-Apr-08	11:44	58.68	20.36
—	—	—	23-May-08	10:17	58.88	20.16

Table 2.3.1-23 (Sheet 4 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	17-Jun-08	9:17	59.14	19.90
OW-07U	79.02	Upper	25-Oct-07	11:04	58.02	21.00
—	—	—	17-Nov-07	8:42	57.99	21.03
—	—	—	18-Dec-07	15:42	55.98[c]	23.04
—	—	—	30-Jan-08	10:24	58.17	20.85
—	—	—	18-Feb-08	11:48	58.30	20.72
—	—	—	31-Mar-08	9:18	58.39	20.63
—	—	—	26-Apr-08	11:42	58.55	20.47
—	—	—	23-May-08	10:14	58.66	20.36
—	—	—	17-Jun-08	9:13	58.81	20.21
OW-08L	84.07	Deep	25-Oct-07	10:00	49.75	34.32
—	—	—	17-Nov-07	8:17	49.98	34.09
—	—	—	18-Dec-07	15:23	50.10	33.97
—	—	—	30-Jan-08	11:07	50.08	33.99
—	—	—	18-Feb-08	12:40	50.16	33.91
—	—	—	31-Mar-08	8:55	50.30	33.77
—	—	—	26-Apr-08	9:56	50.69	33.38
—	—	—	23-May-08	9:00	51.02	33.05
—	—	—	17-Jun-08	8:46	51.39	32.68
OW-08U	83.88	Lower	25-Oct-07	10:03	46.26	37.62
	—	—	17-Nov-07	8:21	46.24	37.64
	—	—	18-Dec-07	15:26	46.36	37.52
	—	—	30-Jan-08	11:05	46.49	37.39
	—	—	18-Feb-08	12:38	46.64	37.24
	—	—	31-Mar-08	8:53	46.79	37.09
	—	—	26-Apr-08	9:54	46.98	36.90
	—	—	23-May-08	8:55	47.25	36.63
	—	—	17-Jun-08	8:43	47.60	36.28
OW-09L	80.00	Deep	25-Oct-07	11:26	52.19	27.81
			17-Nov-07	8:53	51.91	28.09
			18-Dec-07	15:56	51.82	28.18
			30-Jan-08	10:06	51.97	28.03
—	—	—	18-Feb-08	11:14	52.13	27.87
—	—	—	31-Mar-08	9:59	52.10	27.90
—	—	—	26-Apr-08	12:29	46.74[c]	33.26
—	—	—	23-May-08	10:55	52.58	27.42
—	—	—	17-Jun-08	9:59	52.75	27.25
OW-09U	79.24	Upper	25-Oct-07	11:32	51.77	27.47
—	—	—	17-Nov-07	8:51	51.37	27.87

Table 2.3.1-23 (Sheet 5 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	18-Dec-07	15:55	50.83	28.41
—	—	—	30-Jan-08	10:04	51.31	27.93
—	—	—	18-Feb-08	11:13	51.46	27.78
—	—	—	31-Mar-08	9:58	51.32	27.92
—	—	—	26-Apr-08	12:28	51.71	27.53
—	—	—	23-May-08	10:52	51.77	27.47
—	—	—	17-Jun-08	9:57	51.93	27.31
OW-10L	79.88	Deep	25-Oct-07	10:45	54.52	25.36
—	—	—	17-Nov-07	8:31	54.76	25.12
—	—	—	18-Dec-07	15:35	54.81	25.07
—	—	—	30-Jan-08	10:35	54.80	25.08
—	—	—	18-Feb-08	12:16	54.98	24.90
—	—	—	31-Mar-08	9:13	55.15	24.73
—	—	—	26-Apr-08	11:33	53.61[c]	26.27
—	—	—	23-May-08	9:36	56.00	23.88
—	—	—	17-Jun-08	9:05	56.54	23.34
OW-10U	79.53	Upper	25-Oct-07	10:50	57.24	22.29
—	—	—	17-Nov-07	8:34	57.04	22.49
—	—	—	18-Dec-07	15:37	56.92	22.61
—	—	—	30-Jan-08	10:33	57.00	22.53
—	—	—	18-Feb-08	12:14	57.04	22.49
—	—	—	31-Mar-08	9:11	56.83	22.70
—	—	—	26-Apr-08	11:35	56.91	22.62
—	—	—	23-May-08	9:32	56.90	22.63
—	—	—	17-Jun-08	9:07	56.95	22.58
OW-2150L	82.45	Deep	30-Jan-08	13:46	48.01	34.44
—	—	—	18-Feb-08	13:27	47.90	34.55
—	—	—	31-Mar-08	8:15	47.87	34.58
—	—	—	26-Apr-08	10:40	48.11	34.34
—	—	—	23-May-08	18:09	48.29	34.16
—	—	—	17-Jun-08	15:18	48.61	33.84
OW-2150U	82.78	Upper	30-Jan-08	13:43	36.49	46.29
—	—	—	18-Feb-08	13:26	36.70	46.08
—	—	—	31-Mar-08	8:13	36.51	46.27
—	—	—	26-Apr-08	10:38	36.73	46.05
—	—	—	23-May-08	18:07	36.93	45.85
—	—	—	17-Jun-08	15:16	37.17	45.61
OW-2169L	81.72	Lower	30-Jan-08	13:52	44.58	37.14
—	—	—	18-Feb-08	14:42	44.76	36.96

Table 2.3.1-23 (Sheet 6 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	31-Mar-08	8:24	44.91	36.81
—	—	—	26-Apr-08	10:44	45.15	36.57
—	—	—	23-May-08	18:15	45.40	36.32
—	—	—	17-Jun-08	15:25	45.72	36.00
OW-2169U	81.77	Upper	30-Jan-08	13:54	38.29	43.48
—	—	—	18-Feb-08	14:40	38.59	43.18
—	—	—	31-Mar-08	8:20	38.40	43.37
—	—	—	26-Apr-08	10:46	38.71	43.06
—	—	—	23-May-08	18:17	38.82	42.95
—	—	—	17-Jun-08	15:29	39.19	42.58
OW-2181L	81.32	Lower	30-Jan-08	14:00	44.87	36.45
—	—	—	18-Feb-08	14:04	44.74	36.58
—	—	—	31-Mar-08	8:29	44.78	36.54
—	—	—	26-Apr-08	10:51	44.86	36.46
—	—	—	23-May-08	18:23	44.91	36.41
—	—	—	17-Jun-08	15:33	45.06	36.26
OW-2181U	81.31	Upper	30-Jan-08	13:58	38.07	43.24
—	—	—	18-Feb-08	13:51	38.46	42.85
—	—	—	31-Mar-08	8:27	38.27	43.04
—	—	—	26-Apr-08	10:50	38.60	42.71
—	—	—	23-May-08	18:21	38.67	42.64
—	—	—	17-Jun-08	15:30	39.05	42.26
OW-2185L	81.36	Lower	30-Jan-08	14:17	45.54	35.82
—	—	—	18-Feb-08	14:16	45.72	35.64
—	—	—	31-Mar-08	8:37	45.88	35.48
—	—	—	26-Apr-08	11:02	46.13	35.23
—	—	—	23-May-08	18:34	46.38	34.98
—	—	—	17-Jun-08	15:55	46.69	34.67
OW-2185U	81.45	Upper	30-Jan-08	14:15	41.64	39.81
—	—	—	18-Feb-08	14:15	41.76	39.69
—	—	—	31-Mar-08	8:35	41.77	39.68
—	—	—	26-Apr-08	10:59	41.96	39.49
—	—	—	23-May-08	18:30	42.19	39.26
—	—	—	17-Jun-08	15:57	42.54	38.91
OW-2253L	82.66	Deep	30-Jan-08	13:11[b]	34.35[c]	48.31
—	—	—	18-Feb-08	14:49[b]	34.82[c]	47.84
—	—	—	31-Mar-08	7:43	49.52	33.14
—	—	—	26-Apr-08	10:29	49.82	32.84
—	—	—	23-May-08	17:56	50.10	32.56

Table 2.3.1-23 (Sheet 7 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	17-Jun-08	16:08	50.51	32.15
OW-2253U	82.82	Upper	30-Jan-08	13:09[b]	49.23[c]	33.59
—	—	—	18-Feb-08	14:48[b]	49.39[c]	33.43
—	—	—	31-Mar-08	7:41	34.48	48.34
—	—	—	26-Apr-08	10:27	34.65	48.17
—	—	—	23-May-08	17:58	35.68	47.14
—	—	—	17-Jun-08	16:10	36.14	46.68
OW-2269L	82.55	Deep	30-Jan-08	13:21	48.87	33.68
—	—	—	18-Feb-08	15:03	48.99	33.56
—	—	—	31-Mar-08	7:50	49.12	33.43
—	—	—	26-Apr-08	10:16	49.42	33.13
—	—	—	23-May-08	17:47	49.70	32.85
—	—	—	17-Jun-08	15:43	50.07	32.48
OW-2269U	82.43	Lower	30-Jan-08	13:18	46.70	35.73
—	—	—	18-Feb-08	15:00	46.88	35.55
—	—	—	31-Mar-08	7:53	47.02	35.41
—	—	—	26-Apr-08	10:12	47.25	35.18
—	—	—	23-May-08	17:50	47.55	34.88
—	—	—	17-Jun-08	15:40	47.84	34.59
OW-2284L	82.74	Lower	30-Jan-08	13:28	47.40	35.34
—	—	—	18-Feb-08	15:09	47.58	35.16
—	—	—	31-Mar-08	8:03	47.73	35.01
—	—	—	26-Apr-08	10:06	47.96	34.78
—	—	—	23-May-08	17:34	48.27	34.47
—	—	—	17-Jun-08	15:50	48.55	34.19
OW-2284U	82.62	Upper	30-Jan-08	13:25	38.13	44.49
—	—	—	18-Feb-08	15:07	38.32	44.3
—	—	—	31-Mar-08	8:01	38.18	44.44
—	—	—	26-Apr-08	10:08	38.21	44.41
—	—	—	23-May-08	17:38	38.62	44.00
	—	—	17-Jun-08	15:52	38.94	43.68
OW-2301L	83.19	Deep	18-Feb-08	7:39	44.84	38.35
—	—	—	31-Mar-08	7:16	44.97	38.22
—	—	—	26-Apr-08	9:19	45.23	37.96
—	—	—	23-May-08	17:21	45.51	37.68
—	—	—	17-Jun-08	8:31	45.88	37.31
OW-2301U	83.27	Upper	18-Feb-08	7:37	33.03	50.24
—	—	—	31-Mar-08	7:14	32.95	50.32
—	—	—	26-Apr-08	9:15	33.07	50.2

Table 2.3.1-23 (Sheet 8 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	23-May-08	17:18	33.27	50.00
—	—	—	17-Jun-08	8:34	33.60	49.67
OW-2302L	81.95	Deep	18-Feb-08	7:54	44.94	37.01
—	—	—	31-Mar-08	7:27	45.02	36.93
—	—	—	26-Apr-08	9:37	45.27	36.68
—	—	—	23-May-08	8:31	45.48	36.47
—	—	—	17-Jun-08	11:44	45.88	36.07
OW-2302U	81.99	Lower	18-Feb-08	7:53	43.10	38.89
—	—	—	31-Mar-08	7:26	43.22	38.77
—	—	—	26-Apr-08	9:39	43.49	38.50
—	—	—	23-May-08	8:37	43.70	38.29
—	—	—	17-Jun-08	11:46	44.12	37.87
OW-2304L	69.73	Lower	18-Feb-08	8:33	42.26	27.47
—	—	—	31-Mar-08	11:11	42.28	27.45
—	—	—	26-Apr-08	16:04	42.41	27.32
—	—	—	23-May-08	15:58	42.79	26.94
—	—	—	17-Jun-08	13:29	42.94	26.79
OW-2304U	70.1	Upper	18-Feb-08	8:31	33.96	36.14
—	—	—	31-Mar-08	11:10	34.17	35.93
—	—	—	26-Apr-08	16:05	34.37	35.73
—	—	—	23-May-08	16:00	34.57	35.53
—	—	—	17-Jun-08	13:31	34.84	35.26
OW-2307L	78.56	Lower	30-Jan-08	10:47	51.54	27.02
—	—	—	18-Feb-08	12:31	51.75	26.81
—	—	—	31-Mar-08	9:05	51.92	26.64
—	—	—	26-Apr-08	11:26	52.35	26.21
—	—	—	23-May-08	9:25	52.53	26.03
—	—	—	17-Jun-08	8:55	53.46	25.10
OW-2307U	78.59	Upper	30-Jan-08	10:44	45.77	32.82
—	—	—	18-Feb-08	12:29	45.91	32.68
—	—	—	31-Mar-08	9:03	46.09	32.50
—	—	—	26-Apr-08	11:23	46.32	32.27
—	—	—	23-May-08	9:20	46.45	32.14
—	—	—	17-Jun-08	8:57	46.59	32.00
OW-2319L	76.05	Deep	30-Jan-08	9:00	42.37	33.68
—	—	—	18-Feb-08	8:13	41.54	34.51
—	—	—	31-Mar-08	11:01	42.31	33.74
—	—	—	26-Apr-08	14:22	37.44[c]	38.61
—	—	—	23-May-08	12:42	42.71	33.34

Table 2.3.1-23 (Sheet 9 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	17-Jun-08	12:02	43.19	32.86
OW-2319U	75.97	Lower	30-Jan-08	9:01	40.62	35.35
—	—	—	18-Feb-08	8:11	40.74	35.23
—	—	—	31-Mar-08	11:00	40.84	35.13
—	—	—	26-Apr-08	14:25	41.02	34.95
—	—	—	23-May-08	12:49	41.23	34.74
—	—	—	17-Jun-08	12:04	41.63	34.34
OW-2320L	73.19	Deep	30-Jan-08	8:10	43.02	30.17
—	—	—	18-Feb-08	10:28	43.14	30.05
—	—	—	31-Mar-08	10:35	43.24	29.95
—	—	—	26-Apr-08	13:54	43.51	29.68
—	—	—	23-May-08	16:20	43.68	29.51
—	—	—	17-Jun-08	10:41	44.07	29.12
OW-2320U	73.5	Lower	30-Jan-08	8:09	44.59	28.91
—	—	—	18-Feb-08	10:27	44.69	28.81
—	—	—	31-Mar-08	10:34	44.70	28.80
—	—	—	26-Apr-08	13:52	44.86	28.64
—	—	—	23-May-08	16:17	45.02	28.48
—	—	—	17-Jun-08	10:44	45.24	28.26
OW-2320U1	72.9	Upper	30-Jan-08	8:03	43.52	29.38
—	—	—	18-Feb-08	10:33	43.65	29.25
—	—	—	31-Mar-08	10:45	43.62	29.28
—	—	—	26-Apr-08	13:57	43.79	29.11
—	—	—	23-May-08	12:08	43.90	29.00
—	—	—	17-Jun-08	10:35	44.09	28.81
OW-2320U2	72.92	Upper	30-Jan-08	8:04	43.53	29.39
—	—	—	18-Feb-08	10:35	43.69	29.23
—	—	—	31-Mar-08	10:44	43.65	29.27
—	—	—	26-Apr-08	14:00	43.8	29.12
—	—	—	23-May-08	12:11	43.93	28.99
—	—	—	17-Jun-08	10:33	44.10	28.82
OW-2320U3	72.84	Upper	30-Jan-08	8:00	43.58	29.26
—	—	—	18-Feb-08	10:37	43.72	29.12
—	—	—	31-Mar-08	10:42	43.69	29.15
—	—	—	26-Apr-08	14:02	42.89	29.95
—	—	—	23-May-08	12:14	43.97	28.87
—	—	—	17-Jun-08	10:37	44.15	28.69
OW-2320U4	72.91	Upper	30-Jan-08	8:01	43.79	29.12
—	—	—	18-Feb-08	10:39	43.91	29.00

Table 2.3.1-23 (Sheet 10 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
—	—	—	31-Mar-08	10:41	43.89	29.02
—	—	—	26-Apr-08	14:05	40.87[c]	32.04
—	—	—	23-May-08	12:21	44.14	28.77
—	—	—	17-Jun-08	10:39	44.35	28.56
OW-2321L	73.54	Deep	18-Feb-08	9:58	51.68	21.86
—	—	—	31-Mar-08	12:17	51.79	21.75
—	—	—	26-Apr-08	13:31	52.02	21.52
—	—	—	23-May-08	11:57	52.28	21.26
—	—	—	17-Jun-08	11:06	52.68	20.86
OW-2321U	73.27	Lower	18-Feb-08	9:56	51.70	21.57
—	—	—	31-Mar-08	12:16	51.70	21.57
—	—	—	26-Apr-08	13:29	51.86	21.41
—	—	—	23-May-08	11:55	52.01	21.26
—	—	—	17-Jun-08	11:04	52.17	21.10
OW-2324L	26.27	Deep	18-Feb-08	12:03	11.79	14.48
—	—	—	31-Mar-08	9:29	11.99	14.28
—	—	—	26-Apr-08	11:52	12.13	14.14
—	—	—	23-May-08	10:03	13.08	13.19
—	—	—	17-Jun-08	9:28	13.84	12.43
OW-2324U	26.17	Lower	18-Feb-08	12:02	11.28	14.89
—	—	—	31-Mar-08	9:28	11.38	14.79
—	—	—	26-Apr-08	11:53	11.54	14.63
—	—	—	23-May-08	9:58	12.44	13.73
—	—	—	17-Jun-08	9:25	13.26	12.91
OW-2348L	52.7	Deep	18-Feb-08	9:31	39.53	13.17
—	—	—	31-Mar-08	11:55	39.73	12.97
—	—	—	26-Apr-08	15:04	39.31[c]	13.39
—	—	—	23-May-08	13:24	40.66	12.04
—	—	—	17-Jun-08	14:15	41.20	11.50
OW-2348U	52.12	Lower	18-Feb-08	9:29	39.06	13.06
—	—	—	31-Mar-08	11:54	39.17	12.95
—	—	—	26-Apr-08	14:55	39.12	13.00
—	—	—	23-May-08	13:32	40.02	12.10
—	—	—	17-Jun-08	14:18	40.63	11.49
OW-2352L	64.6	Lower	18-Feb-08	9:03	45.17	19.43
—	—	—	31-Mar-08	11:39	45.09	19.51
—	—	—	26-Apr-08	15:30	45.19	19.41
—	—	—	23-May-08	13:56	45.21	19.39
—	—	—	17-Jun-08	13:55	45.36	19.24

Table 2.3.1-23 (Sheet 11 of 11)
VCS Site Monthly Groundwater Levels

Well Number	Reference Elevation (NAVD 88)	Hydrogeologic Unit[a]	Date	Time	DTW (ftbtc)	Water Elevation (ft NAVD 88)
OW-2352U	64.47	Upper	18-Feb-08	9:02	45.09	19.38
—	—	—	31-Mar-08	11:38	45.00	19.47
—	—	—	26-Apr-08	15:32	45.08	19.39
—	—	—	23-May-08	13:54	45.13	19.34
—	—	—	17-Jun-08	13:57	45.27	19.20
OW-2359L1	79.36	Deep	18-Feb-08	11:42	54.54	24.82
—	—	—	31-Mar-08	9:44	54.72	24.64
—	—	—	26-Apr-08	12:11	53.72[c]	25.64
—	—	—	23-May-08	16:49	55.52	23.84
—	—	—	17-Jun-08	9:50	56.02	23.34
OW-2359L2	78.93	Deep	18-Feb-08	11:38	54.12	24.81
—	—	—	31-Mar-08	9:46	54.30	24.63
—	—	—	26-Apr-08	12:07	52.40[c]	26.53
—	—	—	23-May-08	16:59	55.12	23.81
—	—	—	17-Jun-08	9:41	55.61	23.32
OW-2359L3	78.83	Deep	18-Feb-08	11:36	53.89	24.94
—	—	—	31-Mar-08	9:47	54.05	24.78
—	—	—	26-Apr-08	12:05	52.12[c]	26.71
—	—	—	23-May-08	16:56	54.84	23.99
—	—	—	17-Jun-08	9:44	55.37	23.46
OW-2359U1	79.29	Upper	18-Feb-08	11:40	55.01	24.28
—	—	—	31-Mar-08	9:45	55.09	24.20
—	—	—	26-Apr-08	12:09	55.29	24.00
—	—	—	23-May-08	16:47	55.45	23.84
—	—	—	17-Jun-08	9:47	55.67	23.62

DTW = Depth to water
ft NAVD 88 = feet North American Vertical Datum 1988
ftbtc = feet below top of casing
N/A = Not Applicable
[a]Upper = Upper Shallow aquifer; Lower = Lower Shallow aquifer; and Deep = Deep aquifer
[b]Wells OW-2253U/L were mislabeled, sounding of the total depth of the wells on 31-Mar-08 indicated that the well numbers were reversed
[c]Shaded areas indicate an anomaly or suspect measurement reading

Table 2.3.1-24 (Sheet 1 of 7)
Estimated Vertical Hydraulic Gradients at the VCS Site

Well Pair	Date	Upper Well Top of Screen (ft NAVD 88)[a]	Upper Well Bottom of Screen (ft NAVD 88)[a]	Upper Well Midpoint of Screen Elevation (ft NAVD 88)	Upper Well Water Elevation (ft NAVD 88)[b]	Lower Well Top of Screen (ft NAVD 88)[a]	Lower Well Bottom of Screen (ft NAVD 88)[a]	Lower Well Midpoint of Screen Elevation (ft NAVD 88)	Lower Well Water Elevation (ft NAVD 88)[b]	*d*x (ft)	*d*h (ft)	*i* (ft/ft)[c]
OW-01U/L	25-Oct-07	23.65	13.65	18.65	32.19	–26.26	–36.26	–31.26	31.35	49.91	0.84	0.02
	17-Nov-07	23.65	13.65	18.65	32.20	–26.26	–36.26	–31.26	31.35	49.91	0.85	0.02
	18-Dec-07	23.65	13.65	18.65	32.09	–26.26	–36.26	–31.26	31.23	49.91	0.86	0.02
	30-Jan-08	23.65	13.65	18.65	31.68	–26.26	–36.26	–31.26	30.97	49.91	0.71	0.01
	18-Feb-08	23.65	13.65	18.65	31.46	–26.26	–36.26	–31.26	30.80	49.91	0.66	0.01
	31-Mar-08	23.65	13.65	18.65	31.47	–26.26	–36.26	–31.26	30.75	49.91	0.72	0.01
	26-Apr-08[d]	23.65	13.65	18.65	31.74	–26.26	–36.26	–31.26	31.33	49.91	0.41	0.01
	23-May-08	23.65	13.65	18.65	31.13	–26.26	–36.26	–31.26	30.42	49.91	0.71	0.01
	17-Jun-08	23.65	13.65	18.65	30.93	–26.26	–36.26	–31.26	30.17	49.91	0.76	0.02
OW-02U/L	25-Oct-07	23.74	13.74	18.74	25.25	–21.47	–31.47	–26.47	25.17	45.21	0.08	0.00
	17-Nov-07	23.74	13.74	18.74	25.39	–21.47	–31.47	–26.47	25.32	45.21	0.07	0.00
	18-Dec-07	23.74	13.74	18.74	25.55	–21.47	–31.47	–26.47	25.41	45.21	0.14	0.00
	30-Jan-08	23.74	13.74	18.74	25.49	–21.47	–31.47	–26.47	25.32	45.21	0.17	0.00
	18-Feb-08	23.74	13.74	18.74	25.39	–21.47	–31.47	–26.47	25.22	45.21	0.17	0.00
	31-Mar-08	23.74	13.74	18.74	25.45	–21.47	–31.47	–26.47	25.21	45.21	0.24	0.01
	26-Apr-08[d]	23.74	13.74	18.74	25.28	–21.47	–31.47	–26.47	25.72	45.21	–0.44	–0.01
	23-May-08	23.74	13.74	18.74	25.16	–21.47	–31.47	–26.47	24.87	45.21	0.29	0.01
	17-Jun-08	23.74	13.74	18.74	24.94	–21.47	–31.47	–26.47	24.66	45.21	0.28	0.01
OW-03U/L	25-Oct-07	34.05	24.05	29.05	21.09	–10.33	–20.33	–15.33	21.04	44.38	0.05	0.00
	17-Nov-07	34.05	24.05	29.05	22.01	–10.33	–20.33	–15.33	20.94	44.38	1.07	0.02
	18-Dec-07	34.05	24.05	29.05	NA	–10.33	–20.33	–15.33	20.79	44.38	NA	NA
	30-Jan-08	34.05	24.05	29.05	NA	–10.33	–20.33	–15.33	20.50	44.38	NA	NA
	18-Feb-08	34.05	24.05	29.05	NA	–10.33	–20.33	–15.33	20.36	44.38	NA	NA
	31-Mar-08	34.05	24.05	29.05	NA	–10.33	–20.33	–15.33	20.20	44.38	NA	NA
	26-Apr-08	34.05	24.05	29.05	NA	–10.33	–20.33	–15.33	19.98	44.38	NA	NA
	23-May-08	34.05	24.05	29.05	NA	–10.33	–20.33	–15.33	19.98	44.38	NA	NA
	17-Jun-08	34.05	24.05	29.05	NA	–10.33	–20.33	–15.33	19.56	44.38	NA	NA

Table 2.3.1-24 (Sheet 2 of 7)
Estimated Vertical Hydraulic Gradients at the VCS Site

Well Pair	Date	Upper Well Top of Screen (ft NAVD 88)[a]	Upper Well Bottom of Screen (ft NAVD 88)[a]	Upper Well Midpoint of Screen Elevation (ft NAVD 88)	Upper Well Water Elevation (ft NAVD 88)[b]	Lower Well Top of Screen (ft NAVD 88)[a]	Lower Well Bottom of Screen (ft NAVD 88)[a]	Lower Well Midpoint of Screen Elevation (ft NAVD 88)	Lower Well Water Elevation (ft NAVD 88)[b]	*d*x (ft)	*d*h (ft)	*i* (ft/ft)[c]
OW-04U/L	25-Oct-07	6.08	–3.92	1.08	24.93	–19.33	–29.33	–24.33	23.98	25.41	0.95	0.04
	17-Nov-07	6.08	–3.92	1.08	25.06	–19.33	–29.33	–24.33	24.06	25.41	1.00	0.04
	18-Dec-07	6.08	–3.92	1.08	25.02	–19.33	–29.33	–24.33	24.13	25.41	0.89	0.04
	30-Jan-08	6.08	–3.92	1.08	24.88	–19.33	–29.33	–24.33	23.92	25.41	0.96	0.04
	18-Feb-08	6.08	–3.92	1.08	24.76	–19.33	–29.33	–24.33	23.76	25.41	1.00	0.04
	31-Mar-08	6.08	–3.92	1.08	24.64	–19.33	–-29.33	–24.33	23.69	25.41	0.95	0.04
	26-Apr-08	6.08	–3.92	1.08	24.38	–19.33	–29.33	–24.33	23.45	25.41	0.93	0.04
	23-May-08	6.08	–3.92	1.08	24.38	–19.33	–29.33	–24.33	23.45	25.41	0.93	0.04
	17-Jun-08	6.08	–3.92	1.08	24.05	–19.33	–29.33	–24.33	23.10	25.41	0.95	0.04
OW-05U/L	25-Oct-07	33.55	23.55	28.55	26.84	–40.10	–50.10	–45.10	26.73	73.65	0.11	0.00
	17-Nov-07	33.55	23.55	28.55	27.07	–40.10	–50.10	–45.10	26.88	73.65	0.19	0.00
	18-Dec-07	33.55	23.55	28.55	27.24	–40.10	–50.10	–45.10	26.93	73.65	0.31	0.00
	30-Jan-08	33.55	23.55	28.55	27.22	–40.10	–50.10	–45.10	26.85	73.65	0.37	0.01
	18-Feb-08	33.55	23.55	28.55	27.10	–40.10	–50.10	–45.10	26.69	73.65	0.41	0.01
	31-Mar-08	33.55	23.55	28.55	27.05	–40.10	–50.10	–45.10	26.65	73.65	0.40	0.01
	26-Apr-08	33.55	23.55	28.55	26.80	–40.10	–50.10	–45.10	26.38	73.65	0.42	0.01
	23-May-08	33.55	23.55	28.55	26.80	–40.10	–50.10	–45.10	26.38	73.65	0.42	0.01
	17-Jun-08	33.55	23.55	28.55	26.49	–40.10	–50.10	–45.10	25.97	73.65	0.52	0.01
OW-06U/L	25-Oct-07	27.77	17.77	22.77	27.18	–3.45	–13.45	–8.45	27.09	31.22	0.09	0.00
	17-Nov-07	27.77	17.77	22.77	27.39	–3.45	–13.45	–8.45	27.30	31.22	0.09	0.00
	18-Dec-07[d]	27.77	17.77	22.77	27.57	–3.45	–13.45	–8.45	27.69	31.22	–0.12	0.00
	30-Jan-08	27.77	17.77	22.77	27.54	–3.45	–13.45	–8.45	27.33	31.22	0.21	0.01
	18-Feb-08	27.77	17.77	22.77	27.42	–3.45	–13.45	–8.45	27.21	31.22	0.21	0.01
	31-Mar-08	27.77	17.77	22.77	27.34	–3.45	–13.45	–8.45	27.14	31.22	0.20	0.01
	26-Apr-08[d]	27.77	17.77	22.77	27.11	–3.45	–13.45	–8.45	27.33	31.22	-0.22	-0.01
	23-May-08	27.77	17.77	22.77	27.11	–3.45	–13.45	–8.45	26.73	31.22	0.38	0.01
	17-Jun-08	27.77	17.77	22.77	26.75	–3.45	–13.45	–8.45	26.53	31.22	0.22	0.01
OW-07U/L	25-Oct-07	26.02	16.02	21.02	21.00	–33.96	–43.96	–38.96	21.26	59.98	–0.26	0.00

Table 2.3.1-24 (Sheet 3 of 7)
Estimated Vertical Hydraulic Gradients at the VCS Site

Well Pair	Date	Upper Well Top of Screen (ft NAVD 88)[a]	Upper Well Bottom of Screen (ft NAVD 88)[a]	Upper Well Midpoint of Screen Elevation (ft NAVD 88)	Upper Well Water Elevation (ft NAVD 88)[b]	Lower Well Top of Screen (ft NAVD 88)[a]	Lower Well Bottom of Screen (ft NAVD 88)[a]	Lower Well Midpoint of Screen Elevation (ft NAVD 88)	Lower Well Water Elevation (ft NAVD 88)[b]	*dx* (ft)	*dh* (ft)	*i* (ft/ft)[c]
	17-Nov-07	26.02	16.02	21.02	21.03	–33.96	–43.96	–38.96	21.16	59.98	-0.13	0.00
	18-Dec-07[d]	26.02	16.02	21.02	23.04	–33.96	–43.96	–38.96	25.18	59.98	–2.14	-0.04
	30-Jan-08	26.02	16.02	21.02	20.85	–33.96	–43.96	–38.96	20.87	59.98	-0.02	0.00
	18-Feb-08	26.02	16.02	21.02	20.72	–33.96	–43.96	–38.96	20.71	59.98	0.01	0.00
	31-Mar-08	26.02	16.02	21.02	20.63	–33.96	–43.96	–38.96	20.63	59.98	0.00	0.00
	26-Apr-08	26.02	16.02	21.02	20.47	–33.96	–43.96	–38.96	20.36	59.98	0.11	0.00
	23-May-08	26.02	16.02	21.02	20.36	–33.96	–43.96	–38.96	20.16	59.98	0.20	0.00
	17-Jun-08	26.02	16.02	21.02	20.21	–33.96	–43.96	–38.96	19.90	59.98	0.31	0.01
OW-08U/L	25-Oct-07	-6.12	–16.12	–11.12	37.62	–42.93	–52.93	–47.93	34.32	36.81	3.30	0.09
	17-Nov-07	-6.12	–16.12	–11.12	37.64	–42.93	–52.93	–47.93	34.09	36.81	3.55	0.10
	18-Dec-07	-6.12	–16.12	–11.12	37.52	–42.93	–52.93	–47.93	33.97	36.81	3.55	0.10
	30-Jan-08	-6.12	–16.12	–11.12	37.39	–42.93	–52.93	–47.93	33.99	36.81	3.40	0.09
	18-Feb-08	-6.12	–16.12	–11.12	37.24	–42.93	–52.93	–47.93	33.91	36.81	3.33	0.09
	31-Mar-08	–6.12	–16.12	–11.12	37.09	–42.93	–52.93	–47.93	33.77	36.81	3.32	0.09
	26-Apr-08	–6.12	–16.12	–11.12	36.90	–42.93	–52.93	–47.93	33.38	36.81	3.52	0.10
	23-May-08	–6.12	–16.12	–11.12	36.63	–42.93	–52.93	–47.93	33.05	36.81	3.58	0.10
	17-Jun-08	–6.12	–16.12	–11.12	36.28	–42.93	–52.93	–47.93	32.68	36.81	3.60	0.10
OW-09U/L	25-Oct-07	29.24	19.24	24.24	27.47	–30.00	–45.00	–37.50	27.81	61.74	–0.34	–0.01
	17-Nov-07	29.24	19.24	24.24	27.87	–30.00	–45.00	–37.50	28.09	61.74	–0.22	0.00
	18-Dec-07	29.24	19.24	24.24	28.41	–30.00	–45.00	–37.50	28.18	61.74	0.23	0.00
	30-Jan-08	29.24	19.24	24.24	27.93	–30.00	–45.00	–37.50	28.03	61.74	–0.10	0.00
	18-Feb-08	29.24	19.24	24.24	27.78	–30.00	–45.00	–37.50	27.87	61.74	–0.09	0.00
	31-Mar-08	29.24	19.24	24.24	27.92	–30.00	–45.00	–37.50	27.90	61.74	0.02	0.00
	26-Apr-08[d]	29.24	19.24	24.24	27.53	–30.00	–45.00	–37.50	33.26	61.74	–5.73	–0.09
	23-May-08	29.24	19.24	24.24	27.47	–30.00	–45.00	–37.50	27.42	61.74	0.05	0.00
	17-Jun-08	29.24	19.24	24.24	27.31	–30.00	–45.00	–37.50	27.25	61.74	0.06	0.00
OW-10U/L	25-Oct-07	31.53	21.53	26.53	22.29	–47.12	–57.12	–52.12	25.36	78.65	–3.07	–0.04
	17-Nov-07	31.53	21.53	26.53	22.49	–47.12	–57.12	–52.12	25.12	78.65	–2.63	–0.03
	18-Dec-07	31.53	21.53	26.53	22.61	–47.12	–57.12	–52.12	25.07	78.65	–2.46	–0.03

Table 2.3.1-24 (Sheet 4 of 7)
Estimated Vertical Hydraulic Gradients at the VCS Site

Well Pair	Date	Upper Well Top of Screen (ft NAVD 88)[a]	Upper Well Bottom of Screen (ft NAVD 88)[a]	Upper Well Midpoint of Screen Elevation (ft NAVD 88)	Upper Well Water Elevation (ft NAVD 88)[b]	Lower Well Top of Screen (ft NAVD 88)[a]	Lower Well Bottom of Screen (ft NAVD 88)[a]	Lower Well Midpoint of Screen Elevation (ft NAVD 88)	Lower Well Water Elevation (ft NAVD 88)[b]	*d*x (ft)	*d*h (ft)	*i* (ft/ft)[c]
	30-Jan-08	31.53	21.53	26.53	22.53	–47.12	–57.12	–52.12	25.08	78.65	–2.55	–0.03
	18-Feb-08	31.53	21.53	26.53	22.49	–47.12	–57.12	–52.12	24.90	78.65	–2.41	–0.03
	31-Mar-08	31.53	21.53	26.53	22.70	–47.12	–57.12	–52.12	24.73	78.65	–2.03	–0.03
	26-Apr-08[d]	31.53	21.53	26.53	22.62	–47.12	–57.12	–52.12	26.27	78.65	–3.65	–0.05
	23-May-08	31.53	21.53	26.53	22.63	–47.12	–57.12	–52.12	23.88	78.65	–1.25	–0.02
	17-Jun-08	31.53	21.53	26.53	22.58	–47.12	–57.12	–52.12	23.34	78.65	–0.76	–0.01
OW-2150U/L	30-Jan-08	27.78	17.78	22.78	46.29	–57.55	–67.55	–62.55	34.44	85.33	11.85	0.14
	18-Feb-08	27.78	17.78	22.78	46.08	–57.55	–67.55	–62.55	34.55	85.33	11.53	0.14
	31-Mar-08	27.78	17.78	22.78	46.27	–57.55	–67.55	–62.55	34.58	85.33	11.69	0.14
	26-Apr-08	27.78	17.78	22.78	46.05	–57.55	–67.55	–62.55	34.34	85.33	11.71	0.14
	23-May-08	27.78	17.78	22.78	45.85	–57.55	–67.55	–62.55	34.16	85.33	11.69	0.14
	17-Jun-08	27.78	17.78	22.78	45.61	–57.55	–67.55	–62.55	33.84	85.33	11.77	0.14
OW-2169U/L	30-Jan-08	26.77	16.77	21.77	43.48	–8.28	–18.28	–13.28	37.14	35.05	6.34	0.18
	18-Feb-08	26.77	16.77	21.77	43.18	–8.28	–18.28	–13.28	36.96	35.05	6.22	0.18
	31-Mar-08	26.77	16.77	21.77	43.37	–8.28	–18.28	–13.28	36.81	35.05	6.56	0.19
	26-Apr-08	26.77	16.77	21.77	43.06	–8.28	–18.28	–13.28	36.57	35.05	6.49	0.19
	23-May-08	26.77	16.77	21.77	42.95	–8.28	–18.28	–13.28	36.32	35.05	6.63	0.19
	17-Jun-08	26.77	16.77	21.77	42.58	–8.28	–17.28	–12.78	36.00	34.55	6.58	0.19
OW-2181U/L	30-Jan-08	41.31	31.31	36.31	43.24	–8.68	–18.68	–13.68	36.45	49.99	6.79	0.14
	18-Feb-08	41.31	31.31	36.31	42.85	–8.68	–18.68	–13.68	36.58	49.99	6.27	0.13
	31-Mar-08	41.31	31.31	36.31	43.04	–8.68	–18.68	–13.68	36.54	49.99	6.50	0.13
	26-Apr-08	41.31	31.31	36.31	42.71	–8.68	–18.68	–13.68	36.46	49.99	6.25	0.13
	23-May-08	41.31	31.31	36.31	42.64	–8.68	–18.68	–13.68	36.41	49.99	6.23	0.12
	17-Jun-08	41.31	31.31	36.31	42.26	–8.68	–18.68	–13.68	36.26	49.99	6.00	0.12
OW-2185U/L	30-Jan-08	16.45	6.45	11.45	39.81	–8.64	–18.64	–13.64	35.82	25.09	3.99	0.16
	18-Feb-08	16.45	6.45	11.45	39.69	–8.64	–18.64	–13.64	35.64	25.09	4.05	0.16
	31-Mar-08	16.45	6.45	11.45	39.68	–8.64	–18.64	–13.64	35.48	25.09	4.20	0.17
	26-Apr-08	16.45	6.45	11.45	39.49	–8.64	–18.64	–13.64	35.23	25.09	4.26	0.17
	23-May-08	16.45	6.45	11.45	39.26	–8.64	–18.64	–13.64	34.98	25.09	4.28	0.17

Table 2.3.1-24 (Sheet 5 of 7)
Estimated Vertical Hydraulic Gradients at the VCS Site

Well Pair	Date	Upper Well Top of Screen (ft NAVD 88)[a]	Upper Well Bottom of Screen (ft NAVD 88)[a]	Upper Well Midpoint of Screen Elevation (ft NAVD 88)	Upper Well Water Elevation (ft NAVD 88)[b]	Lower Well Top of Screen (ft NAVD 88)[a]	Lower Well Bottom of Screen (ft NAVD 88)[a]	Lower Well Midpoint of Screen Elevation (ft NAVD 88)	Lower Well Water Elevation (ft NAVD 88)[b]	*dx* (ft)	*dh* (ft)	*i* (ft/ft)[c]
	17-Jun-08	16.45	6.45	11.45	38.91	–8.64	–18.64	–13.64	34.67	25.09	4.24	0.17
OW-2253U/L	30-Jan-08[d]	27.82	17.82	22.82	33.59	–52.34	–62.34	–57.34	48.31	80.16	-14.72	-0.18
	18-Feb-08[d]	27.82	17.82	22.82	33.43	–52.34	–62.34	–57.34	47.84	80.16	-14.41	-0.18
	31-Mar-08	27.82	17.82	22.82	48.34	–52.34	–62.34	–57.34	33.14	80.16	15.20	0.19
	26-Apr-08	27.82	17.82	22.82	48.17	–52.34	–62.34	–57.34	32.84	80.16	15.33	0.19
	23-May-08	27.82	17.82	22.82	47.14	–52.34	–62.34	–57.34	32.56	80.16	14.58	0.18
	17-Jun-08	27.82	17.82	22.82	46.68	–52.34	–62.34	–57.34	32.15	80.16	14.53	0.18
OW-2269U/L	30-Jan-08	2.43	-7.57	-2.57	35.73	–47.45	–57.45	–52.45	33.68	49.88	2.05	0.04
	18-Feb-08	2.43	-7.57	-2.57	35.55	-47.45	–57.45	–52.45	33.56	49.88	1.99	0.04
	31-Mar-08	2.43	-7.57	-2.57	35.41	–47.45	–57.45	–52.45	33.43	49.88	1.98	0.04
	26-Apr-08	2.43	-7.57	-2.57	35.18	–47.45	–57.45	–52.45	33.13	49.88	2.05	0.04
	23-May-08	2.43	-7.57	-2.57	34.88	–47.45	–57.45	–52.45	32.85	49.88	2.03	0.04
	17-Jun-08	2.43	-7.57	-2.57	34.59	–47.45	–57.45	–52.45	32.48	49.88	2.11	0.04
OW-2284U/L	30-Jan-08	17.62	7.62	12.62	44.49	–17.26	–27.26	–22.26	35.34	34.88	9.15	0.26
	18-Feb-08	17.62	7.62	12.62	44.30	–17.26	–27.26	–22.26	35.16	34.88	9.14	0.26
	31-Mar-08	17.62	7.62	12.62	44.44	–17.26	–27.26	–22.26	35.01	34.88	9.43	0.27
	26-Apr-08	17.62	7.62	12.62	44.41	–17.26	–27.26	–22.26	34.78	34.88	9.63	0.28
	23-May-08	17.62	7.62	12.62	44.00	–17.26	–27.26	–22.26	34.47	34.88	9.53	0.27
	17-Jun-08	17.62	7.62	12.62	43.68	–17.26	–27.26	–22.26	34.19	34.88	9.49	0.27
OW-2301U/L	18-Feb-08	33.27	23.27	28.27	50.24	–46.81	–56.81	–51.81	38.35	80.08	11.89	0.15
	31-Mar-08	33.27	23.27	28.27	50.32	–46.81	–-56.81	–51.81	38.22	80.08	12.10	0.15
	26-Apr-08	33.27	23.27	28.27	50.20	–46.81	–56.81	–51.81	37.96	80.08	12.24	0.15
	23-May-08	33.27	23.27	28.27	50.00	–46.81	–-56.81	–51.81	37.68	80.08	12.32	0.15
	17-Jun-08	33.27	23.27	28.27	49.67	–46.81	–56.81	–51.81	37.31	80.08	12.36	0.15
OW-2302U/L	18-Feb-08	–3.01	–13.01	–8.01	38.89	–58.05	–68.05	–63.05	37.01	55.04	1.88	0.03
	31-Mar-08	–3.01	–13.01	–8.01	38.77	–58.05	–68.05	–63.05	36.93	55.04	1.84	0.03
	26-Apr-08	–3.01	–13.01	–8.01	38.50	–58.05	–68.05	–63.05	36.68	55.04	1.82	0.03
	23-May-08	–3.01	–13.01	–8.01	38.29	–58.05	–68.05	–63.05	36.47	55.04	1.82	0.03
	17-Jun-08	–3.01	–13.01	–8.01	37.87	–58.05	–68.05	–63.05	36.07	55.04	1.80	0.03

Table 2.3.1-24 (Sheet 6 of 7)
Estimated Vertical Hydraulic Gradients at the VCS Site

Well Pair	Date	Upper Well Top of Screen (ft NAVD 88)[a]	Upper Well Bottom of Screen (ft NAVD 88)[a]	Upper Well Midpoint of Screen Elevation (ft NAVD 88)	Upper Well Water Elevation (ft NAVD 88)[b]	Lower Well Top of Screen (ft NAVD 88)[a]	Lower Well Bottom of Screen (ft NAVD 88)[a]	Lower Well Midpoint of Screen Elevation (ft NAVD 88)	Lower Well Water Elevation (ft NAVD 88)[b]	*d*x (ft)	*d*h (ft)	*i* (ft/ft)[c]
OW-2304U/L	18-Feb-08	30.10	20.10	25.10	36.14	–15.27	–25.27	–20.27	27.47	45.37	8.67	0.19
	31-Mar-08	30.10	20.10	25.10	35.93	–15.27	–25.27	–20.27	27.45	45.37	8.48	0.19
	26-Apr-08	30.10	20.10	25.10	35.73	–15.27	–25.27	–20.27	27.32	45.37	8.41	0.19
	23-May-08	30.10	20.10	25.10	35.53	–15.27	–25.27	–20.27	26.94	45.37	8.59	0.19
	17-Jun-08	30.10	20.10	25.10	35.26	–15.27	–25.27	–20.27	26.79	45.37	8.47	0.19
OW-2307U/L	30-Jan-08	26.59	16.59	21.59	32.82	–21.44	–31.44	–26.44	27.02	48.03	5.80	0.12
	18-Feb-08	26.59	16.59	21.59	32.68	–21.44	–31.44	–26.44	26.81	48.03	5.87	0.12
	31-Mar-08	26.59	16.59	21.59	32.50	–21.44	–31.44	–26.44	26.64	48.03	5.86	0.12
	26-Apr-08	26.59	16.59	21.59	32.27	–21.44	–31.44	–26.44	26.21	48.03	6.06	0.13
	23-May-08	26.59	16.59	21.59	32.14	–21.44	–31.44	–26.44	26.03	48.03	6.11	0.13
	17-Jun-08	26.59	16.59	21.59	32.00	–21.44	–31.44	–26.44	25.10	48.03	6.90	0.14
OW-2319U/L	30-Jan-08	–9.03	–19.03	–14.03	35.35	–68.95	–78.95	–73.95	29.38	59.92	5.97	0.10
	18-Feb-08	–9.03	–19.03	–14.03	35.23	–68.95	–78.95	–73.95	29.25	59.92	5.98	0.10
	31-Mar-08	–9.03	–19.03	–14.03	35.13	–68.95	–78.95	–73.95	29.28	59.92	5.85	0.10
	26-Apr-08[d]	–9.03	–19.03	–14.03	34.95	–68.95	–78.95	–73.95	29.11	59.92	5.84	0.10
	23-May-08	–9.03	–19.03	–14.03	34.74	–68.95	–78.95	–73.95	29.00	59.92	5.74	0.10
	17-Jun-08	–9.03	–19.03	–14.03	34.34	–68.95	–78.95	–73.95	32.86	59.92	1.48	0.02
OW-2320U/L	30-Jan-08	–26.50	–36.50	–1.50	28.91	–66.81	–76.81	–71.81	30.17	40.31	–1.26	–0.03
	18-Feb-08	–26.50	–36.50	–31.50	28.81	–66.81	–76.81	–71.81	30.05	40.31	–1.24	–0.03
	31-Mar-08	–26.50	–36.50	–31.50	28.80	–66.81	–76.81	–71.81	29.95	40.31	–1.15	–0.03
	26-Apr-08	–26.50	–36.50	–31.50	28.64	–66.81	–76.81	–71.81	29.68	40.31	–1.04	–0.03
	23-May-08	–26.50	–36.50	–31.50	28.48	–66.81	–76.81	–71.81	29.51	40.31	–1.03	–0.03
	17-Jun-08	–26.50	–36.50	–31.50	28.62	–66.81	–76.81	–71.81	29.12	40.31	–0.50	–0.01
OW-2321U/L	18-Feb-08	–26.73	–36.73	–31.73	21.57	–66.46	–76.46	–71.46	21.86	39.73	–0.29	-0.01
	31-Mar-08	–26.73	–36.73	–31.73	21.57	–66.46	–76.46	–71.46	21.75	39.73	–0.18	0.00
	26-Apr-08	–26.73	—36.73	–31.73	21.41	–66.46	–76.46	–71.46	21.52	39.73	–0.11	0.00
	23-May-08	–26.73	–36.73	–31.73	21.26	–66.46	–76.46	–71.46	21.26	39.73	0.00	0.00
	17-Jun-08	–26.73	–36.73	–31.73	21.10	–66.46	–76.46	–71.46	20.86	39.73	0.24	0.01
OW-2324U/L	18-Feb-08	–8.83	–18.83	–13.83	14.89	–88.73	–98.73	–93.73	14.48	79.90	0.41	0.01

Table 2.3.1-24 (Sheet 7 of 7)
Estimated Vertical Hydraulic Gradients at the VCS Site

Well Pair	Date	Upper Well Top of Screen (ft NAVD 88)[a]	Upper Well Bottom of Screen (ft NAVD 88)[a]	Upper Well Midpoint of Screen Elevation (ft NAVD 88)	Upper Well Water Elevation (ft NAVD 88)[b]	Lower Well Top of Screen (ft NAVD 88)[a]	Lower Well Bottom of Screen (ft NAVD 88)[a]	Lower Well Midpoint of Screen Elevation (ft NAVD 88)	Lower Well Water Elevation (ft NAVD 88)[b]	*dx* (ft)	*dh* (ft)	*i* (ft/ft)[c]
	31-Mar-08	–8.83	–18.83	–13.83	14.79	–88.73	–98.73	–93.73	14.28	79.90	0.51	0.01
	26-Apr-08	–8.83	–18.83	–13.83	14.63	–88.73	–98.73	–93.73	14.14	79.90	0.49	0.01
	23-May-08	–8.83	–18.83	–13.83	13.73	–88.73	–98.73	–93.73	13.19	79.90	0.54	0.01
	17-Jun-08	–8.83	–18.83	–13.83	12.91	–88.73	–98.73	–93.73	12.43	79.90	0.48	0.01
OW-2348U/L	18-Feb-08	–17.88	–27.88	–22.88	13.06	–81.30	–91.30	–86.30	13.17	63.42	–0.11	0.00
	31-Mar-08	–17.88	–27.88	–22.88	12.95	–81.30	–91.30	–86.30	12.97	63.42	–0.02	0.00
	26-Apr-08[d]	–17.88	–27.88	–22.88	13.00	–81.30	–91.30	–86.30	13.39	63.42	–0.39	-0.01
	23-May-08	–17.88	–27.88	–22.88	12.10	–81.30	–91.30	–86.30	12.04	63.42	0.06	0.00
	17-Jun-08	–17.88	–27.88	–22.88	11.49	–81.30	–91.30	–86.30	11.50	63.42	–0.01	0.00
OW-2352U/L	18-Feb-08	19.47	9.47	14.47	19.38	–15.40	–25.40	–20.40	19.43	34.87	–0.05	0.00
	31-Mar-08	19.47	9.47	14.47	19.47	–15.40	–25.40	–20.40	19.51	34.87	–0.04	0.00
	26-Apr-08	19.47	9.47	14.47	19.39	–15.40	–25.40	–20.40	19.41	34.87	–0.02	0.00
	23-May-08	19.47	9.47	14.47	19.34	–15.40	–25.40	–20.40	19.39	34.87	–0.05	0.00
	17-Jun-08	19.47	9.47	14.47	19.20	–15.40	–25.40	–20.40	19.24	34.87	–0.04	0.00
OW-2359U1/L1	18-Feb-08	–-5.71	–15.71	–10.71	24.28	–75.64	–95.64	–85.64	24.82	74.93	–0.54	–0.01
	31-Mar-08	–5.71	–15.71	–10.71	24.20	–75.64	–95.64	–85.64	24.64	74.93	–0.44	–0.01
	26-Apr-08[d]	–5.71	–15.71	–10.71	24.00	–75.64	–95.64	–85.64	25.64	74.93	–1.64	–0.02
	23-May-08	–5.71	–15.71	–10.71	23.84	–75.64	–95.64	–85.64	23.84	74.93	0.00	0.00
	17-Jun-08	–5.71	–15.71	–10.71	23.62	–75.64	–95.64	–85.64	23.34	74.93	0.28	0.00

ft NAVD 88 = feet North American Vertical Datum of 1988

[a]From Table 2.3.1-22

[b]From Table 2.3.1-23

[c]A negative vertical hydraulic gradient indicates an upward flow between units.

[d] Shaded areas indicate anomaly or suspect reading.

Table 2.3.1-25 (Sheet 1 of 2)
VCS Site Aquifer Pumping Test Results Summary
TW-2320U 48-Hour Aquifer Pumping Test, February 13 and 14, 2008

Observation Well	Saturated Thickness	Theis Method Transmissivity (ft^2/d)	Theis Method Hydraulic Conductivity (ft/d)	Theis Method Storage Coefficient (unitless)	Cooper-Jacob Method Transmissivity (ft^2/d)	Cooper-Jacob Method Hydraulic Conductivity (ft/d)	Cooper-Jacob Method Storage Coefficient (unitless)
OW-2320U1	7	325.3	46.5	2.61×10^{-5}	471.6	67.4	1.65×10^{-5}
OW-2320U2	7	284.0	40.6	1.68×10^{-5}	370.4	52.9	1.18×10^{-5}
OW-2320U3	7	365.8	52.3	1.98×10^{-5}	422.3	60.3	1.46×10^{-5}
Combination of OW-2320U1 through U3	7	374.0	53.4	1.80×10^{-5}	423.1	60.4	N/A
Combination/Recovery	7	727.9	104.0	N/A	N/A	N/A	N/A
Arithmetic Mean	N/A	415.4	59.3	2.02×10^{-5}	421.9	60.3	1.43×10^{-5}

d = day
ft = feet
Data source: FSAR Appendix 2.5.4-B

Table 2.3.1-25 (Sheet 2 of 2)
VCS Site Aquifer Pumping Test Results Summary
TW-2359L 24-Hour Aquifer Pumping Test, February 4 through 6, 2008

Observation Well	Saturated Thickness	Theis Method Transmissivity (ft^2/d)	Theis Method Hydraulic Conductivity (ft/d)	Theis Method Storage Coefficient (unitless)	Cooper-Jacob Method Transmissivity (ft^2/d)	Cooper-Jacob Method Hydraulic Conductivity (ft/d)	Cooper-Jacob Method Storage Coefficient (unitless)
OW-2359L2	20	2006.3	100.3	8.78×10^{-4}	1402.8	70.1	7.50×10^{-4}
OW-2359L3	20	2452.5	122.6	3.75×10^{-4}	1986.2	99.3	2.73×10^{-4}
Combination of OW-2359L2 and L3	20	2311.6	115.6	2.63×10^{-4}	2032.2	101.6	4.21×10^{-4}
Combination/Recovery	20	2311.6	115.6	N/A	N/A	N/A	N/A
Arithmetic Mean	N/A	2270.5	113.5	5.05×10^{-4}	1807.1	90.4	4.81×10^{-4}

d = day

ft = feet

Data Source: FSAR Appendix 2.5.4-B

Table 2.3.1-26 (Sheet 1 of 3)
VCS Site Slug Test Results

					Hydraulic Conductivity (ft/day)					
	Surface Elevation	Depth	Geologic	Saturated	Falling		Rising		Arithmetic	
Observation Well	(NAVD 88)	(ft)	Unit	Thickness (ft)	Bouwer-Rice	Butler	Bouwer-Rice	Butler	Mean	Notes
OW-01U	71.46	63.00	Upper	10.0	13.97	20.70	37.10	31.69	25.87	
OW-02U	74.68	66.00	Upper	10.0	4.46	11.45	12.62	23.37	12.98	
OW-03U	74.89	56.00	Upper	NA	NA	NA	NA	NA	NA	Dry
OW-04U	78.97	88.13	Upper	3.5	3.34	3.49	1.91	1.81	2.64	
OW-05U	77.56	59.28	Upper	10.0	NA	NA	26.79	31.06	28.93	Missing Falling Head data
OW-06U	78.98	65.98	Upper	7.0	10.63	17.70	23.25	23.08	18.67	
OW-07U	77.39	66.13	Upper	10.0	NA	NA	26.43	87.14	56.79	Missing Falling Head data
OW-09U	77.36	62.85	Upper	10.0	28.71	33.84	26.18	23.02	27.94	
OW-10U	77.69	60.10	Upper	NA	NA	NA	NA	NA	NA	Insufficient water for testing
OW-2150U	80.44	67.05	Upper	9.1	0.05	0.08	2.46	4.46	1.76	
OW-2150U	80.44	67.05	Upper	9.1	0.05	0.07	NA	NA	0.06	Duplicate Test
OW-2150 Average	80.44	67.05	Upper	9.1	0.05	0.08	2.46	4.46	0.91	Well Average
OW-2169U	79.47	68.70	Upper	10.0	14.50	30.15	28.44	30.87	25.99	
OW-2181U	79.24	53.02	Upper	10.0	4.08	13.53	8.95	12.82	9.85	
OW-2185U	79.48	78.24	Upper	4.5	9.92	15.15	10.79	13.86	12.43	
OW-2253U	80.86	68.25	Upper	8.5	10.80	11.58	12.48	15.36	12.56	
OW-2284U	80.42	78.45	Upper	5.0	0.85	0.95	1.37	1.82	1.25	
OW-2284U	80.42	78.45	Upper	5.0	0.58	3.04	NA	NA	1.81	Duplicate Test
OW-2284U Average	80.42	78.45	Upper	5.0	0.72	2.00	1.37	1.82	1.53	Well Average
OW-2301U	81.23	63.00	Upper	7.0	12.29	20.62	14.24	21.46	17.15	
OW-2304U	68.33	54.33	Upper	10.0	60.44	61.99	35.62	53.45	52.88	
OW-2307U	76.75	68.11	Upper	10.0	9.64	10.33	7.13	14.67	10.44	
OW-2352U	62.91	58.60	Upper	10.0	3.78	5.03	11.53	12.79	8.28	
OW-01L	71.46	112.95	Lower	10.0	43.26	73.30	48.94	49.32	53.71	
OW-01L	71.46	112.95	Lower	10.0	33.55	25.72	45.98	59.56	41.20	Duplicate Test
OW-01L Average	71.46	112.95	Lower	10.0	38.41	49.51	47.46	54.44	47.45	Well Average
OW-02L	74.68	109.13	Lower	10.0	23.26	24.84	20.46	36.29	26.21	
OW-03L	74.89	100.00	Lower	10.0	83.66	94.77	120.80	120.80	105.01	

Table 2.3.1-26 (Sheet 2 of 3)
VCS Site Slug Test Results

					Hydraulic Conductivity (ft/day)					
	Surface Elevation	Depth	Geologic	Saturated	Falling		Rising		Arithmetic	
Observation Well	(NAVD 88)	(ft)	Unit	Thickness (ft)	Bouwer-Rice	Butler	Bouwer-Rice	Butler	Mean	Notes
OW-03L	74.89	100.00	Lower	10.0	80.62	96.53	NA	NA	88.58	Duplicate Test
OW-03L Average	74.89	100.00	Lower	10.0	82.14	95.65	120.80	120.80	96.79	Well Average
OW-04L	78.97	113.49	Lower	10.0	4.18	8.40	7.39	11.66	7.91	
OW-06L	78.98	98.62	Lower	10.0	87.21	88.25	31.36	29.45	59.07	
OW-08U	81.71	103.03	Lower	10.0	24.67	39.35	82.12	69.06	53.80	
OW-2169L	79.47	103.20	Lower	10.0	1.07	1.32	36.16	36.52	18.77	
OW-2181L	79.24	99.20	Lower	5.2	0.01	0.03	0.01	0.03	0.02	Multiple sat. thicknesses
OW-2185L	79.48	102.96	Lower	10.0	6.17	8.10	19.40	27.27	15.24	
OW-2269U	80.45	93.35	Lower	9.6	0.79	1.13	2.49	3.41	1.96	
OW-2269U	80.45	93.35	Lower	9.6	1.56	2.25	NA	NA	1.91	Duplicate Test
OW-2269U Average	80.45	93.35	Lower	9.6	1.18	1.69	2.49	3.41	1.93	Well Average
OW-2284L	80.42	113.40	Lower	10.0	26.23	38.88	23.94	35.84	31.22	
OW-2302U	80.32	98.18	Lower	10.0	19.49	42.45	45.01	25.94	33.22	
OW-2302U	80.32	98.18	Lower	10.0	NA	NA	48.96	50.07	49.52	Duplicate Test
OW-2302U Average	80.32	98.18	Lower	10.0	19.49	42.45	46.99	38.01	41.37	Well Average
OW-2304L	68.33	98.44	Lower	5.0	16.58	115.20	55.97	60.49	62.06	
OW-2307L	76.75	113.27	Lower	10.0	10.65	19.05	43.17	63.09	33.99	
OW-2319U	74.16	98.15	Lower	7.0	37.72	58.38	69.49	75.61	60.30	
OW-2320U	71.46	113.35	Lower	10.0	77.06	82.09	110.20	152.50	105.46	
OW-2321U	71.62	113.17	Lower	10.0	12.55	18.51	13.45	18.42	15.73	
OW-2324U	24.47	47.98	Lower	8.0	169.10	233.90	78.51	134.50	154.00	
OW-2324U	24.47	47.98	Lower	8.0	147.30	226.00	130.40	150.30	163.50	Duplicate Test
OW-2324U Average	24.47	47.98	Lower	8.0	158.20	229.95	104.46	142.40	158.75	Well Average
OW-2348U	50.63	83.09	Lower	10.0	95.58	121.50	140.70	167.20	131.25	
OW-2348U	50.63	83.09	Lower	10.0	135.60	185.00	128.90	158.50	152.00	Duplicate Test
OW-2348U Average	50.63	83.09	Lower	10.0	115.59	153.25	134.80	162.85	141.62	Well Average
OW-2352L	62.91	84.90	Lower	10.0	27.26	37.82	42.33	38.63	36.51	
OW-05L	77.56	133.28	Deep	10.0	8.62	12.78	9.04	8.34	9.70	
OW-07L	77.39	126.30	Deep	7.0	11.55	8.15	12.09	13.05	11.21	

Table 2.3.1-26 (Sheet 3 of 3)
VCS Site Slug Test Results

					Hydraulic Conductivity (ft/day)					
	Surface Elevation	Depth	Geologic	Saturated	Falling		Rising		Arithmetic	
Observation Well	(NAVD 88)	(ft)	Unit	Thickness (ft)	Bouwer-Rice	Butler	Bouwer-Rice	Butler	Mean	Notes
OW-08L	81.71	135.60	Deep	10.0	0.63	0.69	0.88	0.87	0.77	
OW-09L	77.36	122.43	Deep	9.0	0.90	1.16	0.91	0.99	0.99	
OW-09L	77.36	122.43	Deep	9.0	NA	NA	5.36	7.94	6.65	Duplicate Test
OW-09L Average	77.36	122.43	Deep	9.0	0.90	1.16	3.14	4.47	3.82	Well Average
OW-10L	77.69	140.66	Deep	10.0	9.82	12.90	14.94	14.89	13.14	
OW-2150L	80.44	153.71	Deep	1.5	2.46	4.10	8.67	16.44	7.92	
OW-2253L	80.86	148.35	Deep	10.0	101.40	105.20	77.25	87.90	92.94	
OW-2253L	80.86	148.35	Deep	10.0	99.76	115.20	NA	NA	107.48	Duplicate Test
OW-2253L	80.86	148.35	Deep	10.0	137.60	147.80	NA	NA	142.70	Triplicate test
OW-2253L Average	80.86	148.35	Deep	10.0	112.92	122.73	77.25	87.90	114.37	Well Average
OW-2269L	80.45	138.52	Deep	9.6	0.63	1.26	1.17	1.50	1.14	
OW-2301L	81.23	143.15	Deep	10.0	26.18	38.14	30.29	42.90	34.38	
OW-2302L	80.32	153.50	Deep	3.0	0.97	1.17	9.16	9.96	9.56	
OW-2319L	74.16	156.80	Deep	10.0	0.78	0.71	0.60	0.60	0.67	
OW-2320L	71.46	153.55	Deep	5.0	10.62	13.74	12.76	17.09	13.55	
OW-2321L	71.62	153.06	Deep	10.0	2.40	3.21	17.81	21.56	11.25	
OW-2324L	24.47	128.17	Deep	10.0	77.00	85.12	48.21	52.80	65.78	
OW-2348L	50.63	148.32	Deep	10.0	86.08	86.70	41.74	62.03	69.14	
OW-2348L	50.63	148.32	Deep	10.0	50.94	49.39	36.72	37.56	43.65	Duplicate Test
		Geometric Mean:		Upper	5.93	9.33	11.87	15.96	12.29	
				Lower	14.00	22.13	54.58	30.75	24.76	
				Deep	5.77	7.07	9.12	10.85	9.60	

Note: Shaded values indicate wells with multiple tests, the results of the tests were averaged and used to calculate the geometric mean.
Data source: FSAR Appendix 2.5.4-B

Table 2.3.1-27 (Sheet 1 of 7)
VCS Aquifer Properties from Laboratory Analyses

Boring No.	Sample No.	Sample Depth (ft)	USCS Symbol	Geotechnical Layer	Initial Dry Unit Weight (pcf)	Bulk Density[a] (pcf)	Initial Void Ratio	Specific Gravity	Initial Moisture Content (%)	Porosity[b] (%)
B-2174UD	UD 1	10-11.7	CL	Clay 1 Top	109.4	110.6	0.53	—	19.5	34.6
B-2182UD	UD-1	10-11.7	CL	Clay 1 Top	113.0	114.1	0.53	2.76	14.0	34.5
B-2269UD	UD-1	10-12	CL	Clay 1 Top	109.7	110.9	—	2.67	17.8	—
B-2269UD	UD-1	10-12	CL	Clay 1 Top	114.4	115.6	0.46	2.67	17.6	31.3
B-2269UD	UD-2	13-15	CH	Clay 1 Top	104.9	106.1	0.58	2.66	23.0	36.8
B-2274UD	UD-1	10.2-11.9	CL	Clay 1 Top	113.8	115.0	—	2.75	16.4	—
B-2274UD	UD-1	10.2-11.9	CL	Clay 1 Top	109.2	110.4	0.57	2.75	19.3	36.4
B-2304UD	UD 2	11-13.3	ML	Clay 1 Top	98.6	99.7	0.74	2.74	11.9	42.4
B-2321UD	UD 3	10.0-11.7	CH	Clay 1 Top	111.9	113.1	—	2.71	16.4	—
B-2321UD	UD 3	10.0-11.7	CH	Clay 1 Top	110.3	111.5	—	—	18.8	—
B-2321UD	UD 5	17.0-18.7	CL	Clay 1 Top	100.2	101.4	—	—	18.8	—
B-2321UD	UD-1	5.2	CL	Clay 1 Top	102.4	103.6	—	2.71	17.4	—
B-2321UD	UD-3	11.35	CH	Clay 1 Top	106.6	107.7	—	2.71	15.4	—
B-2321UD	UD-4	15.15	CH	Clay 1 Top	102.0	103.2	—	2.72	21.8	—
B-2321UD	UD-5	18.7	CL	Clay 1 Top	97.0	98.2	—	2.72	19.5	—
B-2352UD	1	3.5-5.2	CL	Clay 1 Top	111.5	112.7	—	2.7	17.3	—
B-2352UD	3	11.5-13.2	CL	Clay 1 Top	108.8	110.0	—	2.71	18.4	—
B-2352UD	UD 1	3.5-5.2	CL	Clay 1 Top	110.8	112.0	0.52	2.70	18.3	34.3
B-2352UD	UD 3	11.5-13.2	CL	Clay 1 Top	108.7	109.9	0.56	2.71	18.6	35.7
B-2269UD	UD-3	30-32	CL	Sand 1	110.7	111.9	—	2.66	15.4	—
B-2269UD	UD-3	30-32	CL	Sand 1	116.6	117.8	0.42	2.66	15.8	29.7
B-2269UD	UD-4	33-34.8	CL	Sand 1	116.7	117.9	0.47	2.74	15.0	31.9
B-2302UD	UD 3	13.5-16.0	SM	Sand 1	103.3	104.5	—	—	17.4	—
B-2319UD	2	5.5-7.5	SC	Sand 1	116.2	117.3	—	2.73	13.7	—
B-2319UD	UD 2	5.5-7.5	SC	Sand 1	117.1	118.2	0.46	2.73	13.7	31.3
B-2319UD	UD 3	11.0-13.0	SM	Sand 1	102.8	103.9	—	2.72	8.7	—
B-2174UD	UD 2	30-31.7	CH	Clay 1 Bottom	100.5	101.7	0.71	—	24.0	41.5

Table 2.3.1-27 (Sheet 2 of 7)
VCS Aquifer Properties from Laboratory Analyses

Boring No.	Sample No.	Sample Depth (ft)	USCS Symbol	Geotechnical Layer	Initial Dry Unit Weight (pcf)	Bulk Density[a] (pcf)	Initial Void Ratio	Specific Gravity	Initial Moisture Content (%)	Porosity[b] (%)
B-2182UD	UD-5	33-34.7	CH	Clay 1 Bottom	97.2	98.5	0.78	2.77	29.6	43.8
B-2182UD	UD-6	37-38.5	CL	Clay 1 Bottom	111.0	112.2	ND	2.75	16.1	—
B-2269UD	UD-5	50-51.7	CH	Clay 1 Bottom	104.9	106.1	—	2.70	21.5	—
B-2269UD	UD-5	50-51.7	CH	Clay 1 Bottom	103.0	104.2	0.64	2.70	21.8	38.9
B-2319UD	UD 4	25.0-27.0	CH	Clay 1 Bottom	106.5	107.7	—	2.72	20.7	—
B-2319UD	UD 4	25.0-27.0	CH	Clay 1 Bottom	105.3	106.5	—	—	21.4	—
B-2319UD	UD-4	26.65	CH	Clay 1 Bottom	109.1	110.3	—	2.72	19.2	—
B-2321UD	7	38.5-40.2	CH	Clay 1 Bottom	101.9	103.1	—	2.78	21.3	—
B-2321UD	UD 6	28.5-30.2	CH	Clay 1 Bottom	96.4	97.7	—	2.72	25.5	—
B-2321UD	UD 7	38.5-40.2	CH	Clay 1 Bottom	102.8	104.0	—	2.78	21.0	—
B-2321UD	UD 7	38.5-40.2	CH	Clay 1 Bottom	106.6	107.7	0.63	2.78	14.8	38.6
B-2321UD	UD-6	30.2	CH	Clay 1 Bottom	96.1	97.4	—	2.72	23.9	—
B-2321UD	UD-8	49.75	CH	Clay 1 Bottom	92.2	93.4	—	2.72	28.5	—
B-2352UD	5	24.0-25.7	CH	Clay 1 Bottom	94.4	95.7	—	2.67	28.0	—
B-2352UD	UD 5	24-25.7	CH	Clay 1 Bottom	100.7	101.9	0.66	2.67	22.7	39.6
B-2359UD	3	30.8-32.8	CH	Clay 1 Bottom	91	92.3	—	2.78	30.2	—
B-2359UD	UD 5	40.0-41.7	CH	Clay 1 Bottom	103.4	104.6	—	—	22.0	—
B-2359UD	UD-4	36.45	CH	Clay 1 Bottom	103.96	105.2	—	2.73	21.6	—
B-2359UD	UD-5	41.15	CH	Clay 1 Bottom	108.96	110.1	—	2.71	18.4	—
B-2302UD	UD 7	59.0-60.2	SC-SM	Sand 2	106.4	107.6	—	—	20.1	—
B-2302UD	UD 9	63.5-66	SP-SM	Sand 2	103.0	104.2	0.63	2.68	21.1	38.7
B-2319UD	UD 5	35.0-37.0	ML	Sand 2	106.2	107.4	—	2.72	18.8	—
B-2359UD	UD 7	55.0-56.7	ML	Sand 2	108.4	109.5	0.53	2.65	14.3	34.6
B-2174UD	UD 3	75-76.7	CL	Clay 3	117.1	118.3	0.47	—	15.8	32.0
B-2182UD	UD-7	65-66.7	SC	Clay 3	95.4	96.6	—	2.74	20.9	—
B-2182UD	UD-7	65-66.7	SC	Clay 3	93.3	94.6	0.84	2.74	25.0	45.5
B-2269UD	UD-7	70-71.7	CH	Clay 3	84.4	85.7	—	2.72	36.6	—
B-2269UD	UD-7	70-71.7	CH	Clay 3	95.5	96.8	0.78	2.72	28.3	43.7

Table 2.3.1-27 (Sheet 3 of 7)
VCS Aquifer Properties from Laboratory Analyses

Boring No.	Sample No.	Sample Depth (ft)	USCS Symbol	Geotechnical Layer	Initial Dry Unit Weight (pcf)	Bulk Density[a] (pcf)	Initial Void Ratio	Specific Gravity	Initial Moisture Content (%)	Porosity[b] (%)
B-2269UD	UD-8	73-74.7	CH	Clay 3	100.6	101.8	0.66	2.67	22.4	39.6
B-2274UD	UD-4	67-68.7	CH	Clay 3	89.24	90.6	—	2.76	32.6	—
B-2274UD	UD-4	67-68.7	CH	Clay 3	93.6	94.9	0.84	2.76	28.1	45.7
B-2302UD	11	69.5-71.5	CH	Clay 3	96.8	98.1	—	2.74	24.2	—
B-2302UD	UD 10	66.0-68.5	CH	Clay 3	103.7	104.9	—	—	22.5	—
B-2302UD	UD 11	69.5-71.5	CH	Clay 3	101.0	102.2	0.69	2.74	18.5	40.9
B-2302UD	UD-12	80.2	CH	Clay 3	101.6	102.8	—	2.68	20.9	—
B-2304UD	7	73.5-75.5	MH	Clay 3	92.6	93.9	—	2.78	29.8	—
B-2304UD	UD 7	73.5-75.5	MH	Clay 3	92.3	93.6	0.9	2.78	27.6	46.8
B-2304UD	UD 8	83.5-85.5	CH	Clay 3	90.8	92.1	—	—	30.9	—
B-2304UD	UD-8	85.3	CH	Clay 3	90.8	92.1	—	2.71	29.6	—
B-2319UD	8	75-77	SP-SM	Clay 3	96.6	97.9	—	2.73	25.3	—
B-2319UD	UD 6	55.0-57.0	ML	Clay 3	91.9	93.2	—	2.71	30.7	—
B-2319UD	UD 7	65.0-67.0	CL	Clay 3	103.4	104.6	—	—	20.1	—
B-2319UD	UD 8	75.0-77.0	SP-SM	Clay 3	98.7	99.9	0.73	2.73	24.6	42.1
B-2319UD	UD-7	66.6	CL	Clay 3	103.2	104.4	—	2.66	18.8	—
B-2321UD	UD 9	58.5-61.0	CL	Clay 3	106.6	107.8	—	—	20.0	—
B-2321UD	UD-10	65.05	CL	Clay 3	116.5	117.6	—	2.67	13.7	—
B-2321UD	UD-9	59.45	CL	Clay 3	104.0	105.2	—	2.68	19.3	—
B-2352UD	UD 8	68.0-69.4	SM	Clay 3	107.3	108.4	0.56	2.68	14.4	35.9
B-2359UD	UD 10	70.0-71.7	CH	Clay 3	114.1	115.3	—	—	16.6	—
B-2359UD	UD-10	71.6	CH	Clay 3	110.7	111.8	—	2.72	16.8	—
B-2174UD	UD 4	90-90.9	CL	Sand 4	118.1	119.3	0.44	—	15.6	30.7
B-2182UD	UD 12B	95-97.5	SP-SM	Sand 4	103.5	104.7	0.64	2.72	17.7	39.0
B-2182UD	UD-11	90.5-93	CL	Sand 4	114.3	115.5	—	2.77	15.8	—
B-2182UD	UD-11	90.5-93.0	CL	Sand 4	125.6	126.7	0.38	2.77	12.3	27.3
B-2182UD	UD-12T	95-97.5	CL	Sand 4	117.4	118.6	—	2.73	15.4	—
B-2302UD	UD 14	108.5-111	SM	Sand 4	110.2	111.4	0.54	2.71	17.8	34.9

Table 2.3.1-27 (Sheet 4 of 7)
VCS Aquifer Properties from Laboratory Analyses

Boring No.	Sample No.	Sample Depth (ft)	USCS Symbol	Geotechnical Layer	Initial Dry Unit Weight (pcf)	Bulk Density[a] (pcf)	Initial Void Ratio	Specific Gravity	Initial Moisture Content (%)	Porosity[b] (%)
B-2302UD	UD-16	122.2	CH	Sand 4	97.6	98.9	—	2.72	25.5	—
B-2319UD	UD 10	95.0-97.0	SP	Sand 4	103.2	104.3	—	2.72	11.2	—
B-2321UD	UD 12	93.0-95.7	SP-SM	Sand 4	101.2	102.4	0.66	2.69	22.7	39.8
B-2321UD	UD 12	93.0-95.7	SP-SM	Sand 4	101.9	103.1	—	2.69	21.3	—
B-2359UD	11	77.0-78.7	SC-SM	Sand 4	106.2	107.4	—	2.72	19.4	—
B-2359UD	UD 11	77.0-78.7	SC-SM	Sand 4	101.9	103.1	0.67	2.72	19.9	40.0
B-2359UD	UD 14	88.5-90.5	ML	Sand 4	96.6	97.9	0.78	2.74	25.3	43.8
B-2359UD	UD-12	80.25	SC	Sand 4	107.2	108.4	—	2.66	18.2	—
B-2182UD	UD-13	120-121.7	SC	Clay 5 Top	111.0	112.2	0.52	2.71	18.7	34.3
B-2182UD	UD-13	120-121.7	SC	Clay 5 Top	104.6	105.8	—	2.71	20.4	—
B-2269UD	UD 9	120-121.7	MH	Clay 5 Top	86.5	87.8	1.00	—	34.9	50.0
B-2269UD	UD-10	123-123.8	CH	Clay 5 Top	115.1	116.3	0.45	2.68	17.4	31.1
B-2302UD	UD-19	147	CL	Clay 5 Top	—	—	—	2.69	21.5	—
B-2304UD	UD 11	111.0-113.0	CH	Clay 5 Top	103.6	104.9	—	—	22.7	—
B-2304UD	UD 13	121.0-123.0	CH	Clay 5 Top	110.0	111.2	—	—	21.0	—
B-2304UD	9	98.5-101	CH	Clay 5 Top	99.8	101.1	—	2.74	25.8	—
B-2304UD	UD 9	98.5-101.0	CH	Clay 5 Top	101.5	102.7	0.69	2.74	22.8	40.7
B-2304UD	UD-11	112.9	CH	Clay 5 Top	103.6	104.8	—	2.71	21.7	—
B-2304UD	UD-13	122.95	CH	Clay 5 Top	108.0	109.1	—	2.71	18.6	—
B-2321UD	14	128.5-130	CH	Clay 5 Top	96.8	98.1	—	2.75	25.5	—
B-2321UD	UD 14	128.5-130.3	CH	Clay 5 Top	97.0	98.3	—	2.75	25.0	—
B-2321UD	UD 15	130.5-132.5	CH	Clay 5 Top	106.8	108.0	—	—	20.3	—
B-2321UD	UD-15	132.5	CH	Clay 5 Top	102.2	103.4	—	2.71	21.0	—
B-2359UD	18	112-113.1	SC	Clay 5 Top	92.4	93.7	—	2.77	25.5	—
B-2359UD	UD 17	110-111.7	SM	Clay 5 Top	106.9	108.1	0.58	2.71	17.4	36.8
B-2359UD	UD 19	114.0-116.6	SM	Clay 5 Top	105.7	106.9	0.60	2.70	17.3	37.4
B-2304UD	UD 15	141.0-143.5	SP-SM	Sand 5	99.2	100.4	0.69	2.68	17.9	40.8
B-2182UD	UD-15	145-147.5	ML	Clay 5 Bottom	95.4	96.6	—	2.70	26.8	—

Table 2.3.1-27 (Sheet 5 of 7)
VCS Aquifer Properties from Laboratory Analyses

Boring No.	Sample No.	Sample Depth (ft)	USCS Symbol	Geotechnical Layer	Initial Dry Unit Weight (pcf)	Bulk Density[a] (pcf)	Initial Void Ratio	Specific Gravity	Initial Moisture Content (%)	Porosity[b] (%)
B-2182UD	UD-15	145-147.5	ML	Clay 5 Bottom	102.5	103.8	0.65	2.70	25.3	39.2
B-2269UD	UD-11	150-151.7	CH	Clay 5 Bottom	103.7	104.9	—	2.70	21.8	—
B-2269UD	UD-11	150-151.7	CH	Clay 5 Bottom	105.0	106.2	0.60	2.70	21.8	37.7
B-2359UD	UD-20	121.25	CH	Clay 5 Bottom	85.9	87.2	—	2.72	34.0	—
B-2174UD	UD 8	145-147	SM	Sand 6	101.0	102.2	0.66	2.68	17.5	39.8
B-2174UD	UD 10	183-185	SM	Sand 6	109.8	111.0	0.55	2.72	15.7	35.5
B-2182UD	UD 16	180-182.5	SM	Sand 6	107.0	108.2	0.57	2.68	15.1	36.3
B-2269UD	UD 16	280-281.2	SC	Sand 6	107.5	108.7	0.56	2.69	18.6	35.9
B-2182UD	UD-17	215-217.5	CL	Clay 7	101.7	102.9	—	2.72	22.8	—
B-2174UD	UD 15	265-267	SC	Sand 8	108.6	109.8	0.52	2.65	19.3	34.2
B-2274UD	UD 12	221.1-223.6	SC	Sand 8	114.7	115.8	0.45	2.66	10.6	31.0
B-2274UD	UD 13	240-242.5	CL	Sand 8	114.1	115.3	0.48	—	15.6	32.4
B-2274UD	UD-13	240-242.5	CL	Sand 8	112.9	114.1	—	2.70	17.1	—
B-2182UD	UD-25	303-304.2	CH	Clay 9	91.3	92.6	—	2.79	26.5	—
B-2182UD	UD-25	303-304.2	CH	Clay 9	95.7	97.0	0.82	2.79	25.1	45.0
B-2182UD	UD-26	320-321.5	CL	Clay 9	114.5	115.7	0.49	2.73	15.5	32.8
B-2182UD	UD-26	320-321.5	CL	Clay 9	115.5	116.6	—	2.73	14.9	—
B-2182UD	UD-28	330-332	CH	Clay 9	97.3	98.6	0.76	2.74	28.0	43.1
B-2182UD	UD-29	333-334.7	CH	Clay 9	96.9	98.1	—	2.72	24.7	—
B-2304UD	9	98.5-101	CH	Clay 5 Top	99.8	101.1	—	2.74	25.8	—
B-2304UD	UD 9	98.5-101.0	CH	Clay 5 Top	101.5	102.7	0.69	2.74	22.8	40.7
B-2304UD	UD-11	112.9	CH	Clay 5 Top	103.6	104.8	—	2.71	21.7	—
B-2304UD	UD-13	122.95	CH	Clay 5 Top	108.0	109.1	—	2.71	18.6	—
B-2321UD	14	128.5-130	CH	Clay 5 Top	96.8	98.1	—	2.75	25.5	—
B-2321UD	UD 14	128.5-130.3	CH	Clay 5 Top	97.0	98.3	—	2.75	25.0	—
B-2321UD	UD 15	130.5-132.5	CH	Clay 5 Top	106.8	108.0	—	—	20.3	—
B-2321UD	UD-15	132.5	CH	Clay 5 Top	102.2	103.4	—	2.71	21.0	—
B-2359UD	18	112-113.1	SC	Clay 5 Top	92.4	93.7	—	2.77	25.5	—

Table 2.3.1-27 (Sheet 6 of 7)
VCS Aquifer Properties from Laboratory Analyses

Boring No.	Sample No.	Sample Depth (ft)	USCS Symbol	Geotechnical Layer	Initial Dry Unit Weight (pcf)	Bulk Density[a] (pcf)	Initial Void Ratio	Specific Gravity	Initial Moisture Content (%)	Porosity[b] (%)
B-2359UD	UD 17	110-111.7	SM	Clay 5 Top	106.9	108.1	0.58	2.71	17.4	36.8
B-2359UD	UD 19	114.0-116.6	SM	Clay 5 Top	105.7	106.9	0.60	2.70	17.3	37.4
B-2304UD	UD 15	141.0-143.5	SP-SM	Sand 5	99.2	100.4	0.69	2.68	17.9	40.8
B-2182UD	UD-15	145-147.5	ML	Clay 5 Bottom	95.4	96.6	—	2.70	26.8	—
B-2182UD	UD-15	145-147.5	ML	Clay 5 Bottom	102.5	103.8	0.65	2.70	25.3	39.2
B-2269UD	UD-11	150-151.7	CH	Clay 5 Bottom	103.7	104.9	—	2.70	21.8	—
B-2269UD	UD-11	150-151.7	CH	Clay 5 Bottom	105.0	106.2	0.60	2.70	21.8	37.7
B-2359UD	UD-20	121.25	CH	Clay 5 Bottom	85.9	87.2	—	2.72	34.0	—
B-2174UD	UD 8	145-147	SM	Sand 6	101.0	102.2	0.66	2.68	17.5	39.8
B-2174UD	UD 10	183-185	SM	Sand 6	109.8	111.0	0.55	2.72	15.7	35.5
B-2182UD	UD 16	180-182.5	SM	Sand 6	107.0	108.2	0.57	2.68	15.1	36.3
B-2269UD	UD 16	280-281.2	SC	Sand 6	107.5	108.7	0.56	2.69	18.6	35.9
B-2182UD	UD-17	215-217.5	CL	Clay 7	101.7	102.9	—	2.72	22.8	—
B-2174UD	UD 15	265-267	SC	Sand 8	108.6	109.8	0.52	2.65	19.3	34.2
B-2274UD	UD 12	221.1-223.6	SC	Sand 8	114.7	115.8	0.45	2.66	10.6	31.0
B-2182UD	UD-30	340-341.1	CL	Clay 9	116.9	118.1	—	2.73	15.5	—
B-2182UD	UD-30	340-341.1	CL	Clay 9	117.6	118.8	0.45	2.73	15.0	31.1
B-2182UD	UD-31	343-344	CL	Clay 9	115.9	117.1	0.48	2.74	15.8	32.2
B-2274UD	UD-16	300-301.8	CH	Clay 9	90.9	92.2	—	2.76	26.8	—
B-2274UD	UD-16	300-301.8	CH	Clay 9	95.4	96.6	0.81	2.76	25.0	44.7
B-2274UD	UD-17	320-322.5	MH	Clay 9	99.2	100.4	0.71	2.72	24.3	41.6
B-2274UD	UD 18	330.1-332.6	SM	Sand 10	110.6	111.7	0.54	2.71	14.0	35.1
B-2274UD	UD 19	350.1-352.6	SM	Sand 10	104.7	105.9	0.60	2.69	20.5	37.5
B-2182UD	UD-33	380-381.7	CH	Clay 11	84.9	86.2	—	2.78	33.8	—
B-2182UD	UD-33	380-381.7	CH	Clay 11	86.6	87.9	1.00	2.78	32.2	50.0
B-2182UD	UD-37	400-402.5	CL	Clay 11	91.4	92.7	—	2.76	29.3	—
B-2182UD	UD-37	400-402.5	CL	Clay 11	103.1	104.3	0.67	2.76	23.6	40.1
B-2269UD	UD-18	375-376.6	CL	Clay 11	104.1	105.3	0.67	2.78	22.3	40.0

Table 2.3.1-27 (Sheet 7 of 7)
VCS Aquifer Properties from Laboratory Analyses

Boring No.	Sample No.	Sample Depth (ft)	USCS Symbol	Geotechnical Layer	Initial Dry Unit Weight (pcf)	Bulk Density[a] (pcf)	Initial Void Ratio	Specific Gravity	Initial Moisture Content (%)	Porosity[b] (%)
B-2269UD	UD-20	400-402.1	CH	Clay 11	85.7	87.0	—	2.77	32.9	—
B-2269UD	UD-20	400-402.1	CH	Clay 11	102.7	103.9	0.69	2.77	24.1	40.7
B-2274UD	UD-20	380-381.8	MH	Clay 11	86.0	87.3	—	2.76	34.9	—
B-2274UD	UD-20	380-381.8	MH	Clay 11	89.6	90.9	0.92	2.76	31.0	48.0
B-2274UD	UD-21	390-391.8	CH	Clay 11	83.6	84.9	—	2.75	36.7	—
B-2274UD	UD-22	400-401.3	CH	Clay 11	98.2	99.5	—	2.72	26.3	—
B-2274UD	UD-22	400-401.3	CH	Clay 11	96.7	98.0	0.76	2.72	25.6	43.1
B-2174UDR	UD-26	445-446	CH	Clay 13	96.2	97.5	—	2.78	27.6	—
B-2174UDR	UD-26	445-446	CH	Clay 13	98.7	100.0	0.76	2.78	26.2	43.2
B-2174UDR	UD-27	490-492.5	CH	Clay 13	109.6	110.8	—	2.73	20.2	—
B-2274UD	UD-26	580-582.5	CL	Clay 17	111.0	112.2	—	2.70	17.8	—

a $$Bulk\ Density = Dry\ Unit\ Weight * \left(1 + \frac{Initial\ Moisture\ Content}{100}\right)$$ (Barnes 1995)

b $$Porosity = \frac{Initial\ Void\ Ratio}{1 + Initial\ Void\ Ratio}$$ (Barnes 1995)

Data source: FSAR Appendix 2.5.4-A & B

Table 2.3.1-28
VCS Site Permeability Values from Guelph Permeameter Tests

Borehole Number	Northing (NAD83 TXSC)	Easting (NAD83 TXSC)	Surface Elevation (NAVD 88)	Test Elevation (NAVD 88)	Saturated Permeability (cm/s)	Saturated Permeability (ft/d)
B-2309P-U	13405492.3	2600435.2	76.25	71.25	1.00×10^{-8}	0.00003
B-2309P-L	13405491.6	2600445.1	76.13	66.13	1.44×10^{-6}	0.00408
B-2311P-U	13407705.7	2602287.6	75.71	70.71	6.94×10^{-8}	0.00020
B-2311P-L	13407703.0	2602296.9	75.33	65.33	1.00×10^{-8}	0.00003
B-2312P-U	13410699.8	2604161.2	75.46	70.46	1.76×10^{-7}	0.00050
B-2312P-L	13410694.3	2604153.2	75.50	65.50	4.00×10^{-5}	0.11340
B-2313P-U	13412117.4	2605610.9	77.88	72.88	1.00×10^{-8}	0.00003
B-2313P-L	13412115.6	2605606.1	77.97	67.97	2.64×10^{-6}	0.00757
B-2314P-U	13413938.0	2607776.5	75.48	70.48	4.73×10^{-6}	0.01341
B-2314P-L	13413940.7	2607782.6	75.42	65.42	1.00×10^{-8}	0.00003
B-2325P-U	13401288.3	2603699.2	73.79	68.79	1.71×10^{-6}	0.00485
B-2325P-L	13401292.3	2603696.5	73.85	63.85	4.20×10^{-4}	1.19070
B-2326P-U	13403069.2	2605616.5	70.97	65.97	1.00×10^{-8}	0.00003
B-2326P-L	13403074.7	2605620.4	70.76	60.76	1.44×10^{-6}	0.00408
B-2327P-U	13404711.4	2607393.8	71.24	66.24	1.00×10^{-8}	0.00003
B-2327P-L	13404712.2	2607384.0	70.81	60.81	1.60×10^{-5}	0.04536
B-2328P-U	13406233.3	2609021.3	68.13	63.13	1.60×10^{-5}	0.04536
B-2328P-L	13406222.9	2609021.2	68.42	58.42	9.70×10^{-4}	2.74995
B-2329P-U	13407878.0	2610791.9	68.07	63.07	1.00×10^{-8}	0.00003
B-2329P-L	13407871.4	2610784.7	68.06	58.06	1.00×10^{-8}	0.00003
B-2330P-U	13410096.3	2613184.0	67.89	62.89	1.88×10^{-6}	0.00533
B-2330P-L	13410088.7	2613185.0	68.18	58.18	5.37×10^{-7}	0.00152
B-2339P-U	13399916.5	2608670.1	68.75	63.75	1.99×10^{-6}	0.00564
B-2339P-L	13399911.2	2608674.7	68.63	58.63	2.40×10^{-5}	0.06804
B-2341P-U	13401608.5	2610954.3	65.22	60.22	2.70×10^{-6}	0.00765
B-2341P-L	13401608.5	2610954.3	65.22	55.22	1.08×10^{-5}	0.03062
B-2342P-U	13402788.9	2612523.3	67.61	62.61	1.00×10^{-8}	0.00003
B-2342P-L	13402761.0	2612526.3	67.34	57.34	1.00×10^{-8}	0.00003
B-2343P-U	13404159.4	2614386.7	64.62	59.62	1.00×10^{-8}	0.00003
B-2343P-L	13404159.4	2614395.9	64.95	54.95	1.00×10^{-8}	0.00003
B-2345P-U	13405835.3	2616662.5	67.91	62.91	1.00×10^{-8}	0.00003
B-2345P-L	13405831.4	2616657.3	67.79	57.79	1.00×10^{-8}	0.00003
					Geometric mean =	0.00093

Shaded values indicate a permeability below the method detection limit and are interpreted as 1.00×10^{-8} cm/s or 3×10^{-5} feet/day.

Data source: FSAR Appendix 2.5.4-B

Table 2.3.1-29 (Sheet 1 of 3)
Summary Statistics of VCS Aquifer Properties from Laboratory Analyses

Geotechnical Layer	Parameter	Bulk Density (pcf)[a]	Porosity (%)[a]	Grain Size Permeability (ft/d)[b]
Clay 1 (Top)	Number of Tests	19	8	—
—	Minimum	98.2	31.3	—
—	Maximum	115.6	42.4	—
—	Geometric Mean	108.6	35.6	—
Sand 1	Number of Tests	7	3	19
—	Minimum	103.9	29.7	0.03
—	Maximum	118.2	31.9	85.05
—	Geometric Mean	112.9	30.9	0.85
Clay 1 (Bottom)	Number of Tests	20	5	—
—	Minimum	92.3	38.6	—
—	Maximum	112.2	43.8	—
—	Geometric Mean	102.9	40.4	—
Sand 2	Number of Tests	4	2	21
—	Minimum	104.2	34.6	0.03
—	Maximum	109.5	38.7	48.20
—	Geometric Mean	107.2	36.5	1.13
Clay 3	Number of Tests	27	9	—
—	Minimum	85.7	32.0	—
—	Maximum	118.3	46.8	—
—	Geometric Mean	100.6	41.1	—
Sand 4	Number of Tests	14	7	28
—	Minimum	97.9	27.3	0.03
—	Maximum	126.7	43.8	70.88
—	Geometric Mean	108.4	36.1	2.84
Clay 5 (Top)	Number of Tests	17	6	—
—	Minimum	87.8	31.1	—
—	Maximum	116.3	50.0	—
—	Geometric Mean	104.0	37.9	—
Sand 5	Number of Tests	1	1	13
—	Minimum	100.4	40.8	0.14
—	Maximum	100.4	40.8	56.70
—	Geometric Mean	100.4	40.8	0.85
Clay 5 (Bottom)	Number of Tests	5	2	—
—	Minimum	87.2	37.7	—

Table 2.3.1-29 (Sheet 2 of 3)
Summary Statistics of VCS Aquifer Properties from Laboratory Analyses

Geotechnical Layer	Parameter	Bulk Density (pcf)[a]	Porosity (%)[a]	Grain Size Permeability (ft/d)[b]
—	Maximum	106.2	39.2	—
—	Geometric Mean	99.5	38.4	—
Sand 6	Number of Tests	4	4	11
—	Minimum	102.2	35.5	0.03
—	Maximum	111.0	39.8	39.69
—	Geometric Mean	107.4	36.8	1.13
Clay 7	Number of Tests	1	—	—
—	Minimum	102.9	—	—
—	Maximum	102.9	—	—
—	Geometric Mean	102.9	—	—
Sand 8	Number of Tests	4	3	2
—	Minimum	109.8	31.0	2.84
—	Maximum	115.8	34.2	2.84
—	Geometric Mean	113.7	32.5	2.84
Clay 9	Number of Tests	12	7	—
—	Minimum	92.2	31.1	—
—	Maximum	118.8	45.0	—
—	Geometric Mean	104.6	38.2	—
Sand 10	Number of Tests	2	2	—
—	Minimum	105.9	35.1	—
—	Maximum	111.7	37.5	—
—	Geometric Mean	108.8	36.3	—
Clay 11	Number of Tests	12	6	—
—	Minimum	84.9	40.0	—
—	Maximum	105.3	50.0	—
—	Geometric Mean	93.7	43.5	—
Sand 12	Number of Tests	—	—	—
—	Minimum	—	—	—
—	Maximum	—	—	—
—	Geometric Mean	—	—	—
Clay 13	Number of Tests	3	1	11
—	Minimum	97.5	43.2	0.03
—	Maximum	110.8	43.2	39.69
—	Geometric Mean	102.6	43.2	1.13
Sand 14	Number of Tests	—	—	—

Table 2.3.1-29 (Sheet 3 of 3)
Summary Statistics of VCS Aquifer Properties from Laboratory Analyses

Geotechnical Layer	Parameter	Bulk Density (pcf)[a]	Porosity (%)[a]	Grain Size Permeability (ft/d)[b]
—	Minimum	—	—	—
—	Maximum	—	—	—
—	Geometric Mean	—	—	—
Clay 15	Number of Tests	—	—	2
—	Minimum	—	—	2.84
—	Maximum	—	—	2.84
—	Geometric Mean	—	—	2.84
Sand 16	Number of Tests	—	—	—
—	Minimum	—	—	—
—	Maximum	—	—	—
—	Geometric Mean	—	—	—
Clay 17	Number of Tests	1	—	—
—	Minimum	112.2	—	—
—	Maximum	112.2	—	—
—	Geometric Mean	112.2	—	—
Sand 18	Number of Tests	—	—	—
—	Minimum	—	—	—
—	Maximum	—	—	—
—	Geometric Mean	—	—	—

a. Table 2.3.1-27
b. Hazen equation (Fetter 1988)

$k = c(D_{10})^2$, where, k = hydrostatic conductivity (cm/sec)
d_{10} = effective grain size (cm)
c = grain size/sorting coefficient

Table 2.3.1-30 (Sheet 1 of 3)
Regional Hydrogeochemical Data

Sample Location	Sample Date	Sample Depth (ft bgs)	Unit	pH (standard units)	Specific Conductance (µmhos/cm)	Total Dissolved Solids (mg/L)	Total Hardness (mg/L as CaCO3)	Total Fe (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	ORP (mV)	Temperature (°C)
National Primary DWS	—	—	—	—	—	—	—	—	15	—	—	—
National Secondary DWS	—	—	—	6.5-8.5	—	500	—	—	—	—	—	—
7924601	4/11/2001	40	Lissie	6.75	1646	913	401	1.36	1.8 ± 1.7	4.9 ± 2.6	NA	22.2
7924601	3/30/2005	40	Lissie	NA	2150	1217	501	2.09	2.1 ± 4.6	1.9 ± 4.2	NA	22.4
7924901	2/5/1959	90	Lissie	7.8	967	560	294	NA	NA	NA	NA	NA
7924901	6/28/1979	90	Lissie	8.2	987	560	306	NA	NA	NA	NA	NA
7924901	8/25/1983	90	Lissie	8.3	1072	584	286	NA	NA	NA	NA	NA
7924902	3/26/1997	125	Lissie	7.2	918	531	293	NA	NA	NA	57.5	22.8
7924902	4/11/2001	125	Lissie	6.91	1016	572	286	NA	2.6 ± 1.6	4.1 ± 2.7	NA	23.2
7924902	3/22/2005	125	Lissie	NA	994	575	292	NA	4.8 ± 3.2	10 ± 2	NA	23.2
7924904	2/4/1959	254	Chicot	7.2	2050	1113	597	NA	NA	NA	NA	NA
7932101	5/16/1969	250	Lissie	7.5	1848	899	541	NA	NA	NA	NA	NA
7932101	8/16/1975	250	Lissie	7.7	1823	904	529	NA	NA	NA	NA	NA
7932101	6/28/1979	250	Lissie	7.8	1573	782	399	NA	NA	NA	NA	NA
7932103	3/26/1997	142	Lissie	7.09	1750	1088	493	NA	NA	NA	52.2	23.3
7932103	4/11/2001	142	Lissie	6.77	1940	1107	451	NA	4.5 ± 2.7	6.3 ± 3.9	NA	23.2
7932403	4/20/1992	150	Chicot	6.51	1579	936	545	0.025	4.8 ± 2.2	9.6 ± 2.1	53.3	23.6
7932404	2/4/1959	100	Chicot	7.4	1430	753	429	NA	NA	NA	NA	NA
7932602	4/28/1959	595	Lissie	7.9	1940	1064	57	NA	NA	NA	NA	NA
7932602	4/14/1971	595	Lissie	7.6	2058	1040	56	NA	NA	NA	NA	NA
8017501	8/25/1983	1026	Goliad	8.6	1430	733	44	NA	NA	NA	NA	NA
8017503	5/31/1949	1062	Evangeline	7.8	NA	718	120	NA	<4.0	4.6 ± 2.6	–165.3	28.3
8017503	4/22/1992	1062	Evangeline	7.63	1265	725	126	NA	NA	NA	NA	NA
8017504	5/12/1949	1059	Evangeline	7.7	NA	700	126	NA	NA	NA	NA	NA
8017506	7/30/1965	420	Evangeline	7.81	1050	591	131	0.02	NA	NA	NA	NA
8017511	5/12/1949	1130	Evangeline	7.7	NA	700	126	NA	NA	NA	NA	NA

Table 2.3.1-30 (Sheet 2 of 3)
Regional Hydrogeochemical Data

Sample Location	Sample Date	Sample Depth (ft bgs)	Unit	pH (standard units)	Specific Conductance (µmhos/cm)	Total Dissolved Solids (mg/L)	Total Hardness (mg/L as CaCO3)	Total Fe (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	ORP (mV)	Temperature (°C)
8017902	1/29/1959	500	Gulf Coast	7.5	1640	898	164	NA	NA	NA	NA	NA
8017904	7/22/1981	1001	Gulf Coast	8.5	1591	832	132	NA	NA	NA	NA	NA
8017904	8/25/1983	1001	Gulf Coast	8.2	1584	827	129	NA	NA	NA	NA	NA
8017905	6/4/1981	1010	Evangeline	7.93	1240	843	132	NA	NA	NA	NA	NA
8017905	4/22/1992	1010	Evangeline	7.69	1489	856	115	0.138	<4[a]	6.3 ± 2.9	–219.4	29.7
8017905	3/26/1997	1010	Evangeline	7.56	1403	823	113	0.098	NA	NA	-98	29.3
8017905	3/29/2005	1010	Evangeline	NA	1538	830	117	0.135	7.4 ± 4.7	6.4 ± 2.7	NA	29.3
San Antonio River (USGS 08188570)	12/19/2006	0	—	8.1	1310	740	350	NA	NA	NA	NA	20
Guadalupe River (USGS 08176500)	3/25/1994	0	—	8.1	579	339	240	0.008	NA	NA	NA	22.5
National Primary DWS	—	—	—	—	—	—	—	—	—	—	—	4.0
National Secondary DWS	—	—	—	—	—	—	—	—	—	250	250	2.0
7924601	4/11/2001	40	Lissie	34.4	127	20.4	169	2.77	489.36	260	58.4	0.31
7924601	3/30/2005	40	Lissie	36.6	153	28.5	235	2.84	510.1	424	84.5	0.52
7924901	2/5/1959	90	Lissie	30	100	11	94	NA	387	111	22	0.5
7924901	6/28/1979	90	Lissie	45	103	12	79	NA	353.9	115	24	0.3
7924901	8/25/1983	90	Lissie	44	95	12	94	3	362.44	128	25	0.4
7924902	3/26/1997	125	Lissie	19.7	96.5	12.6	92.7	3.25	356.34	102	19.8	0.26
7924902	4/11/2001	125	Lissie	42.4	94.4	12.3	87.4	2.89	346.58	125	22.5	0.38
7924902	3/22/2005	125	Lissie	46	96.3	12.3	92	3.19	346.57	120	21.1	0.56
7924904	2/4/1959	254	Chicot	31	185	33	177	NA	280	488	61	0.3
7932101	5/16/1969	250	Lissie	33	171	28	113	NA	303.87	347	58	<0.1[a]
7932101	8/16/1975	250	Lissie	32	186	16	120	NA	302.65	351	50	0.1
7932101	6/28/1979	250	Lissie	33	150	6	122	6	244.07	285	59	0.2
7932103	3/26/1997	142	Lissie	20.5	158	23.9	224	6.44	353.9	371	108	<0.02[a]
7932103	4/11/2001	142	Lissie	36.7	144	22.1	206	5.57	346.58	390	129	0.29
7932403	4/20/1992	150	Chicot	34	170	29	120	8.2	273.36	376	63	0.22

Table 2.3.1-30 (Sheet 3 of 3)
Regional Hydrogeochemical Data

Sample Location	Sample Date	Sample Depth (ft bgs)	Unit	pH (standard units)	Specific Conductance (µmhos/cm)	Total Dissolved Solids (mg/L)	Total Hardness (mg/L as CaCO3)	Total Fe (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	ORP (mV)	Temperature (°C)
7932404	2/4/1959	100	Chicot	34	131	25	106	NA	297	252	59	0.3
7932602	4/28/1959	595	Lissie	15	12	6.6	404	2.8	362.1	435	8.6	0.7
7932602	4/14/1971	595	Lissie	15	11.4	6.9	384	NA	358.78	437	8.65	0.5
8017501	8/25/1983	1026	Goliad	9	9.6	5.1	276	2	339.26	250	2	0.6
8017503	5/31/1949	1062	Evangeline	8.4	25	14	247	NA	427	195	19	NA
8017503	4/22/1992	1062	Evangeline	19	25	15	233	4.4	406.38	211	16	0.5
8017504	5/12/1949	1059	Evangeline	13	26	15	233	NA	422	183	23	NA
8017506	7/30/1965	420	Evangeline	18	33	12	185	NA	388	152	1	NA
8017511	5/12/1949	1130	Evangeline	13	26	15	233	NA	422	183	23	NA
8017902	1/29/1959	500	Gulf Coast	20	38	17	281	3.3	312.09	348	36	1
8017904	7/22/1981	1001	Gulf Coast	31	40	8	258	4	356.34	234	70	0.4
8017904	8/25/1983	1001	Gulf Coast	22	27	15	261	4	378.31	242	70	0.4
8017905	6/4/1981	1010	Evangeline	12	30	14	279	NA	347.01	266	64	0.2
8017905	4/22/1992	1010	Evangeline	21	24	13	279	5.3	352.68	275	63	0.48
8017905	3/26/1997	1010	Evangeline	12.5	22.1	13.6	291	4.2	356.34	244	58.1	0.32
8017905	3/29/2005	1010	Evangeline	22.7	22.7	23.8	273	3.56	355.12	264	51.7	0.69
San Antonio River (USGS 08188570)	12/19/2006	0	—	15.3	103	21.4	116	11.8	283	159	118	0.72

Source: Reference TWDBb Dec 2007
DWS = Drinking Water Standard
NA = Not Analyzed
Bold values exceed National Primary or Secondary DWS (U.S. EPA)

Table 2.3.1-31 (Sheet 1 of 3)
VCS Site Hydrogeochemical Data

Sample Location	Sample Date	Sample Depth (ft NAVD 88)[a]	Unit[b]	pH (standard units)	Specific Conductance (µmhos/cm)	Total Dissolved Solids (mg/L)	Total Hardness (mg/L as CaCO3)	Total Fe (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	ORP (mV)	Temperature (°C)
National Primary DWS	—	—	—	—	—	—	—	—	15	—	—	—
National Secondary DWS	—	—	—	**6.5–8.5**	—	**500**	—	—	—	—	—	—
OW-2301 U	2/18/2008	28.27	Upper	7.20	921	**520**	—	<0.500[c]	—	—	151.5	22.61
OW-2301 L	2/18/2008	–51.81	Deep	6.82	1162	**669**	—	<0.500[c]	—	—	74.6	23.40
OW-2302 U	2/21/2008	–8.01	Lower	6.89	1019	**574**	—	<0.500[c]	—	—	77.5	24.39
OW-2302 L	2/21/2008	–63.05	Deep	6.65	2066	**1,180**	—	18.3	—	—	211.7	23.37
OW-2304 U	2/21/2008	25.1	Upper	6.53	2043	**1,200**	—	0.14 B	—	—	81.2	22.43
OW-2304 L	2/21/2008	–20.27	Lower	6.73	1997	**1,160**	—	<0.500[c]	—	—	119.3	23.05
OW-2307 U	2/20/2008	21.59	Upper	7.20	1106	**566**	—	0.564	—	—	56.8	23.10
OW-2307 L	2/20/2008	–26.44	Lower	6.91	1053	466	—	<0.500[c]	—	—	152.2	23.17
OW-2319 U	2/21/2008	–14.03	Lower	6.95	1199	**665**	—	<0.500[c]	—	—	81.2	22.84
OW-2319 L	2/21/2008	–73.95	Deep	6.71	2258	**1,340**	—	6.65	—	—	100.2	22.96
OW-2321 U	2/19/2008	–31.73	Lower	6.85	1687	**733**	—	<0.500[c]	—	—	109.9	23.52
OW-2321 L	2/19/2008	–71.46	Deep	6.58	3819	**919**	—	3.78	—	—	97.7	23.90
OW-2324 U	2/20/2008	–13.83	Lower	6.83	1281	**586**	—	<0.500[c]	—	—	110.9	22.14
OW-2324 L	2/20/2008	–93.73	Deep	6.68	2158	**1,090**	—	<0.500[c]	—	—	59.8	22.82
OW-2348 U	2/19/2008	–22.88	Lower	6.82	2414	**1,110**	—	<0.500[c]	—	—	164.3	22.67
OW-2348 L	2/19/2008	–86.3	Deep	6.60	4122	**1,050**	—	<0.500[c]	—	—	42.1	23.19
OW-2352 U	2/19/2008	14.47	Upper	7.13	1515	**602**	—	0.14 B	—	—	180.7	22.45
OW-2352 L	2/19/2008	–20.4	Lower	6.79	3437	**788**	—	1.30	—	—	61.5	22.40
OW-2359 U1	2/20/2008	–10.71	Upper	6.87	1192	**554**	—	<0.500[c]	—	—	27.3	23.29
OW-2359 L2	2/20/2008	–86.07	Deep	6.74	2031	**973**	—	<0.500[c]	—	—	87.7	23.44

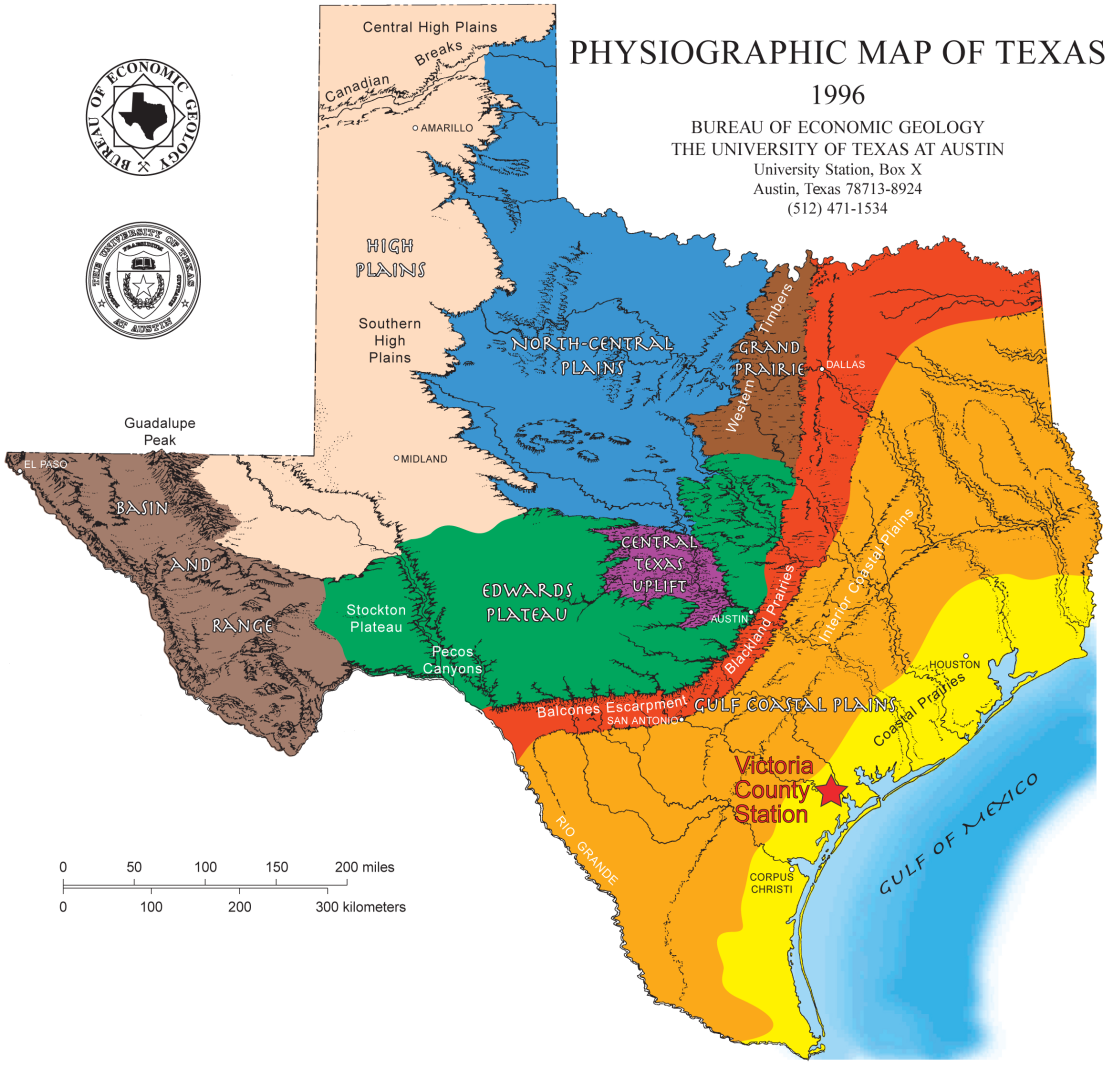
Table 2.3.1-31 (Sheet 2 of 3)
VCS Site Hydrogeochemical Data

Sample Location	Sample Date	Sample Depth (ft NAVD 88)[a]	Unit[b]	Silica (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Bicarbonate (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)
National Primary DWS	—	—	—	—	—	—	—	—	—	—	—	**4.0**	**10**
National Secondary DWS	—	—	—	—	—	—	—	—	—	**250**	**250**	**2.0**	—
OW-2301 U	2/18/2008	28.27	Upper	58.4	77.4 N	8.66	130	3.86	333	73.5	35.4	0.66	0.68
OW-2301 L	2/18/2008	–51.81	Deep	36.0	114 N	14.6	122	5.13	300	155	62.5	0.26	0.36
OW-2302 U	2/21/2008	–8.01	Lower	39.6	91	12.4 E	119	4.55	339	110	26.1	0.44	0.73
OW-2302 L	2/21/2008	–63.05	Deep	155	265	30.8 E	167	9.69	308	**440**	125	0.23	0.56
OW-2304 U	2/21/2008	25.1	Upper	41.5	206	27.0 E	152	3.50	399	**441**	17.1	0.30	2.1
OW-2304 L	2/21/2008	–20.27	Lower	40.7	192	38.2 E	151	5.20	300	**436**	153	0.38	0.32
OW-2307 U	2/20/2008	21.59	Upper	48.4	44.9 N	7.04	163	3.34	490	59.9	18.9	1.0	0.36
OW-2307 L	2/20/2008	–26.44	Lower	41.5	83.9 N	12.0	100	4.97	298	100	25.4	0.40	1.4
OW-2319 U	2/21/2008	–14.03	Lower	40.2	73	12.4 E	147	4.10	378	163	41.1	0.53	0.63
OW-2319 L	2/21/2008	–73.95	Deep	92.7	229	35.7 E	189	7.58	310	**480**	198	0.26	0.43
OW-2321 U	2/19/2008	–31.73	Lower	41.9	111 N	18.4	133	4.61	300	220	65.3	0.41	0.50
OW-2321 L	2/19/2008	–71.46	Deep	66.3	166 N	27.1	128	6.59	279	**355**	59.6	0.28	0.52
OW-2324 U	2/20/2008	–13.83	Lower	38.3	111 N	15.6	100	3.61	289	160	58.3	0.29	0.67
OW-2324 L	2/20/2008	–93.73	Deep	33.6	196 N	33.6	138	6.74	249	**517**	86.0	0.22	0.54
OW-2348 U	2/19/2008	–22.88	Lower	35.5	159 N	30.4	166	4.38	252	**453**	106	0.37	0.57
OW-2348 L	2/19/2008	–86.3	Deep	34.0	175 N	33.3	111	5.42	252	**424**	93.3	0.27	0.41
OW-2352 U	2/19/2008	14.47	Upper	37.0	82.2 N	19.5	139	2.18	329	164	55.7	0.74	0.61
OW-2352 L	2/19/2008	–20.4	Lower	45.4	95.8 N	19.7	184	4.09	311	234	118	0.37	1.1
OW-2359 U1	2/20/2008	–10.71	Upper	37.9	93.1 N	13.4	111	3.85	309	148	45.6	0.44	0.71
OW-2359 L2	2/20/2008	–86.07	Deep	32.7	169 N	26.7	124	6.10	247	**415**	76.0	0.23	0.55

Table 2.3.1-31 (Sheet 3 of 3)
VCS Site Hydrogeochemical Data

[a]Calculated from Table 2.3.1-22 by the following equation: (Top of screen – Bottom of Screen)/2
[b]Upper = Upper Shallow aquifer; Lower = Lower Shallow aquifer; and Deep = Deep aquifer.
[c]Indicates the compound analyzed was not detected at or above the specified laboratory method detection limit.
B = Estimated result. Result is less than the reporting limit.
DWS = Drinking Water Standard
E = Matrix interference
N = Spiked analyte recovery is outside stated control limits. Method performance confirmed using Laboratory Control Spike sample results.
NA = Not Analyzed
Bold values exceed National Primary or Secondary DWS (U.S. EPA)

Figure 2.3.1-14 Regional Site Location Plan



PROVINCE	MAX. ELEV. (ft)	MIN. ELEV. (ft)	TOPOGRAPHY	GEOLOGIC STRUCTURE	BEDROCK TYPES
Gulf Coastal Plains					
Coastal Prairies	300	0	Nearly flat prairie, <1 ft/mi to Gulf	Nearly flat strata	Deltaic sands and muds
Interior Coastal Plains	800	300	Parallel ridges (questas) and valleys	Beds tilted toward Gulf	Unconsolidated sands and muds
Blackland Prairies	1000	450	Low rolling terrain	Beds tilted south and east	Chalks and marls
Grand Prairie	1250	450	Low stairstep hills west; plains east	Strata dip east	Calcareous east; sandy west
Edwards Plateau					
Principal	3000	450	Flat upper surface with box canyons	Beds dip south; normal faulted	Limestones and dolomites
Pecos Canyons	2000	1200	Steep-walled canyons		Limestones and dolomites
Stockton Plateau	4200	1700	Mesa-formed terrain; highs to west	Unfaulted, near-horizontal beds	Carbonates and alluvial sediments
Central Texas Uplift	2000	800	Knobby plain; surrounded by questas	Centripetal dips, strongly faulted	Granites; metamorphics; sediments
North-Central Plains	3000	900	Low north-south ridges (questas)	West dip; minor faults	Limestones; sandstones; shales
High Plains					
Central	4750	2900	Flat prairies slope east and south	Slight dips east and south	Eolian silts and fine sands
Canadian Breaks	3800	2350	Highly dissected; local solution valleys		
Southern	3800	2200	Flat; many playas; local dune fields		
Basin and Range	8750	1700	North-south mountains and basins	Some complex folding and faulting	Igneous; metamorphics; sediments

Modified from reference Bureau of Economic Geology, 1996

Figure 2.3.1-15 Physiographic Map of Texas

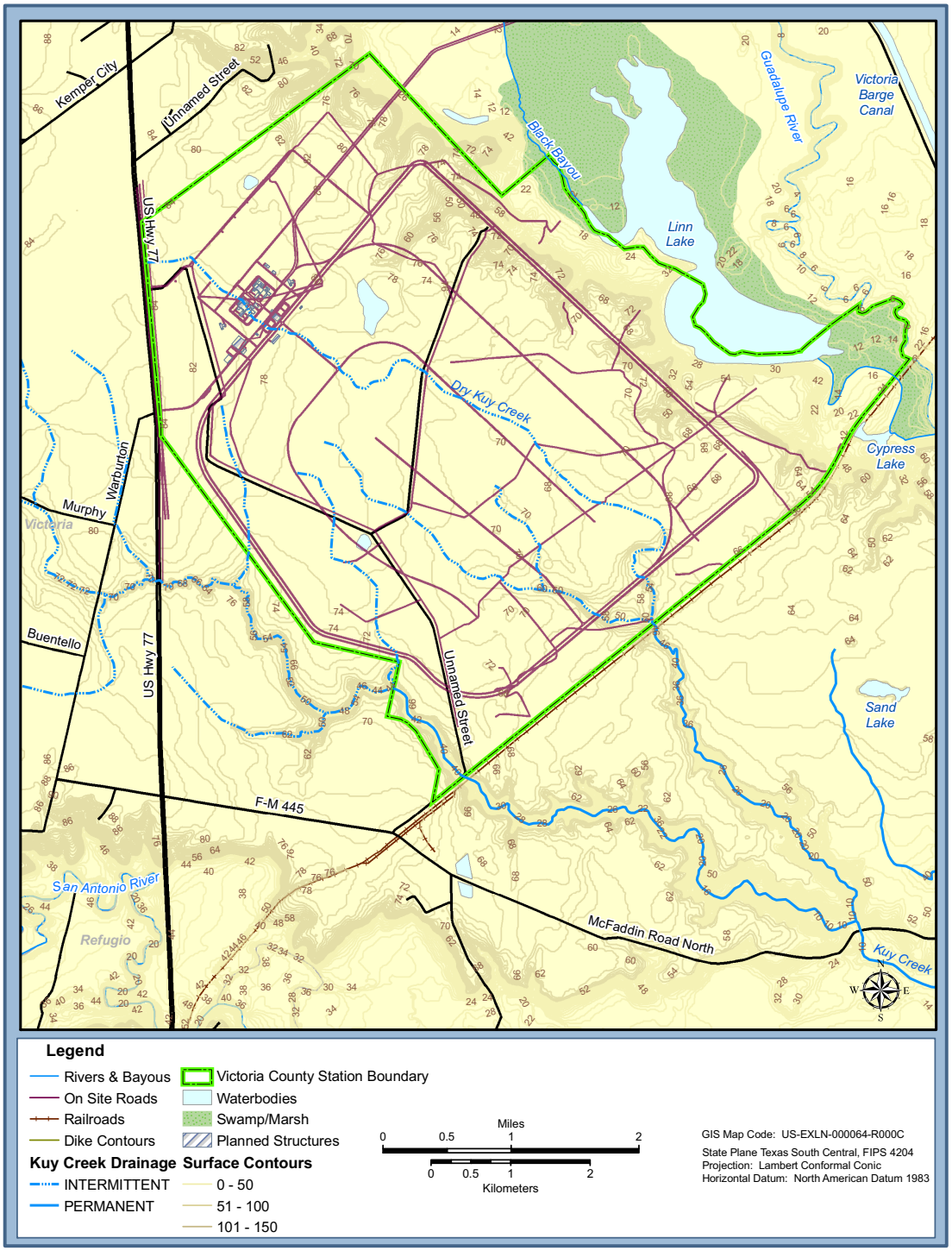


Figure 2.3.1-16 Detailed Site Location Plan

Modified from reference TWDB Dec 2005

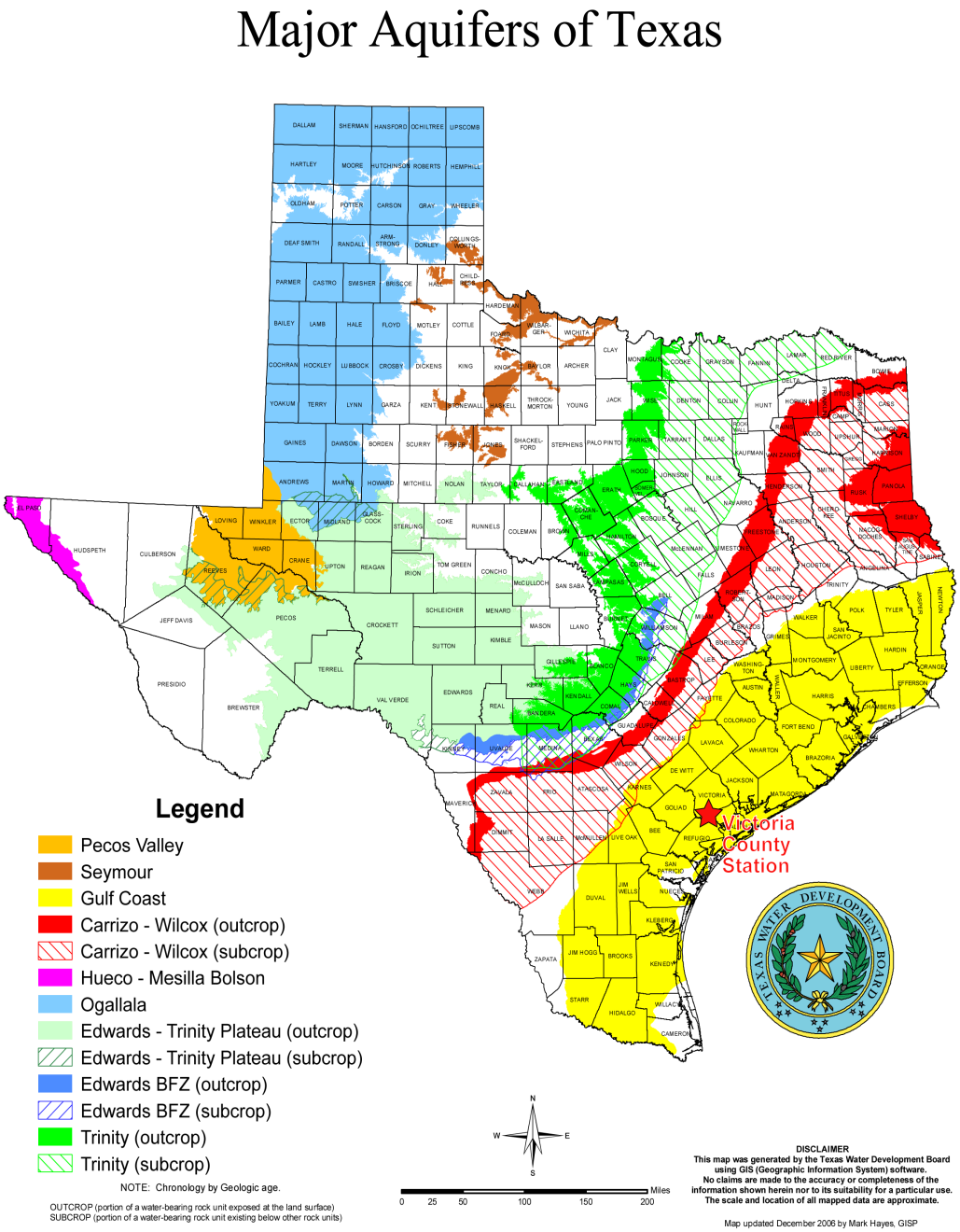
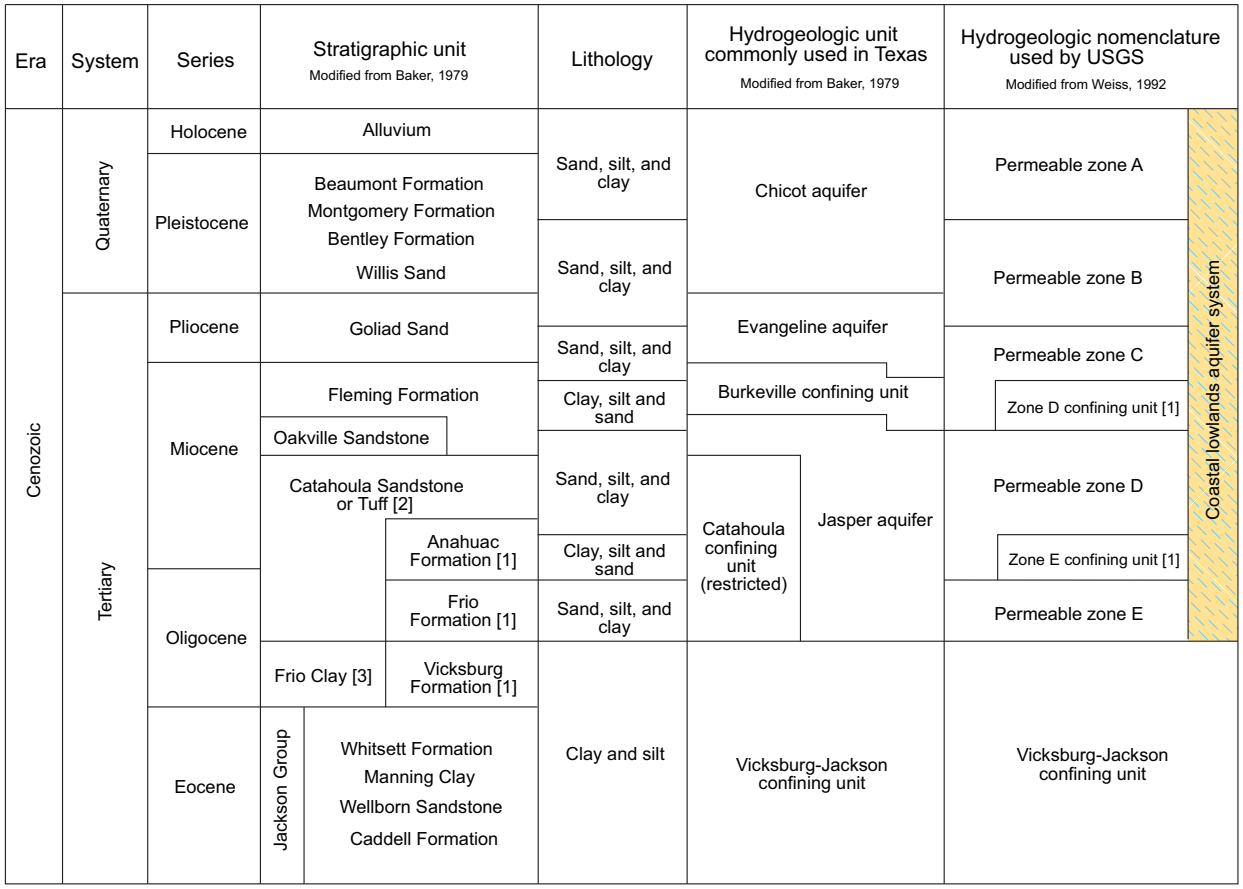


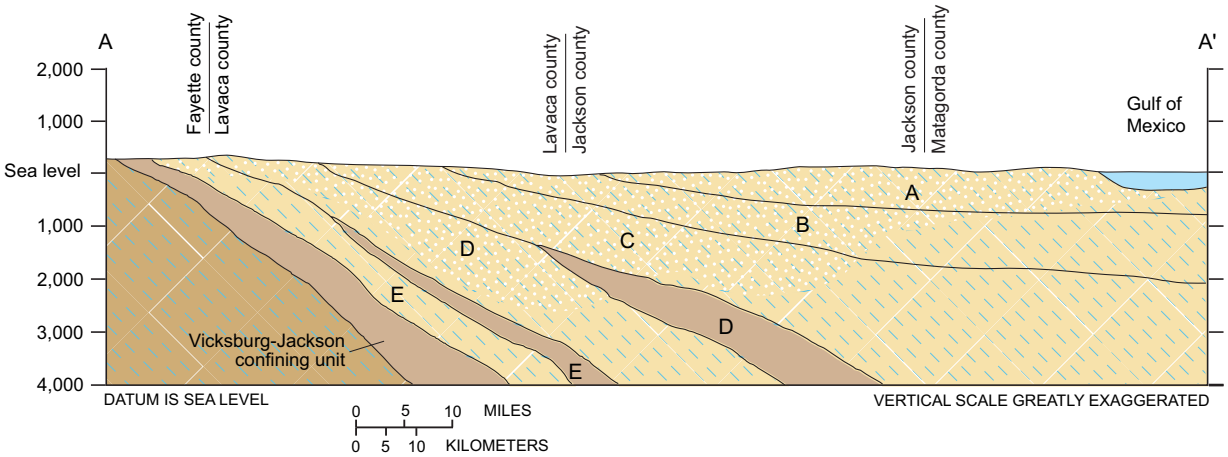
Figure 2.3.1-17 Major Aquifers of Texas



[1] Present only in the subsurface
[2] Called Catahoula Tuff west of Lavaca County
[3] Not recognized at surface east of Live Oak County

Modified from reference Ryder 1996

Figure 2.3.1-18 Correlation of USGS and Texas Nomenclature



Notes:

Coastal lowlands aquifer system—Dot patterned area indicates freshwater

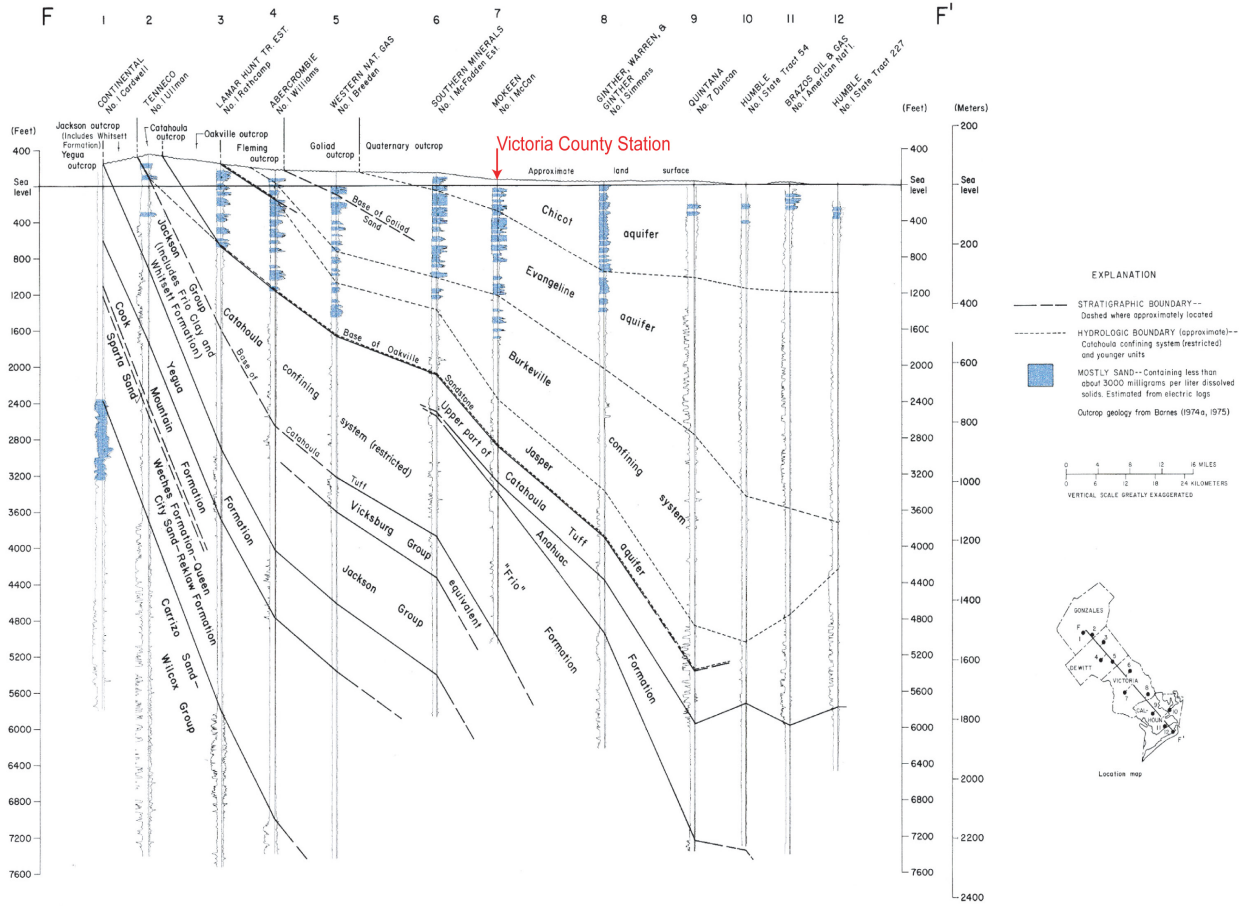
Texas coastal uplands aquifer system

Confining unit

D Hydrogeologic unit

Modified from reference Ryder 1996

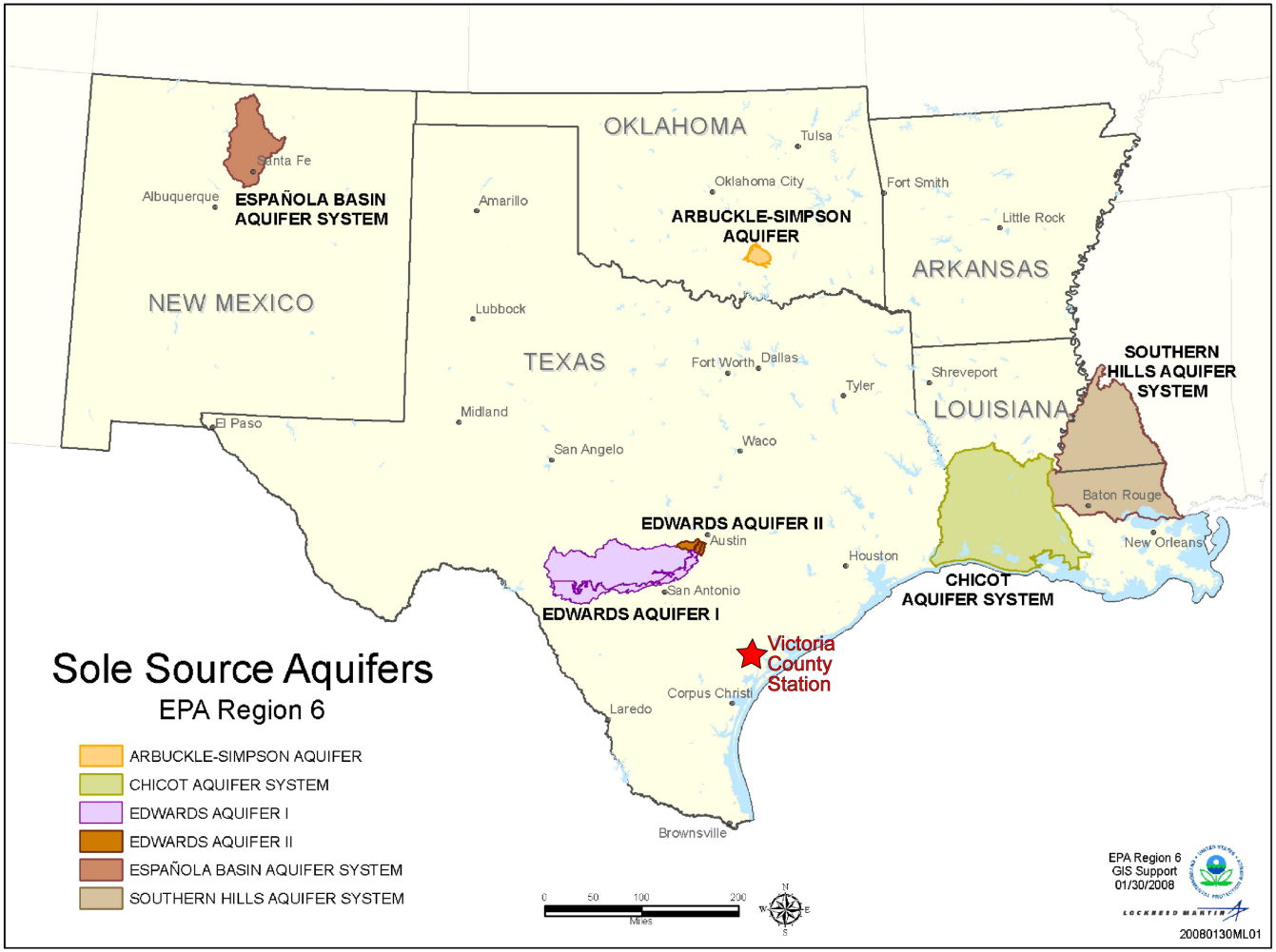
Figure 2.3.1-19 Generalized Cross Section through the Coastal Lowlands/Coastal Uplands Aquifer Systems



Stratigraphic and Hydrogeologic Section F-F'

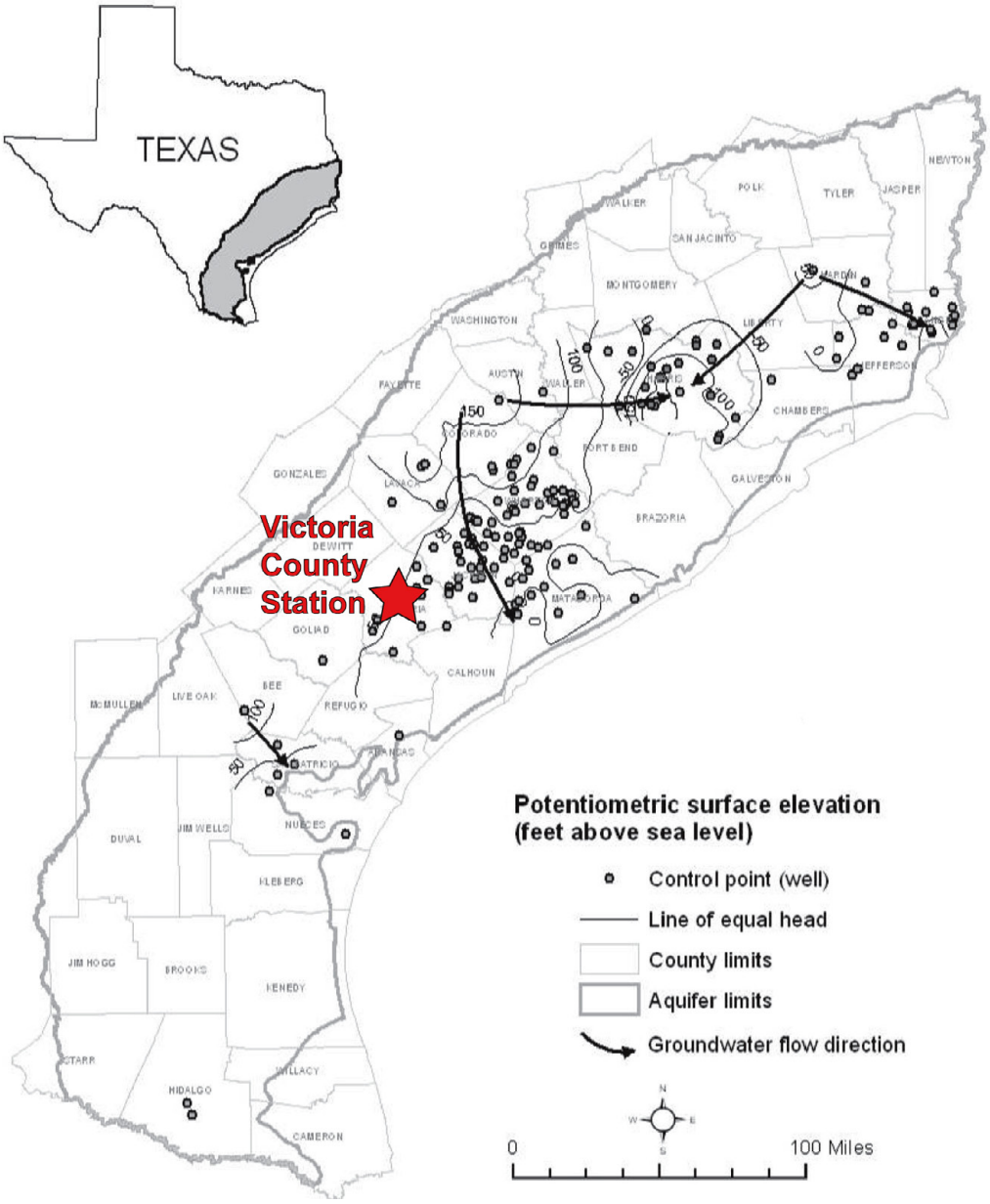
Modified from reference Baker Jul 1979

Figure 2.3.1-20 Regional Hydrogeologic Cross Section through the Gulf Coast Aquifer System



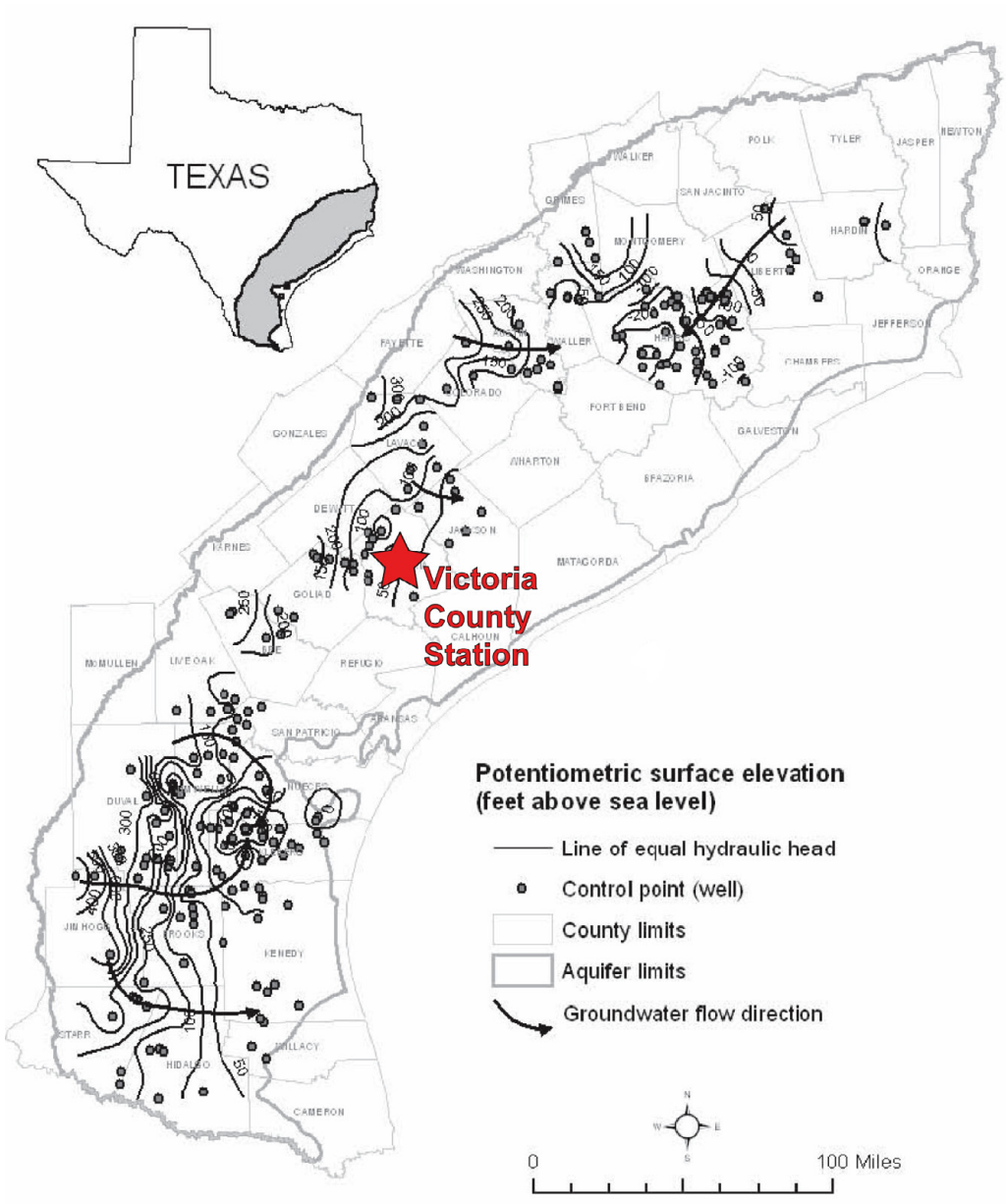
Modified from reference U.S. EPA Jan 2008

Figure 2.3.1-21 Sole Source Aquifers U.S. EPA Region 6



Modified from reference Chowdhury et al. Feb 2006

Figure 2.3.1-22 Regional Potentiometric Surface Map for the Chicot Aquifer, Including Water Level Measurements from 2001 to 2005 (Sheet 1 of 2)



Modified from reference Chowdhury et al. Feb 2006

Figure 2.3.1-22 Regional Potentiometric Surface Map for the Evangeline Aquifer, Including Water Level Measurements from 2001 to 2005 (Sheet 2 of 2)

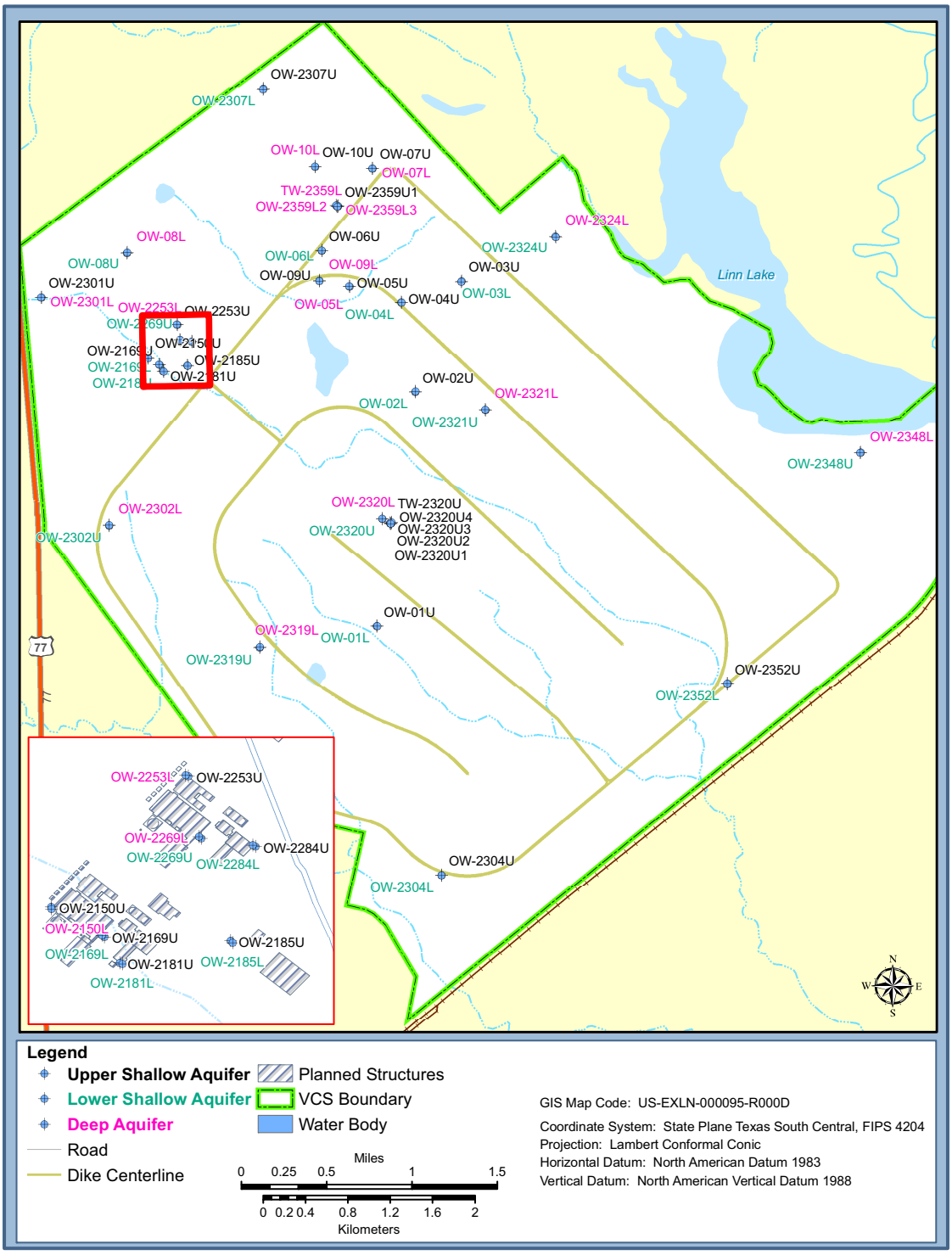


Figure 2.3.1-23 VCS Site Well Location Plan

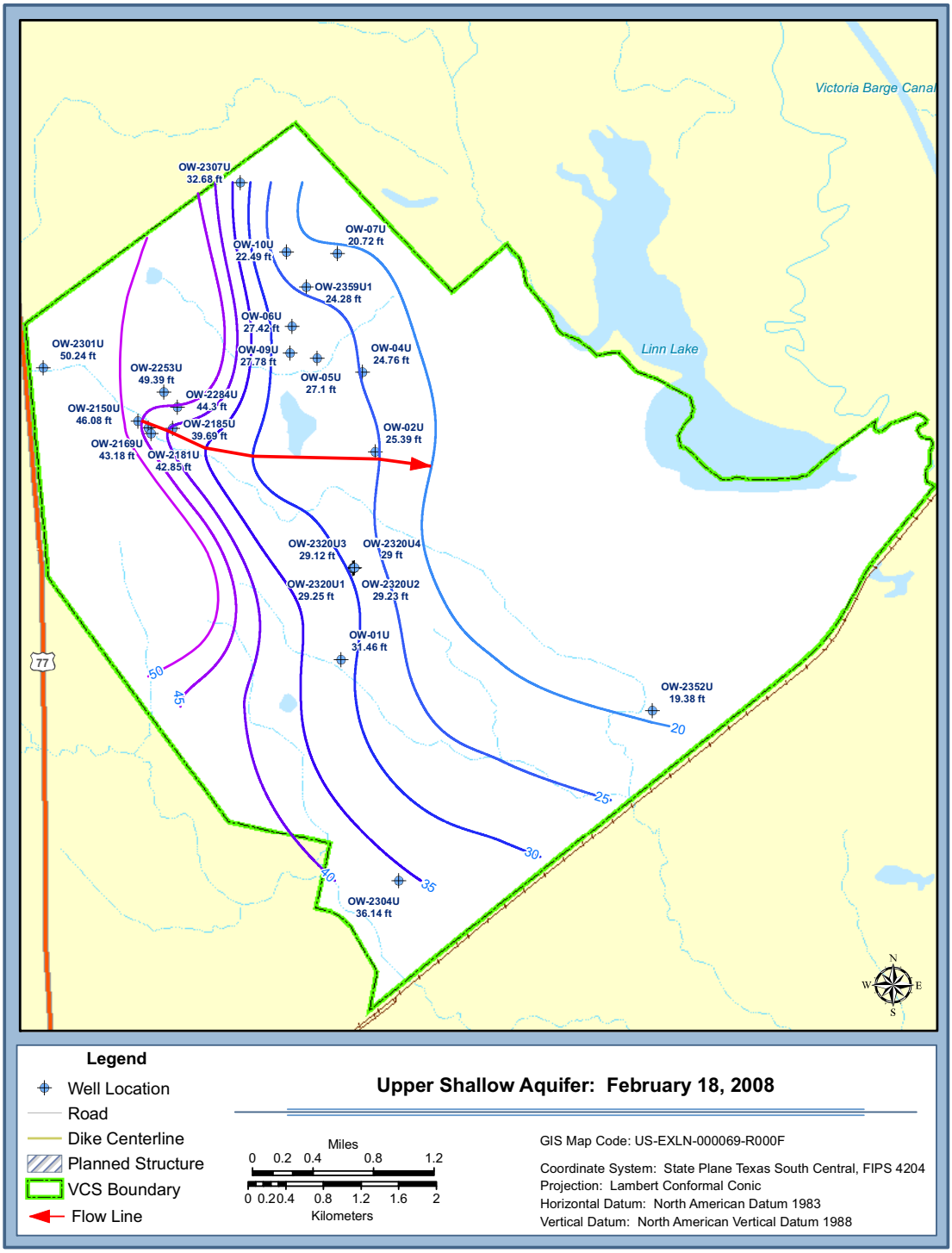


Figure 2.3.1-24 Potentiometric Surface Maps (Sheet 1 of 6)

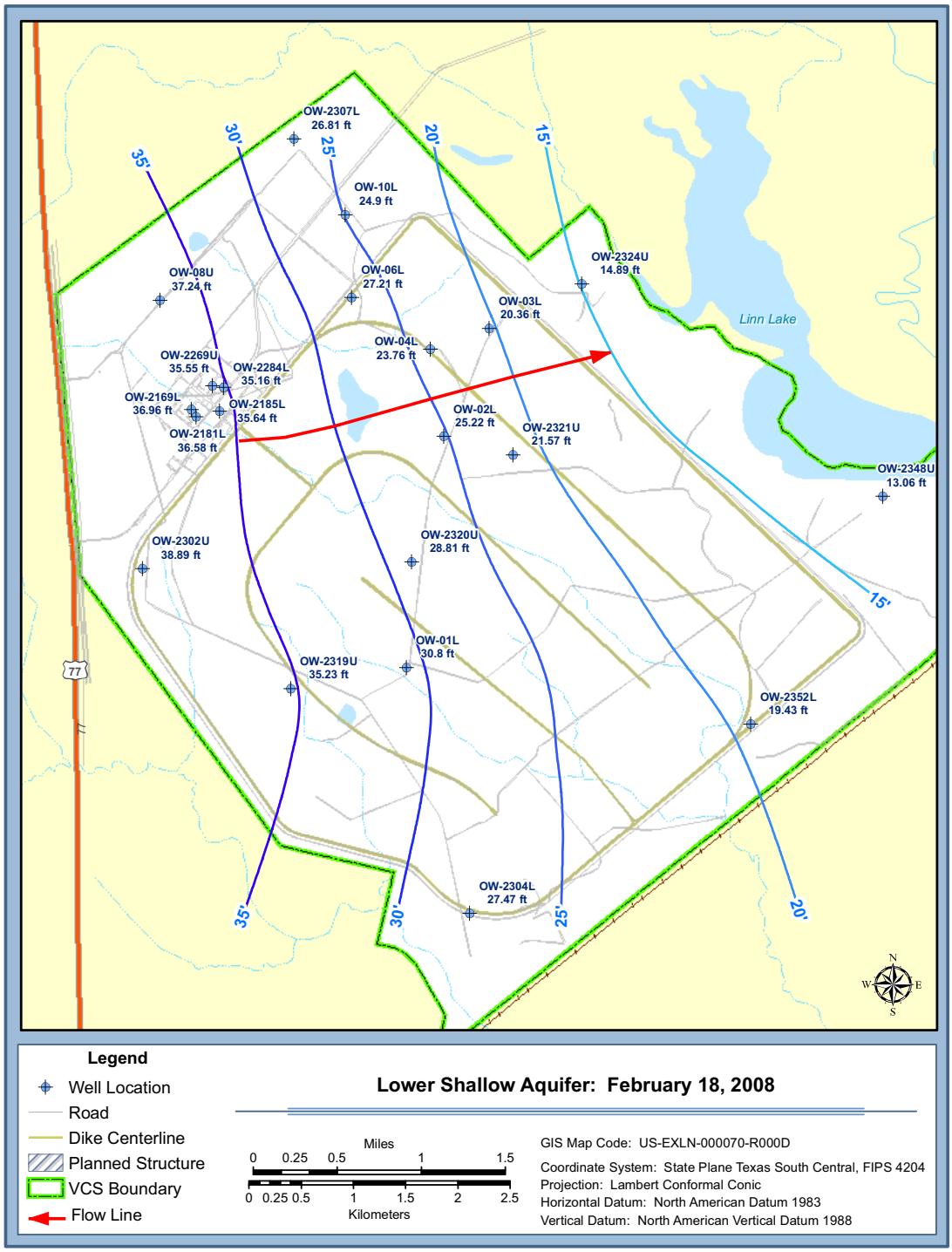


Figure 2.3.1-24 Potentiometric Surface Maps (Sheet 2 of 6)

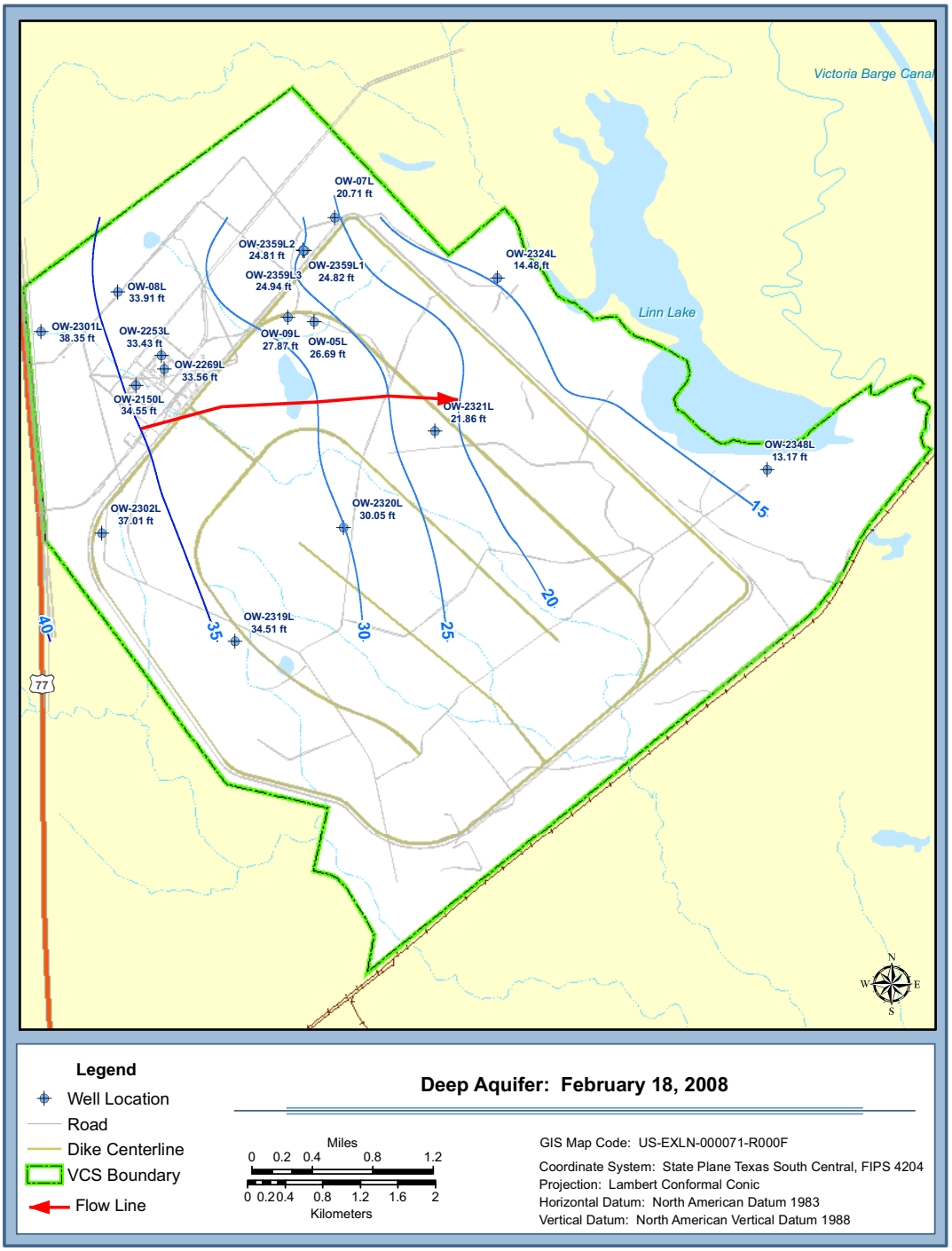


Figure 2.3.1-24 Potentiometric Surface Maps (Sheet 3 of 6)

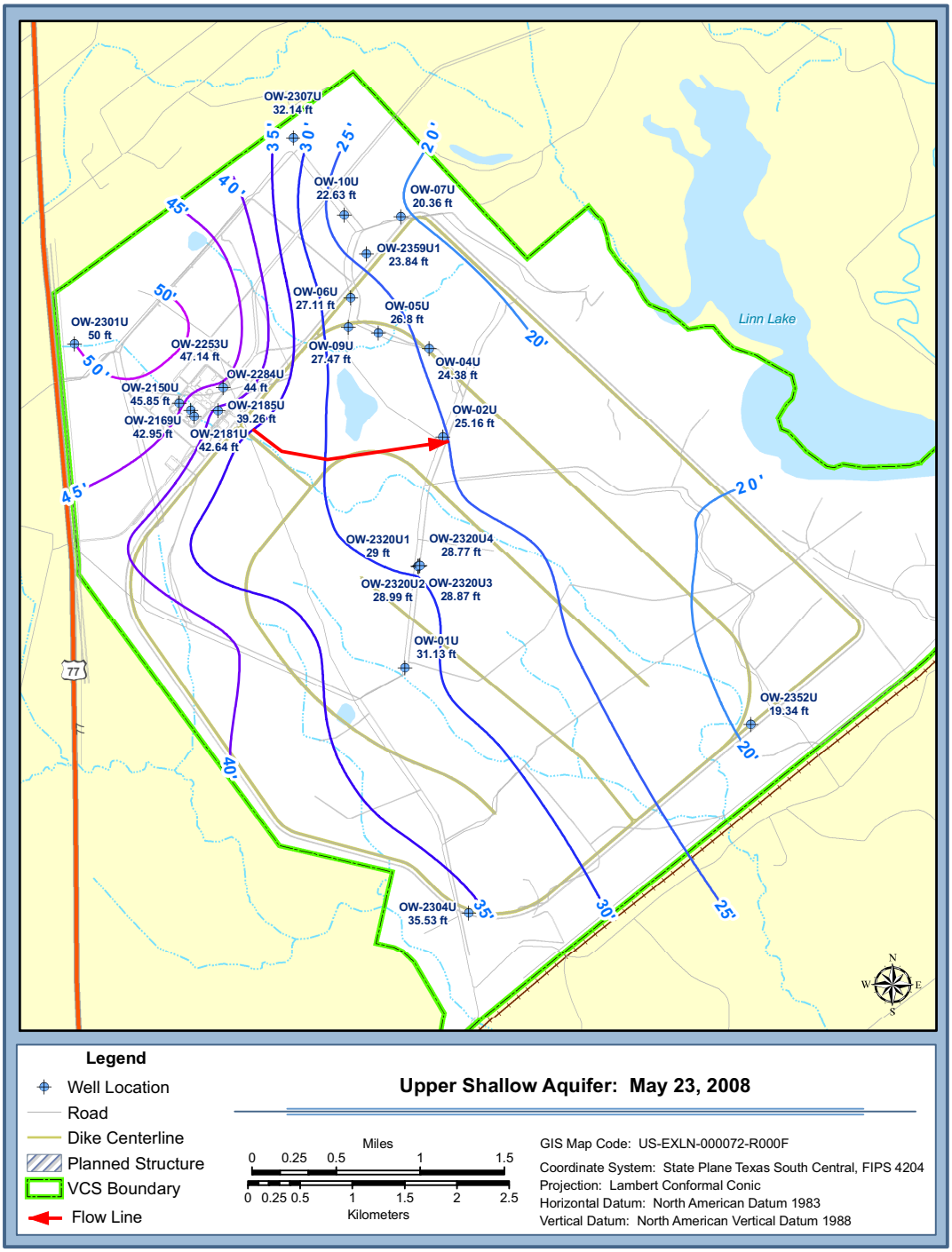


Figure 2.3.1-24 Potentiometric Surface Maps (Sheet 4 of 6)

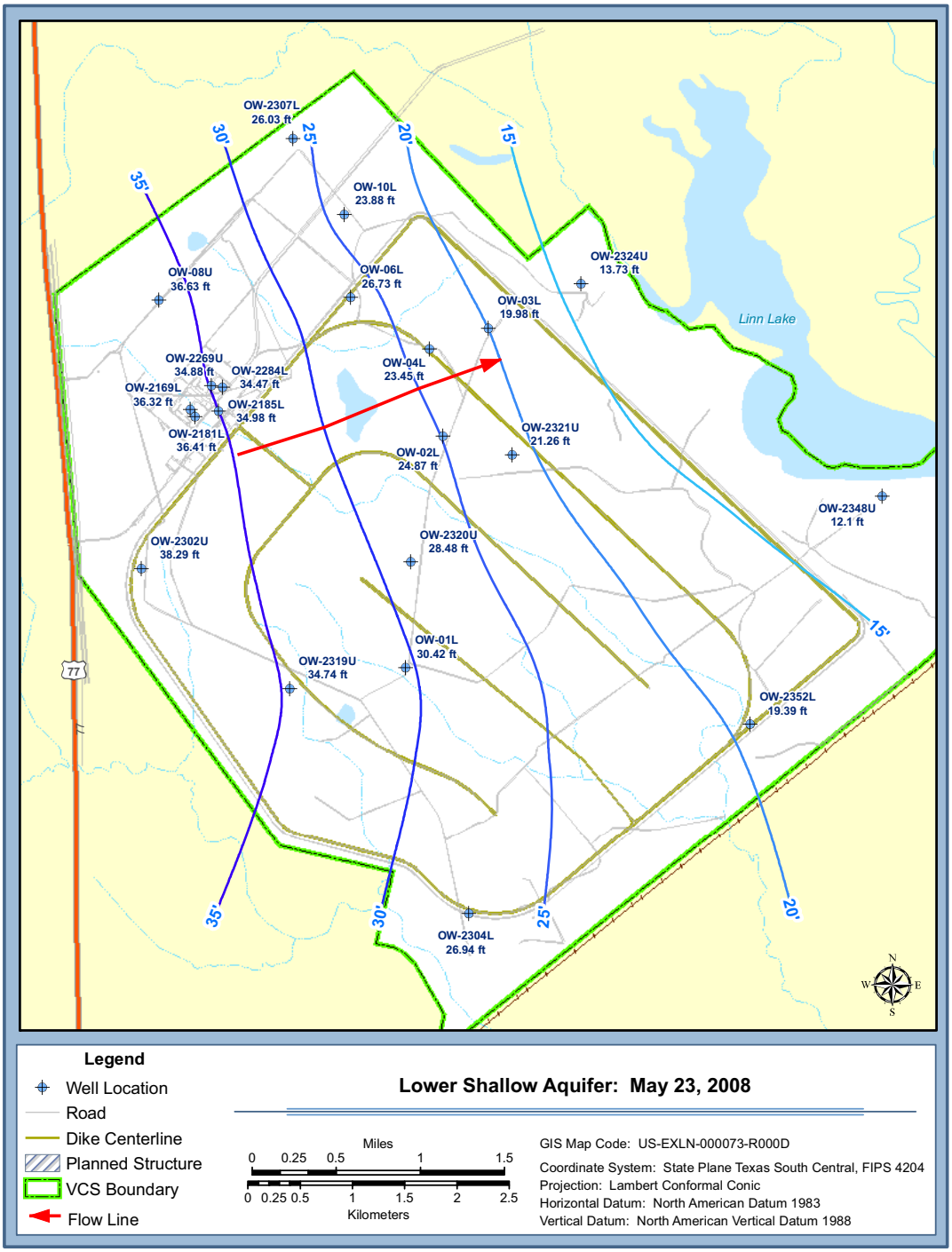


Figure 2.3.1-24 Potentiometric Surface Maps (Sheet 5 of 6)

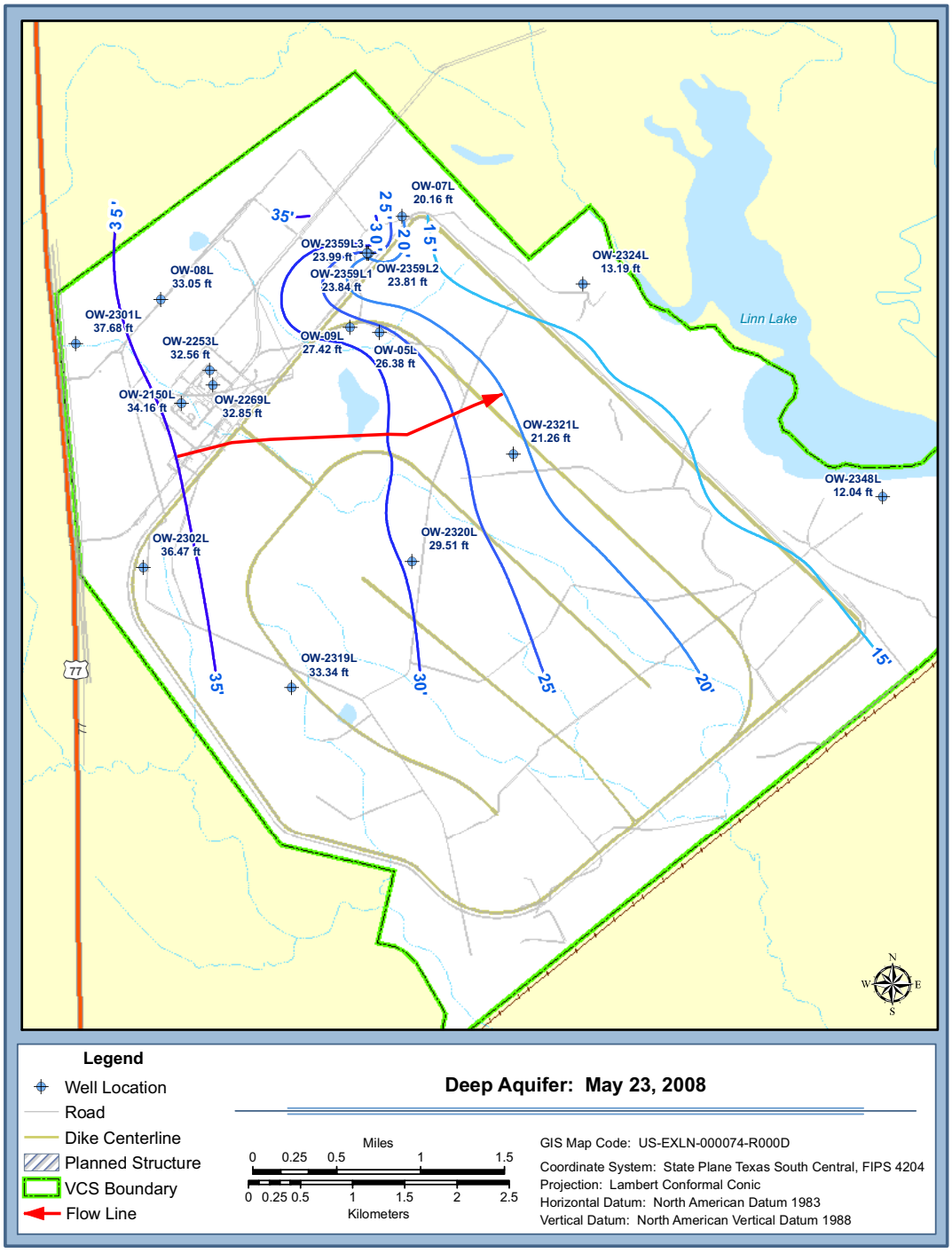
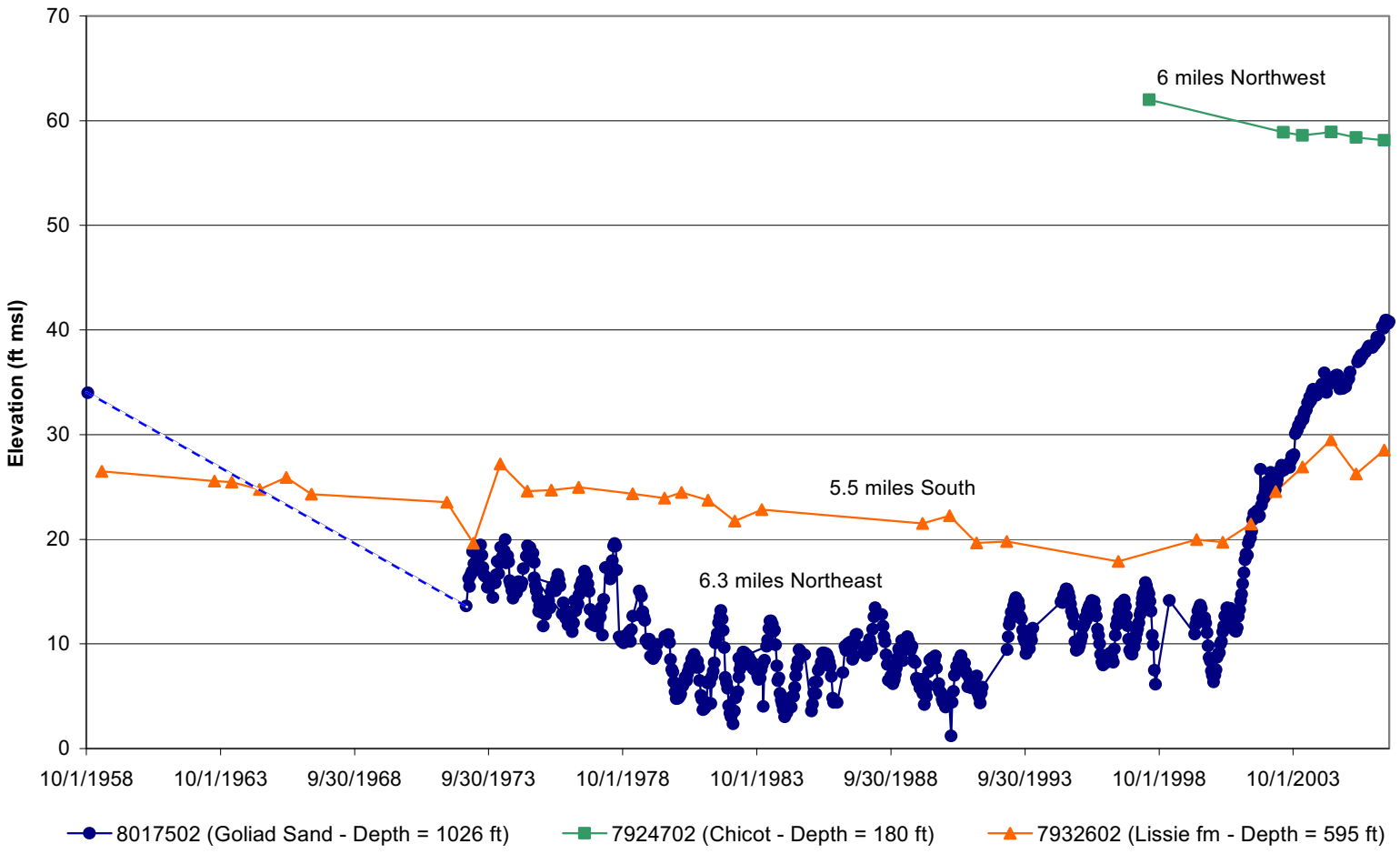


Figure 2.3.1-24 Potentiometric Surface Maps (Sheet 6 of 6)



Source: Reference TWDBb Dec 2007

Figure 2.3.1-25 Regional Hydrographs

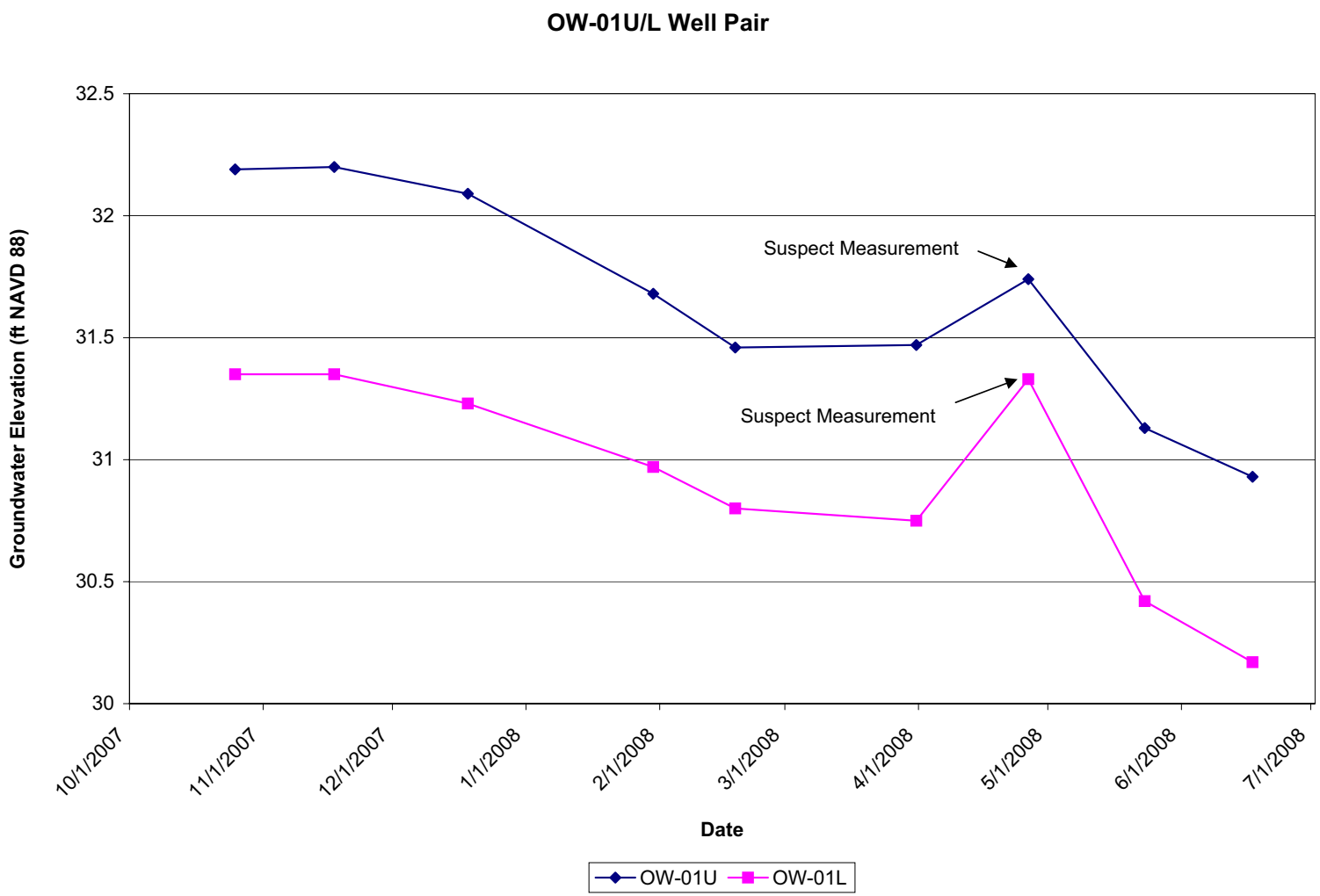


Figure 2.3.1-26 VCS Site Hydrographs; OW-01U/L Well Pair (Sheet 1 of 10)

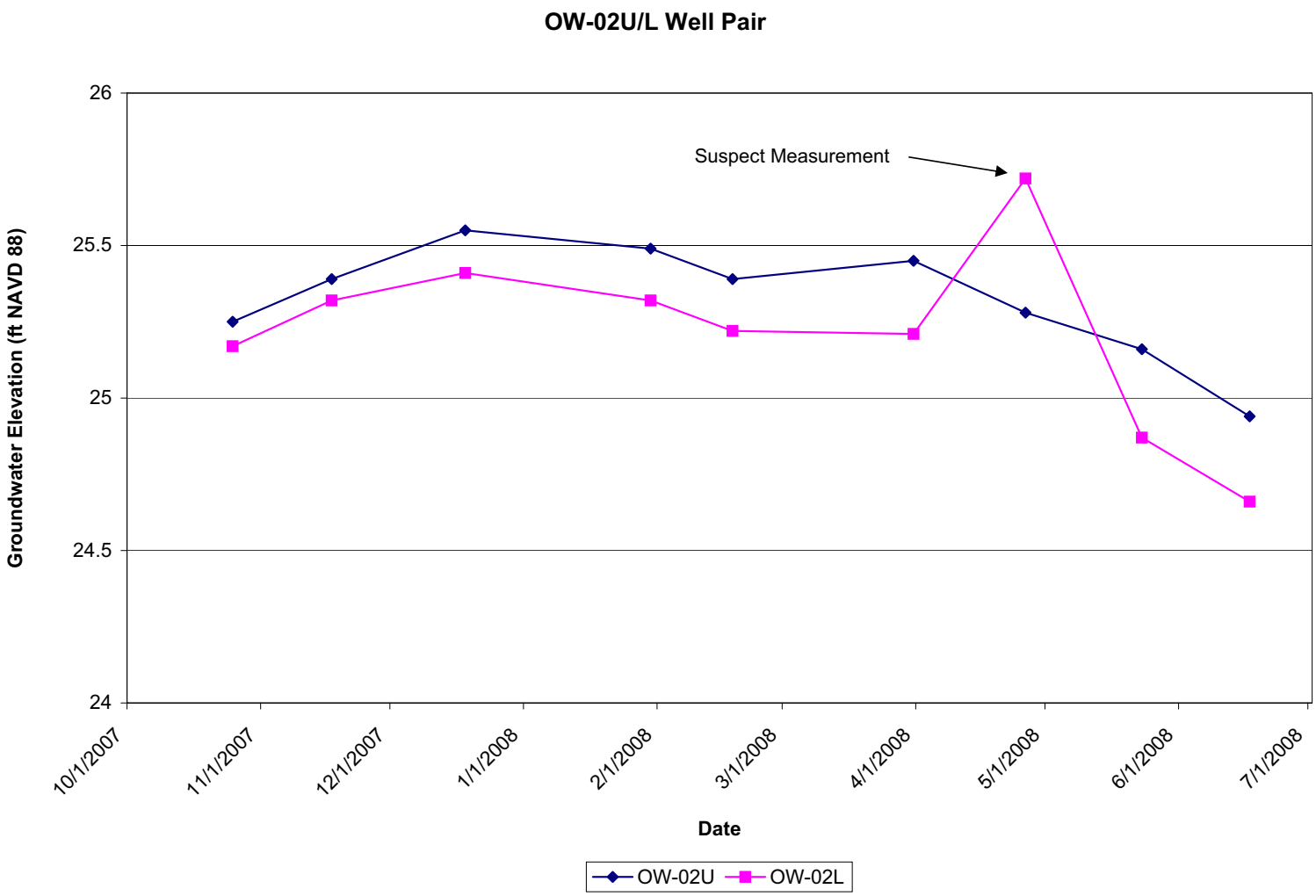


Figure 2.3.1-26 VCS Site Hydrographs; OW-02U/L Well Pair (Sheet 2 of 10)

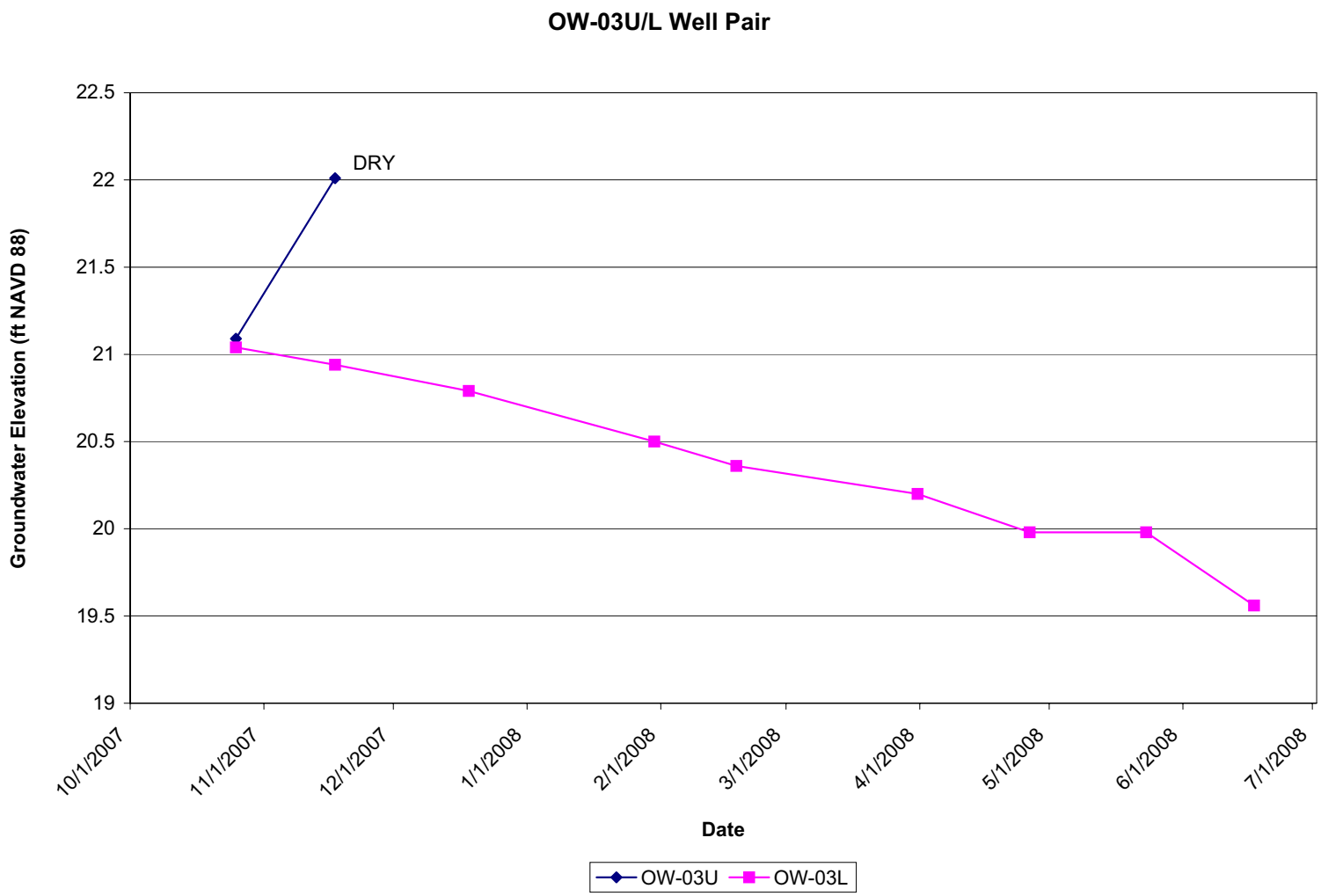


Figure 2.3.1-26 VCS Site Hydrographs; OW-03U/L Well Pair (Sheet 3 of 10)

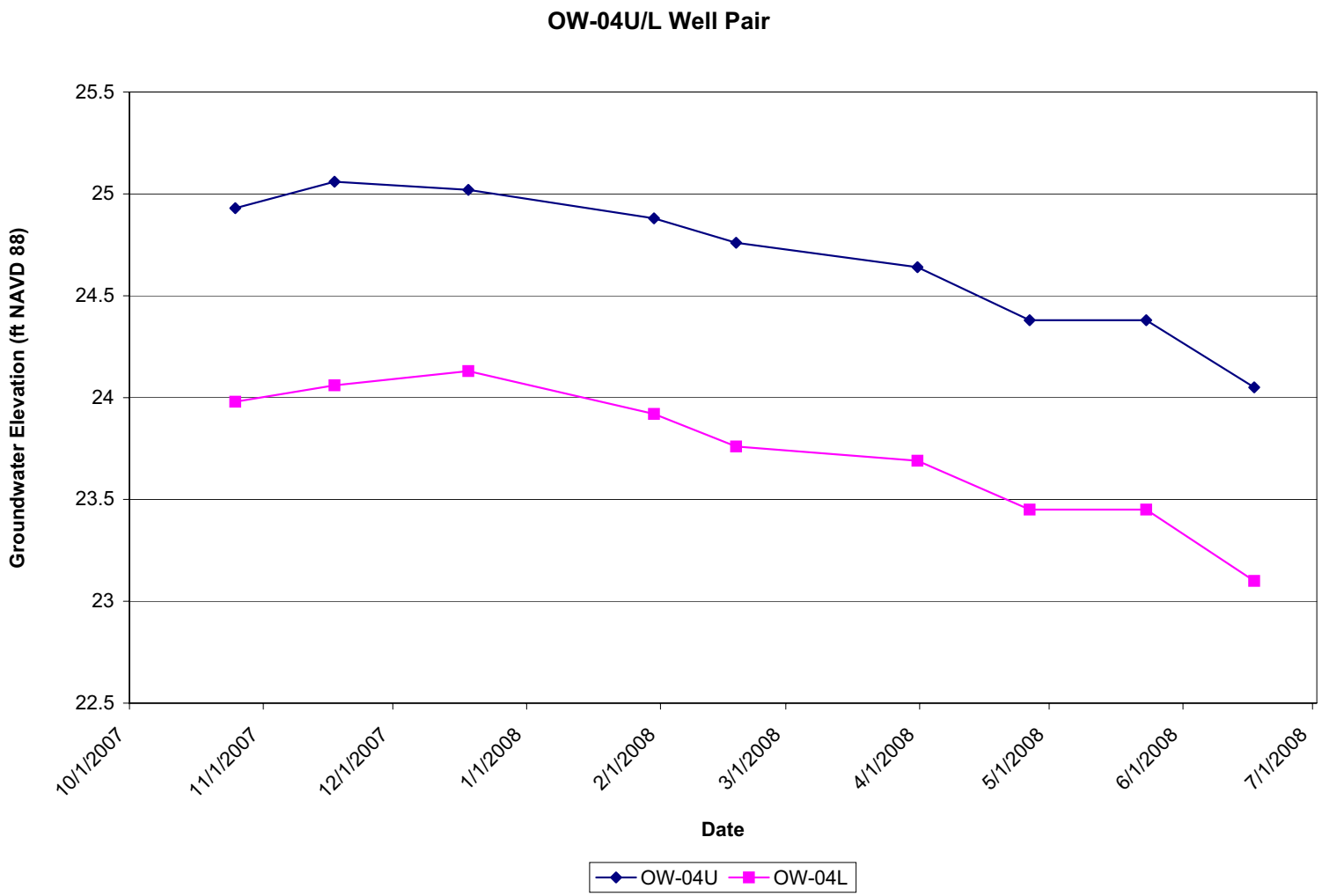


Figure 2.3.1-26 VCS Site Hydrographs; OW-04U/L Well Pair (Sheet 4 of 10)

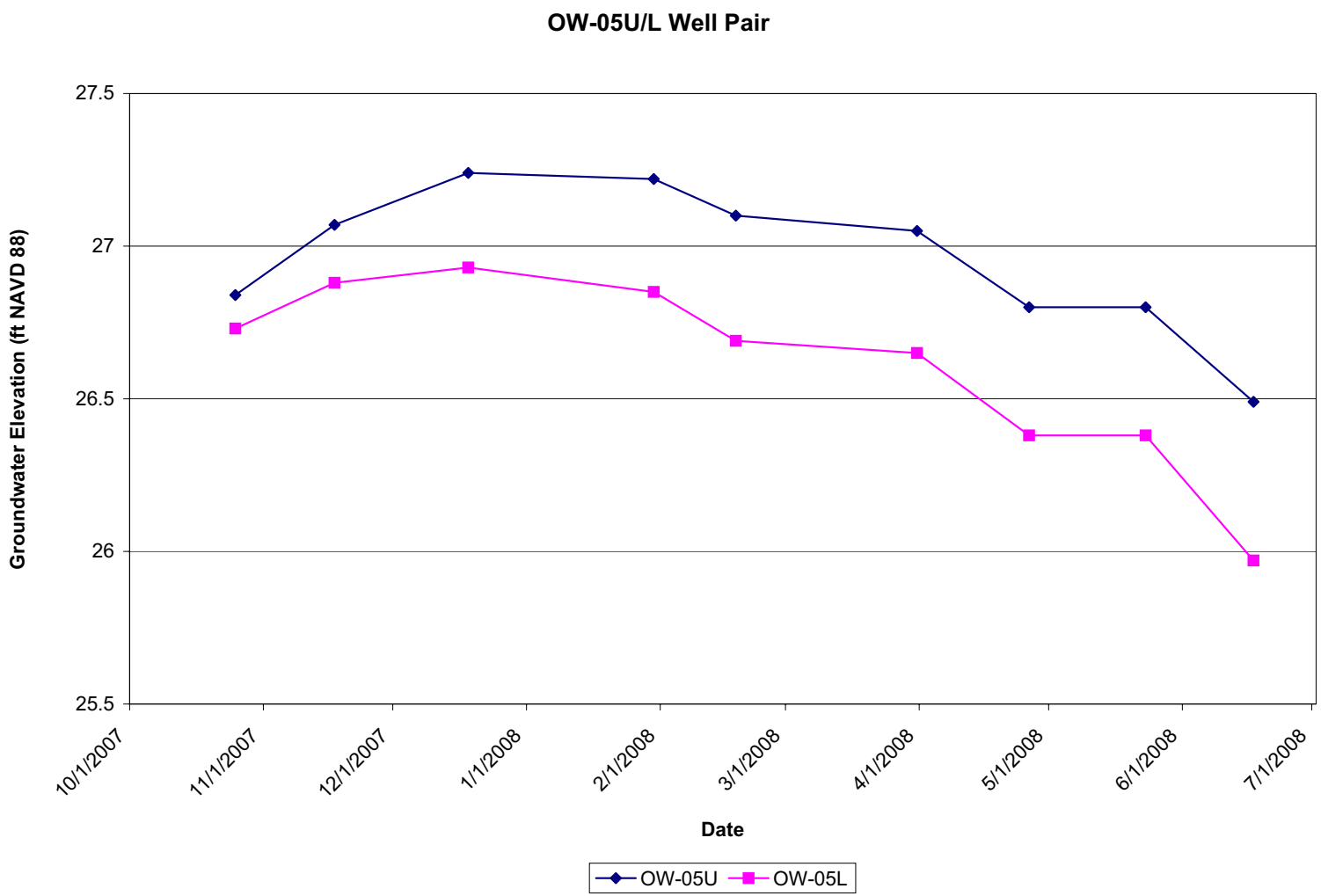


Figure 2.3.1-26 VCS Site Hydrographs; OW-05U/L Well Pair (Sheet 5 of 10)

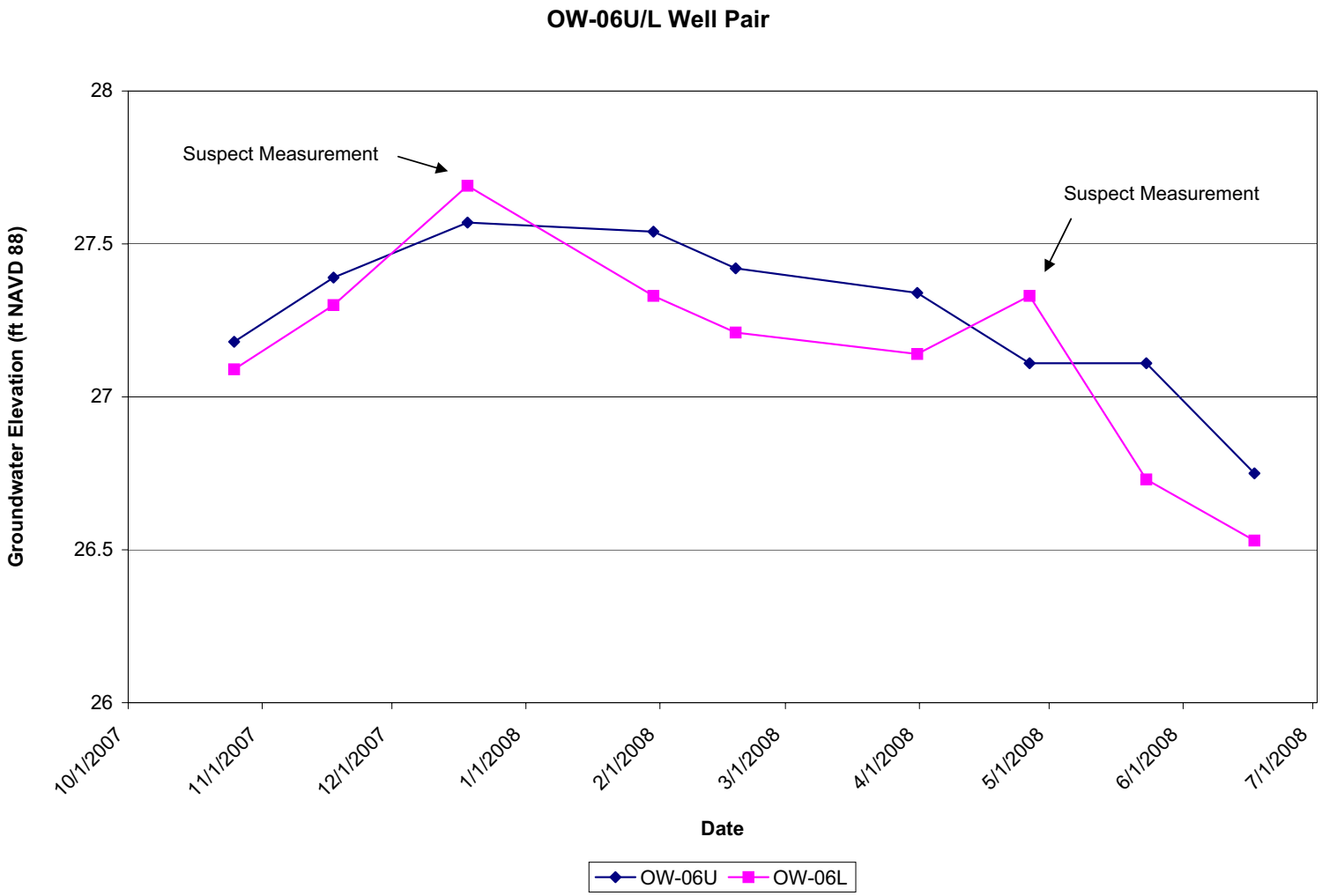


Figure 2.3.1-26 VCS Site Hydrographs; OW-06U/L Well Pair (Sheet 6 of 10)

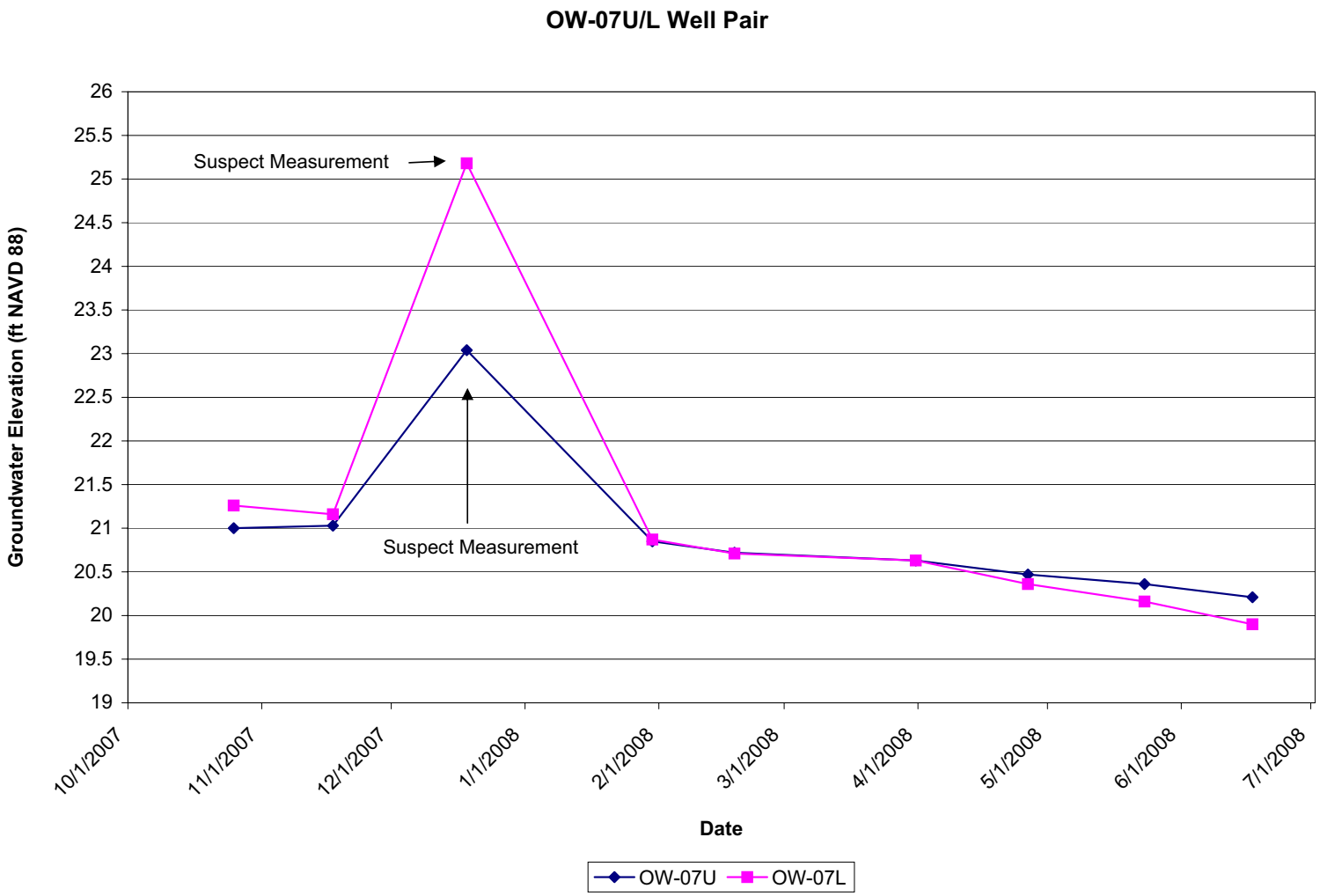


Figure 2.3.1-26 VCS Site Hydrographs; OW-07U/L Well Pair (Sheet 7 of 10)

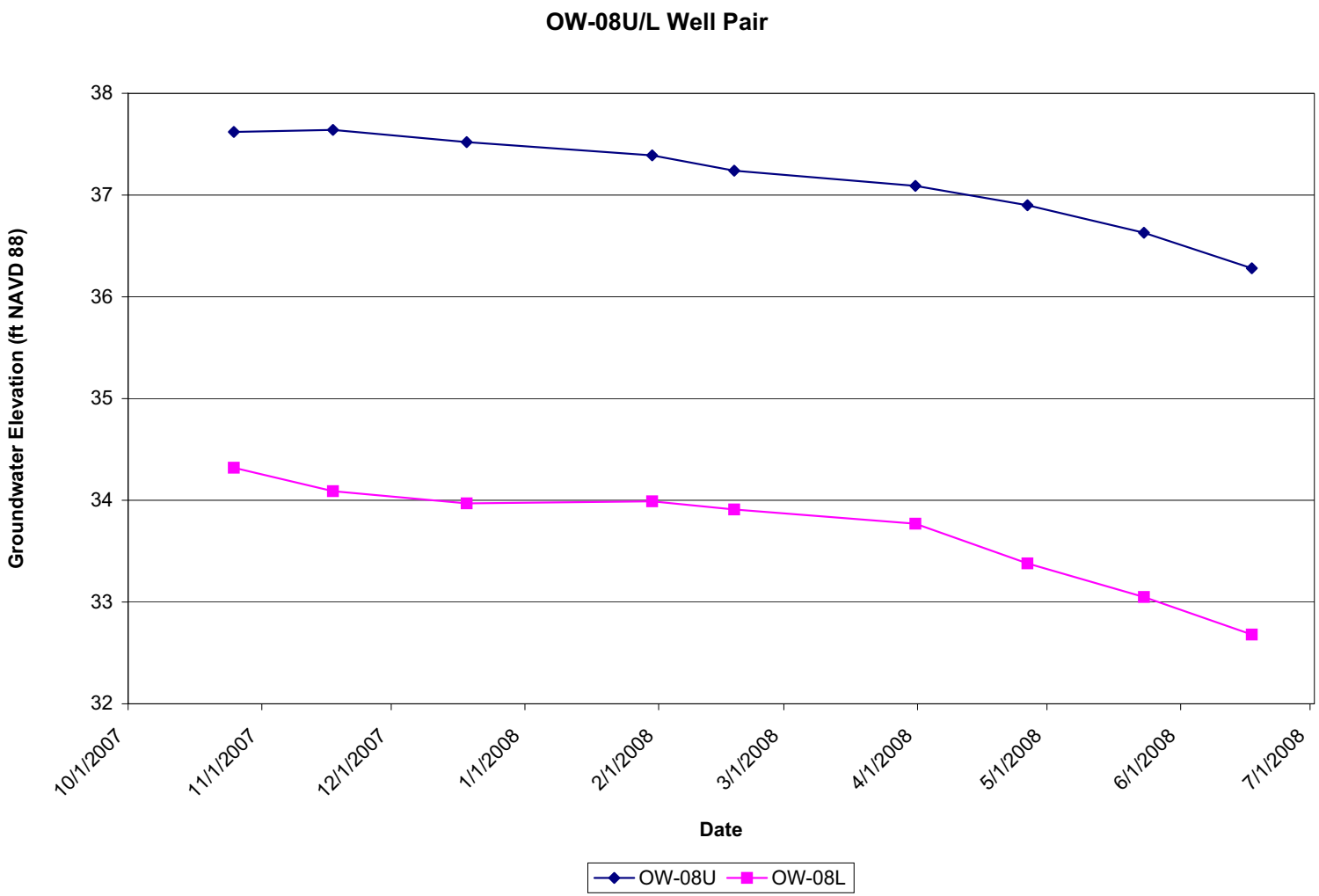


Figure 2.3.1-26 VCS Site Hydrographs; OW-08U/L Well Pair (Sheet 8 of 10)

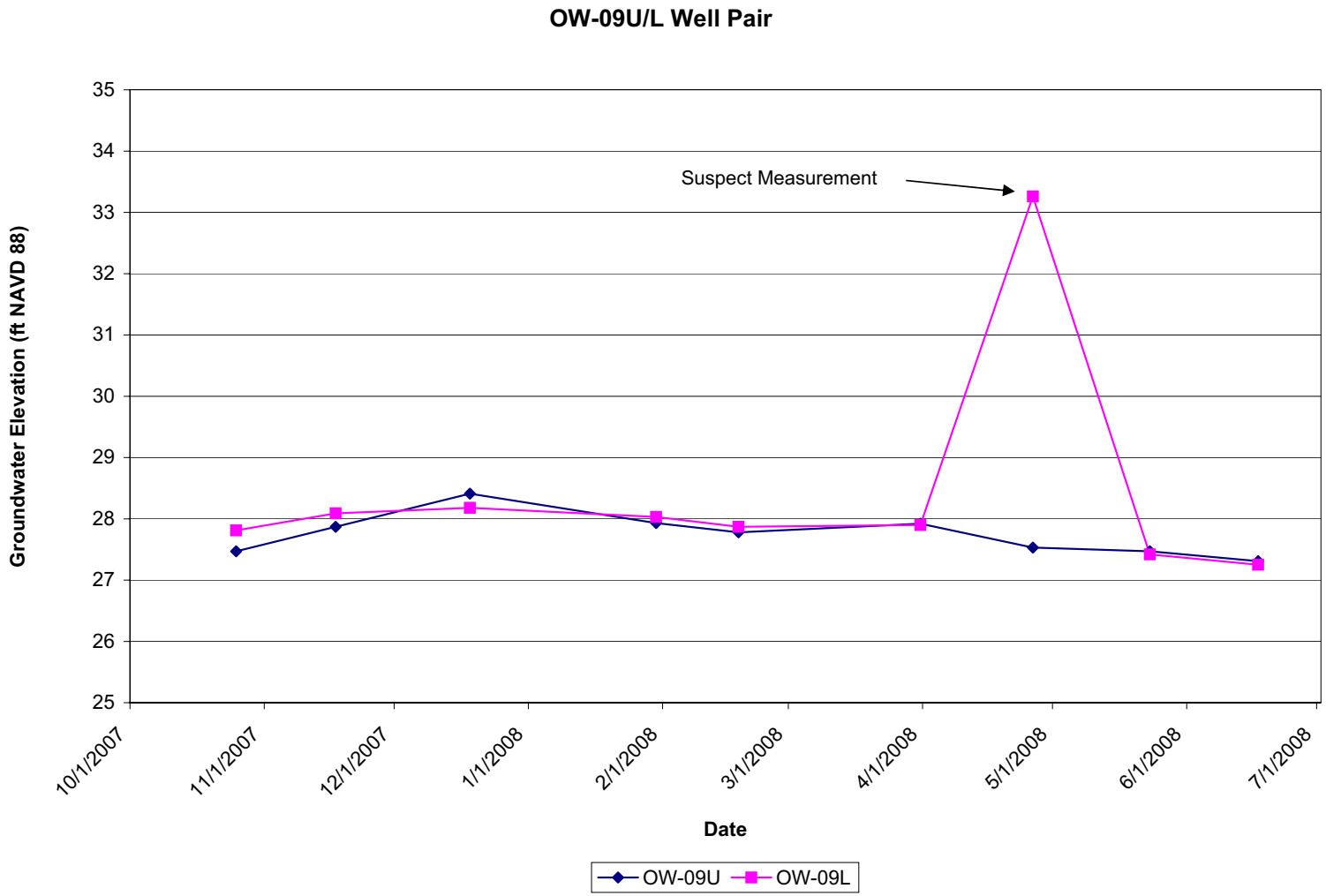


Figure 2.3.1-26 VCS Site Hydrographs; OW-09U/L Well Pair (Sheet 9 of 10)

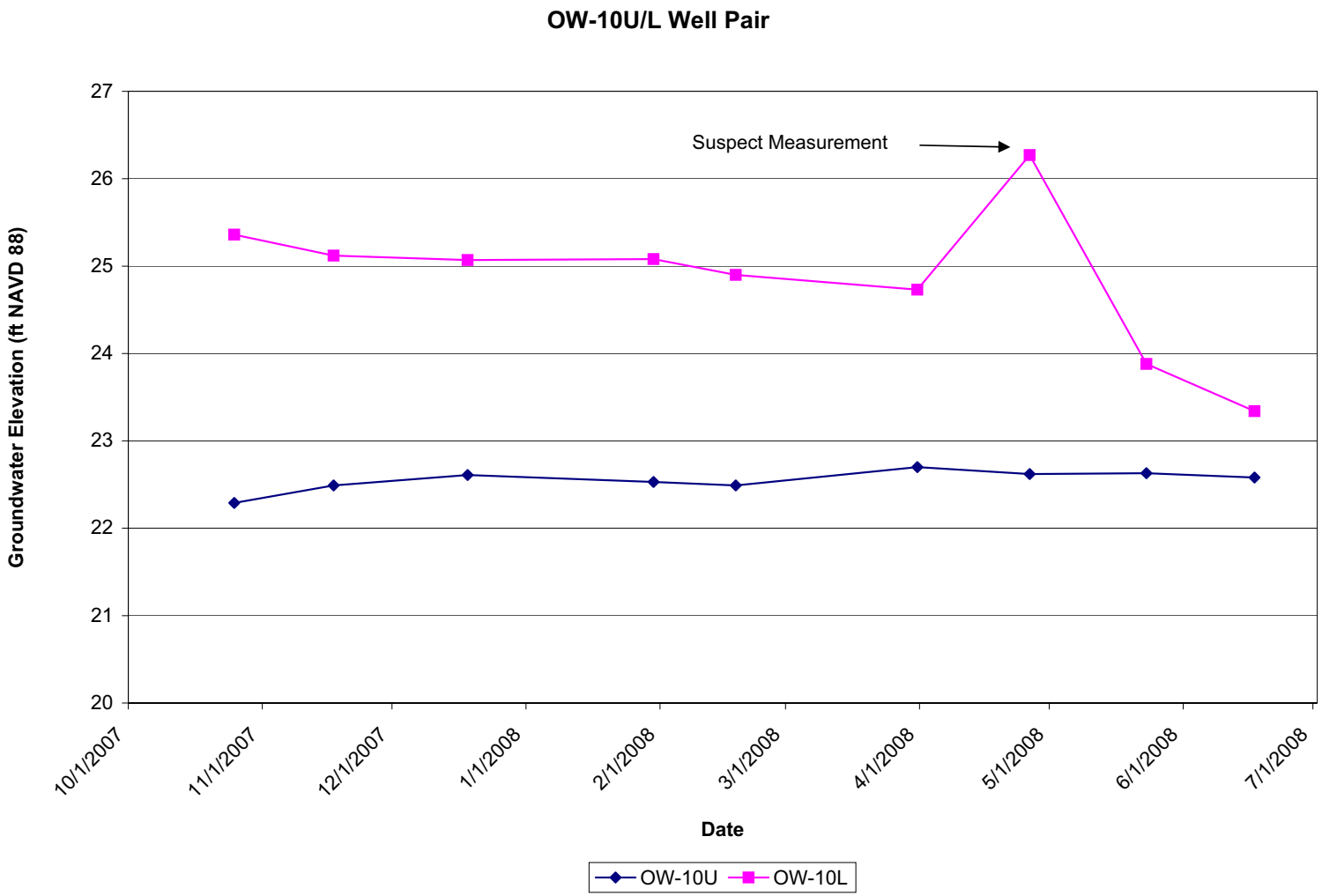


Figure 2.3.1-26 VCS Site Hydrographs; OW-10U/L Well Pair (Sheet 10 of 10)

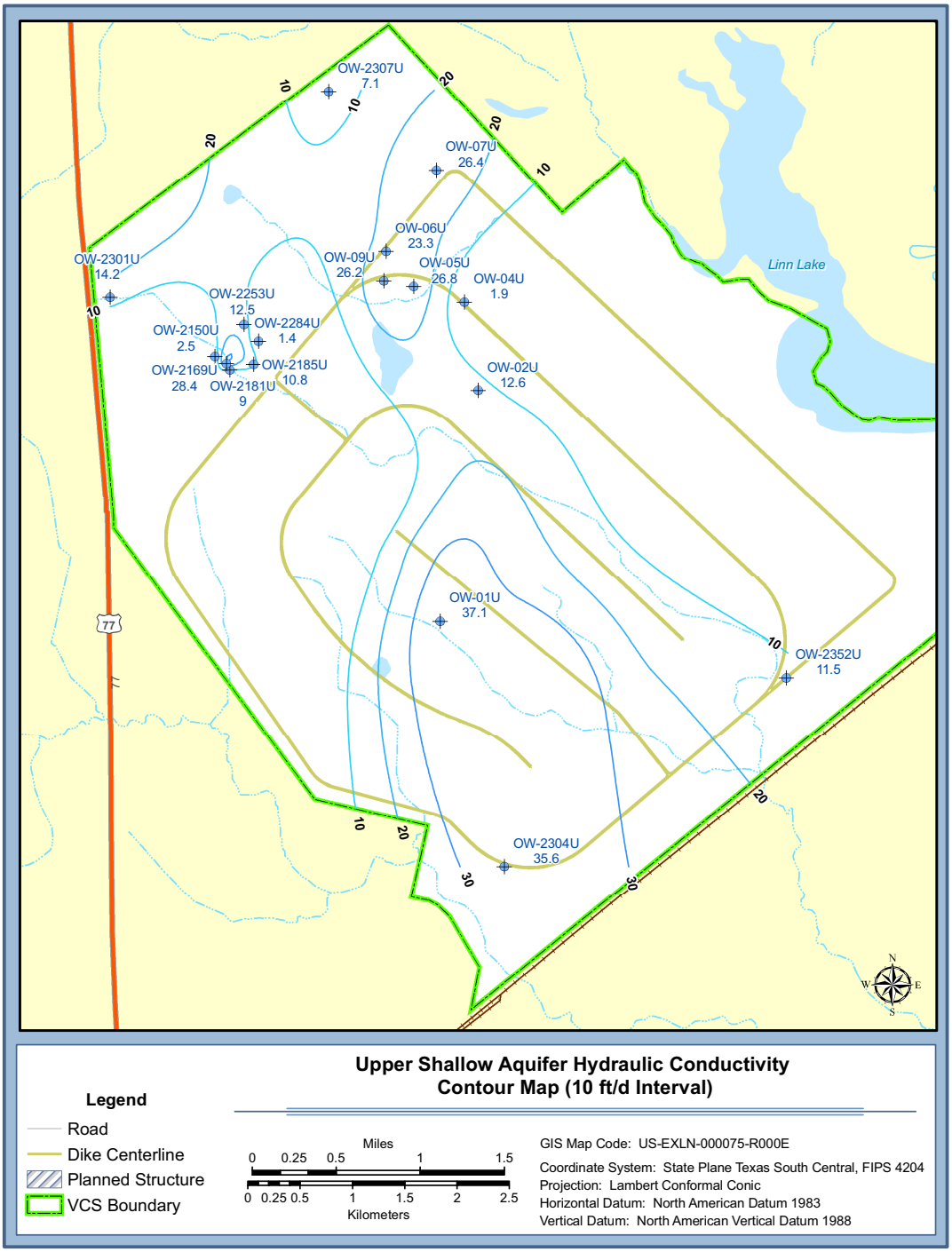


Figure 2.3.1-27 Contour Maps of Hydraulic Conductivity from Slug Tests (Sheet 1 of 3)

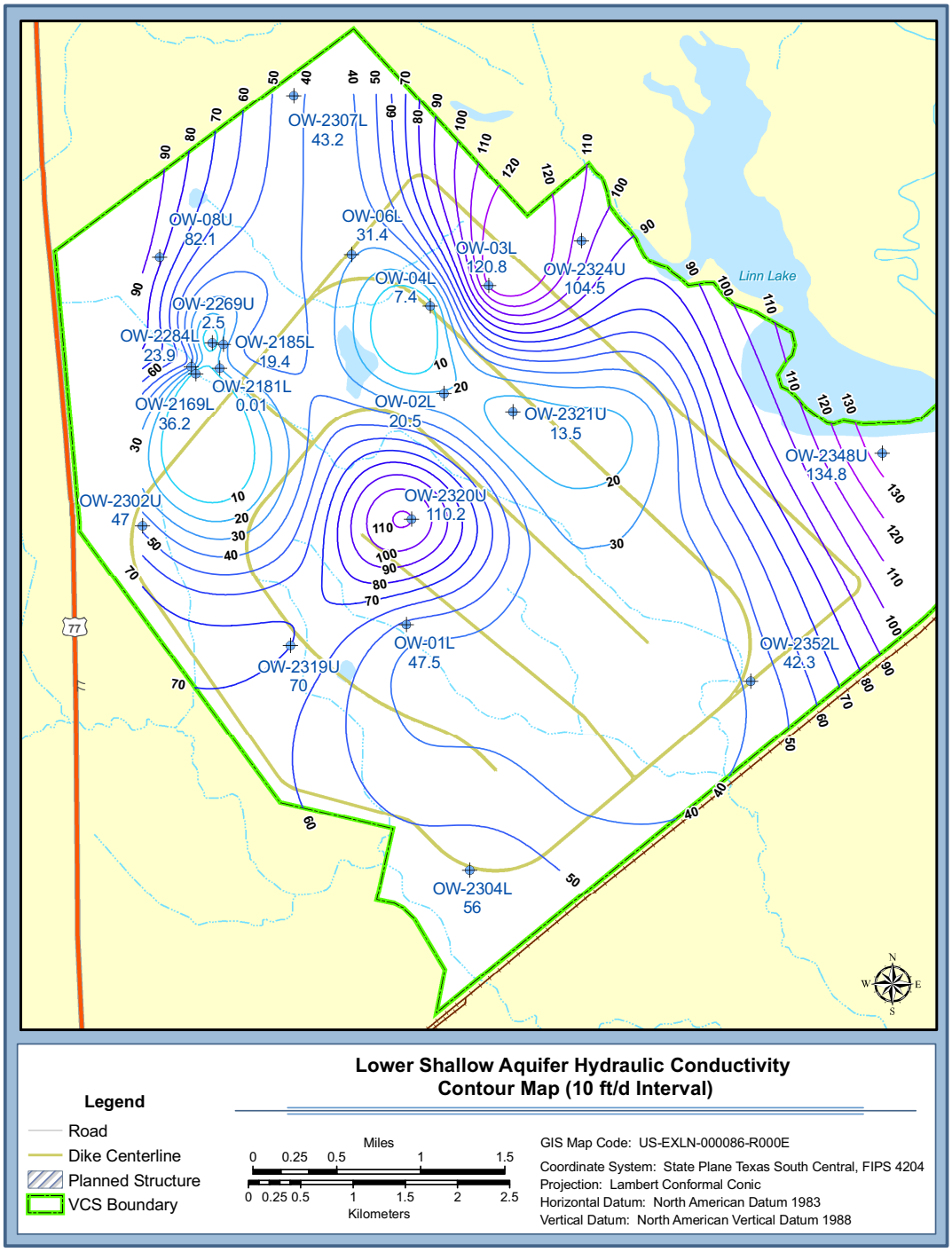


Figure 2.3.1-27 Contour Maps of Hydraulic Conductivity from Slug Tests (Sheet 2 of 3)

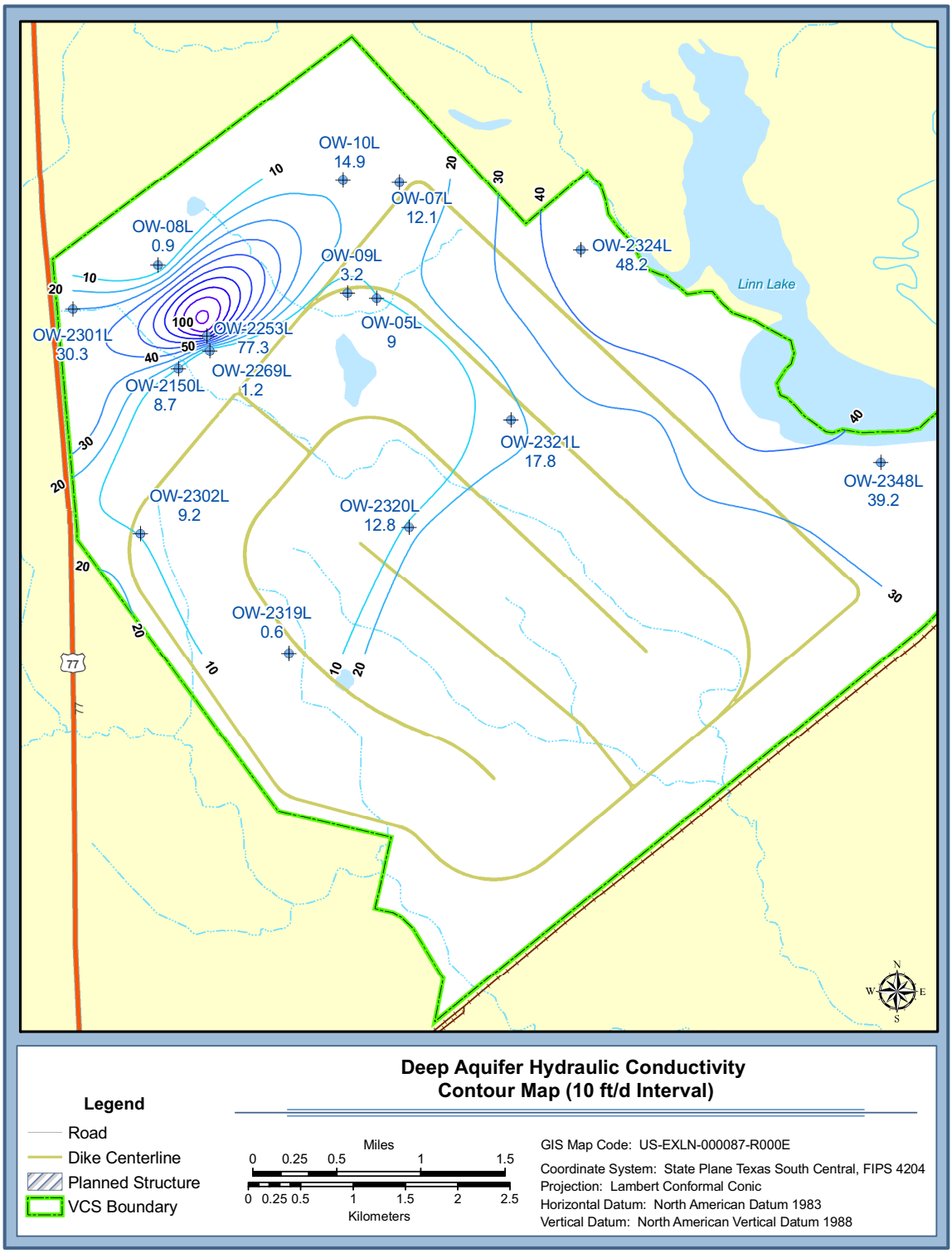
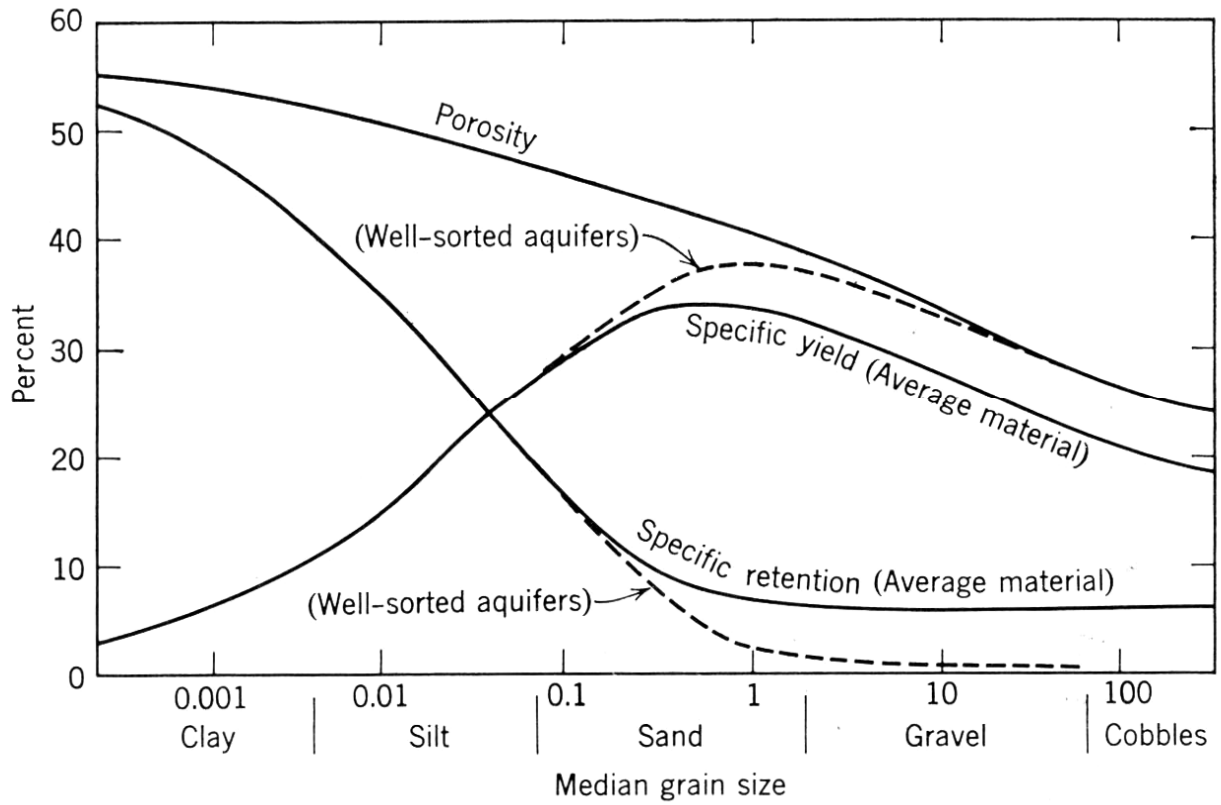


Figure 2.3.1-27 Contour Maps of Hydraulic Conductivity from Slug Tests (Sheet 3 of 3)



Reference Davis, 1966

Figure 2.3.1-28 Relationship of Porosity, Specific Yield, and Specific Retention

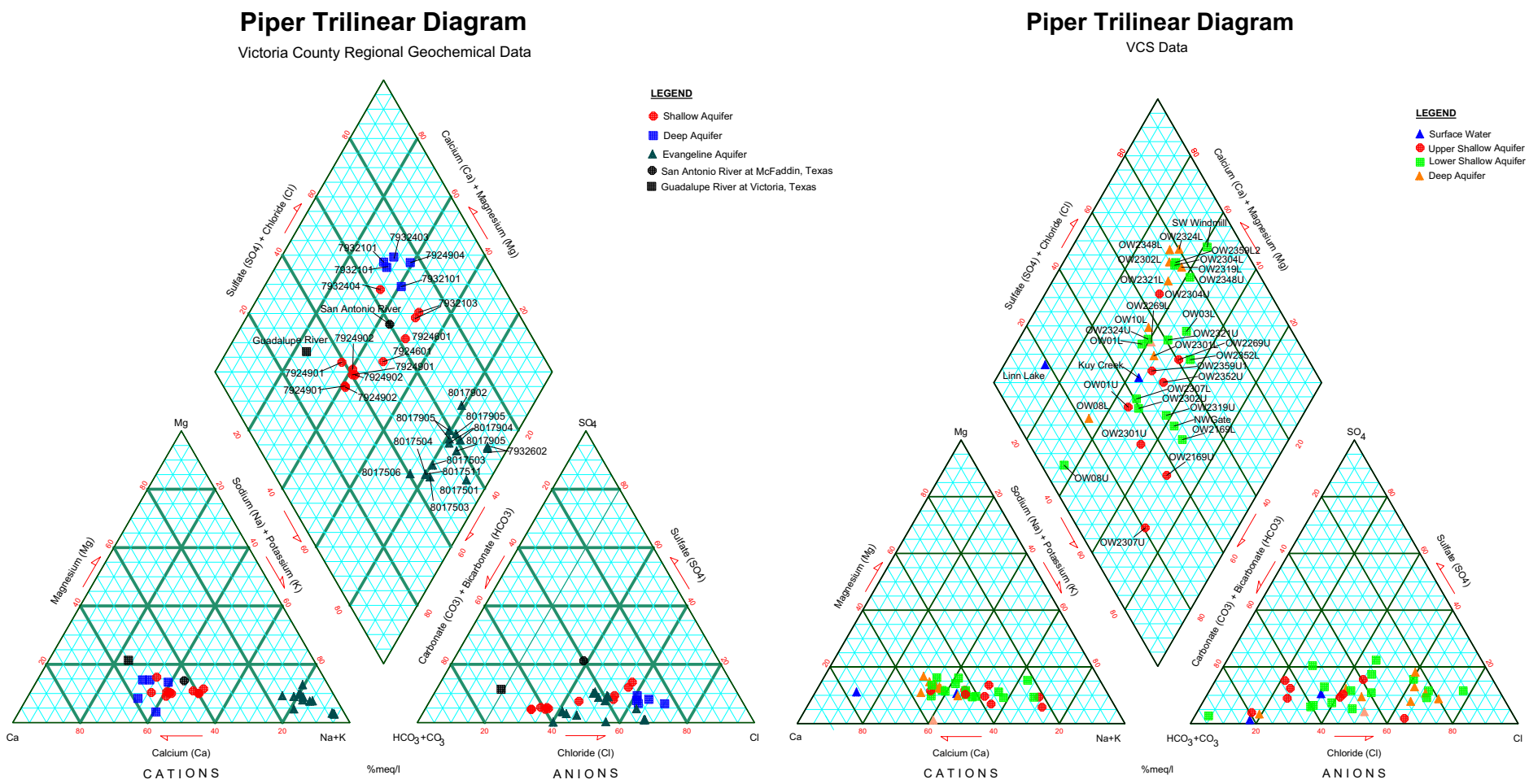


Figure 2.3.1-29 Trilinear Diagram of Hydrogeochemical Data

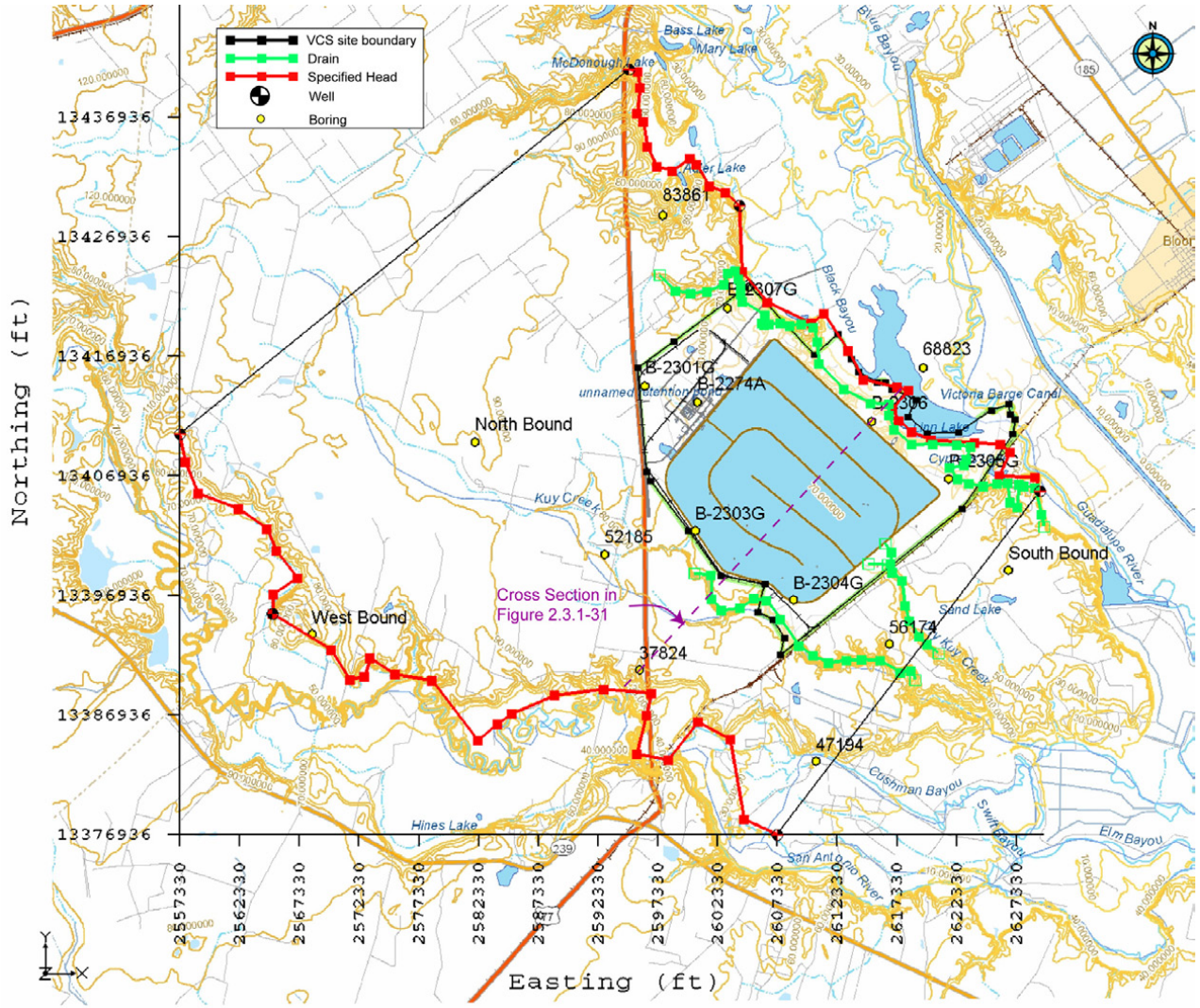


Figure 2.3.1-30 Groundwater Model Plan View

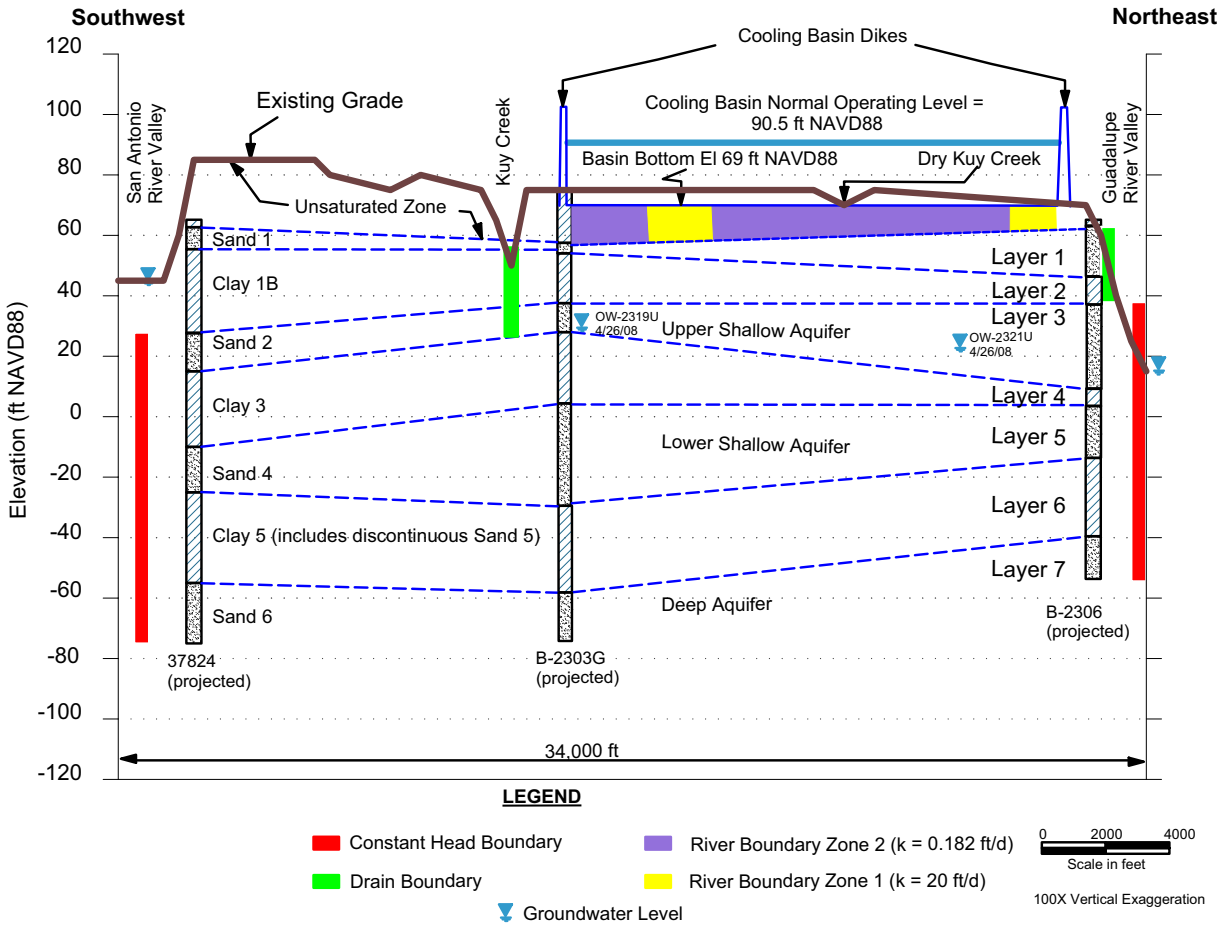


Figure 2.3.1-31 Generalized Cross Section of the Groundwater Model Area

2.3.2 Water Use

This subsection describes the groundwater and surface water uses that could affect or be affected by the construction and operation of the facility. Included are a description of the types of consumptive water uses; identification of their locations; and quantification of current and projected water demands, supplies and needs. A description of surface water returns upstream of the proposed VCS water intake location is provided in Subsection 2.3.3.2.7.

2.3.2.1 Groundwater Use

As discussed in Subsection 2.3.1, VCS is located over the central portion of the Gulf Coast Aquifer System. The principal aquifer used in Victoria County for domestic and livestock wells is the Chicot Aquifer (TBWE Jan 1962), the shallowest aquifer in the Gulf Coast Aquifer System (TDWR Jul 1979). The primary source of groundwater for municipal and industrial use in Victoria County is the Evangeline Aquifer (TCEQ Oct 2007a), which underlies the Chicot Aquifer and is the most productive aquifer of the Gulf Coast System.

The Gulf Coast Aquifer has not been declared a sole source aquifer by the EPA (U.S. EPA 2007). The nearest sole source aquifer in Texas is the Edwards Aquifer System, located approximately 100 miles north of the site. The Edwards Aquifer is hydraulically upgradient (TWDB Sep 2004, TWDB Feb 2006) and beyond the boundaries of the regional and local hydrogeologic systems associated with the site. Springs from the Edwards Aquifer are sources of tributary waters to the Guadalupe River and are discussed further in Subsection 2.3.2.2.

2.3.2.1.1 Regional Groundwater Use

Groundwater use as reported to the Texas Water Development Board (TWDB) by each of the 13 counties within 50 miles of the site is summarized in Table 2.3.2-1. Groundwater is the primary source of drinking water for six of the 13 counties. Irrigation systems are the largest users (79.2%) of groundwater in the 50-mile region, followed by municipal water supply systems (13.1%), and manufacturing (3.7%). Smaller amounts of groundwater are used by steam electric power generation, mining, and livestock (TWDB 2007a).

Significant regional decreases in water levels in the Gulf Coast Aquifer during the 1970s and 1980s prompted concern regarding the allocation of groundwater, causing a number of users, including municipalities, to revert to surface water as their primary source of water. New development, recent droughts, and the potential for saltwater intrusion have also heightened concerns about long-term groundwater availability in the Gulf Coast Aquifer System (TWDB Jan 2003). Aquifer declines of 200 to 300 feet have been measured in some areas of eastern and southeastern Harris and northern Galveston Counties. Other areas of significant water-level declines include the Kingsville area in Kleberg County and portions of Jefferson, Orange, and Wharton Counties. Some of the declines have resulted in compaction of dewatered clays and significant land surface subsidence. Subsidence is generally less than 0.5 foot over most of the Texas coast but has been as much as 9 feet in Harris and

surrounding Counties. Conversion to surface water use in many of the problem areas has reversed the declining trend (TWDB Nov 1995).

Section 16.051 of the Texas Water Code (TWC) directs the TWDB to prepare and maintain a comprehensive state water plan that provides for development, management, and conservation of water resources and preparation for and response to drought conditions. In 1998, the TWDB adopted rules establishing 16 regional water planning areas and required each Regional Water Planning Group (RWPG) to prepare a regional water plan that would be assembled into the state water plan. The site is located in the South Central Texas regional water planning area, initially designated by the TWDB as "Region L." As shown in Figure 2.3.2-1, Region L encompasses all or part of 21 counties. These 21 counties are included in whole or in part in the Rio Grande, Nueces, San Antonio, Guadalupe, Lavaca, and Colorado River Basins. Under Senate Bill 1, enacted by the 75th Texas Legislature in 1997, the RWPGs are required to plan for the future water needs under drought conditions.

Senate Bill 1 established a statewide comprehensive regional water planning initiative and included amendments to Chapter 36 of the TWC. This chapter requires groundwater conservation districts (GCDs) to develop and implement a comprehensive management plan for their groundwater resources, in coordination with the surface water management entities. There are 15 GCDs in the South Central Texas Region. With the exception of Calhoun County, a GCD serves all or a portion of each county in the region. The responsibilities and authorities of these GCDs vary depending on their creating legislation and governing law, and some districts are not responsible for all aquifers within the geographic boundaries of the district.

Since the late 1990s, the TWDB has commissioned the development of mathematical groundwater availability models for the north, south, and central portions of the Gulf Coast Aquifer to predict how the aquifer might respond to increased pumping and drought. The groundwater availability models are being developed with substantial stakeholder input. The goal is to provide reliable projections of groundwater availability to ensure adequate supplies or identify inadequate supplies over the current planning period.

2.3.2.1.2 Gulf Coast Aquifer Availability Projections

The regional water plan adopted by Region L in 2006 defines groundwater availability as the amount of groundwater available for use in the region as determined by analysis of aquifer recharge, existing groundwater demands, projected groundwater demands, limits of drawdown, and the annual groundwater availability calculations provided in each of the Region L GCD's comprehensive water plans.

The projected groundwater supply available in Region L from the Gulf Coast Aquifer during a drought of record condition is 132,348 acre-feet per year throughout the 2010-through-2060 projection period (TWDB Jan 2006).

Available and allocated groundwater supply projections for Victoria, Calhoun, and Refugio Counties, as given in the 2006 South Central Regional Water Plan (TWDB Jan 2006), are provided in Tables 2.3.2-2, 2.3.2-3, and 2.3.2-4, respectively. Because neither Victoria County nor Calhoun County had a GCD when the 2006 plan was being prepared, the 2006 Region L Plan uses earlier groundwater availability estimates developed by the TWDB for the 1997 state water plan and used in the 2001 Region L Plan. Refugio County does have an established GCD, so the groundwater availability numbers from their approved 2003 management plan were used for the 2006 Region L Plan. None of the groundwater availability projections for these three counties came from the Central Gulf Coast groundwater availability modeling, because that groundwater availability modeling was not satisfactorily completed when the 2006 Region L Plan was in development.

Uddameri and Kuchanur (Aug 2006) developed a three-dimensional, county-scale, mathematical model to represent groundwater flow characteristics in Refugio County using the United States Geological Survey MODFLOW model. Simulation-optimization schemes estimate groundwater availability as a function of both science and policy choices and risk-preference of stakeholders involved. The stakeholder concerns were incorporated as constraints, which included prevention of saltwater intrusion in the aquifer, limiting the amount of allowable drawdown in the Chicot and Evangeline aquifers, and maintaining current flow gradients (especially near baseflow-dependent streams and rivers). For the conditions assumed, the results of the study indicated that approximately 39,968 acre-feet per year of groundwater could be extracted without violating the specified constraints. The groundwater availability results of the Uddameri and Kuchanur study for Refugio County are nearly identical to the Refugio County groundwater availability projections provided in the 2006 South Central Regional Water Plan (TWDB Jan 2006).

2.3.2.1.3 Local Groundwater Use

Reported permitted groundwater uses for Victoria County are included in Table 2.3.2-1. In 2004, groundwater pumping in Victoria County was 15,529 acre-feet per year. The largest consumer of groundwater that year was municipal water use, followed by irrigation (TWDB 2007a).

Groundwater in the vicinity of the site is primarily used for domestic and livestock purposes. A data query of the TWDB statewide well database on water wells located within 6 miles of the site (TWDB 2007b) is summarized in Table 2.3.2-5, and the locations of the wells are shown in Figure 2.3.2-2. A series of stock wells at the site and a domestic well located at the McCan Ranch house are not listed in the TWDB well database.

A Texas Commission on Environmental Quality (TCEQ) public water systems database query (TCEQ Oct 2007a) indicates that the nearest public water system (TX-2350014) is located more than 5 miles east of the site. It consists of three wells at an industrial facility (INVISTA, formerly DuPont) that produce from the Evangeline Aquifer. These wells have a total production of approximately 3550 acre-feet per year and serve a population of 900 people (TCEQ 2008b). Table 2.3.2-6 summarizes the public water systems located within 10 miles of the site. The locations of the systems are shown on Figure 2.3.2-3.

The city of Victoria switched from a groundwater supply to a primarily surface water supply in September 2001, with groundwater as a backup during drought periods. The average daily consumption of surface water by the Victoria water system is approximately 11,100 acre-feet per year (TCEQ 2008e). This implies an approximate decrease in groundwater use from the Evangeline aquifer of 11,100 acre-feet per year during non-drought periods.

As of January 24, 2008, the TCEQ Water Utility Database had no future public water supply applications pending for Victoria, Calhoun, or Refugio Counties (TCEQ 2008c). The Victoria County Groundwater Conservation District (VCGCD) was formed by the state legislature in 2005 and is in the process of developing a groundwater management plan for the use of groundwater in the county, which is scheduled for completion in 2008 (VCGCD Mar 2008). As a new district, data regarding pending or potential groundwater use applications is not available (VCGCD Jan 2008).

As part of preparing the groundwater management plan, the VCGCD has commissioned two studies to evaluate groundwater conditions in Victoria County. The first study (Uddameri Jan 2008) contains technical elements for consideration in the groundwater management plan, including: (1) recharge from precipitation, (2) areas conducive to artificial recharge, (3) estimates of current use, (4) projection of future water demands, (5) horizontal exchange of water at district boundaries, (6) vertical exchange of water between different aquifers, and (7) estimates of managed available groundwater. The second study (Uddameri Feb 2008) focuses on the stakeholder approach to estimating groundwater availability. This approach uses the concept of managed available groundwater, which is estimated based on the desired future conditions of the aquifer. Uddameri (Feb 2008) includes two water use scenarios for a proposed nuclear power plant near McFaddin, Texas. The two scenarios involve additional pumping from the Evangeline Aquifer of either 10,000 acre-feet per year or 50,000 acre-feet per year.

The VCGCD Groundwater Management Plan is expected to be adopted by the VCGCD Board of Directors during their September 2008 board meeting, and submitted to the TWDB by November 1, 2008 (VCGCD July 2008).

2.3.2.2 Surface Water Use

Major hydrologic features in the region of the VCS site are shown on Figure 2.3.1-2**.** Permitted surface water users within counties located within 50-miles of the VCS site are indicated in Table 2.3.2-7. Permitted uses of surface water bodies include municipal water supply, manufacturing, steam electric, irrigation, mining, and livestock.

The Guadalupe River is a spring-fed river that rises in the western part of Kerr County and flows more than 430 river miles (TWDB Jan 2006). Springs from the Edwards Aquifer are the sources of tributary rivers to the Guadalupe River. Edwards Aquifer water flows from Comal Springs in New Braunfels into the Comal River. Water from the Edwards Aquifer also flows from San Marcos Springs in San Marcos into the San Marcos River. Both the Comal and San Marcos Rivers are major tributaries to the Guadalupe River (GBRA 2008).

The Guadalupe River drains approximately 10,128 square miles above the Guadalupe-Blanco River Authority (GBRA) Salt Water Barrier, of which approximately 4180 square miles are in the San Antonio River Basin (TWDB Jan 2006). The Guadalupe River drains into the Guadalupe Bay and San Antonio Bay approximately 11 miles downstream of the GBRA Salt Water Barrier (SARA 2007).

Major reservoirs in the Guadalupe River Basin include Canyon Reservoir and Coleto Creek Reservoir. Canyon Reservoir is a large water supply and flood control project located in Comal County on the mainstream of the Guadalupe River. It is owned and operated by the GBRA under certificate of adjudication C18-2074, as amended. Canyon Dam was completed in 1964, resulting in a total authorized impoundment of 740,900 acre-feet. At present, 386,200 acre-feet of this amount is considered the conservation storage capacity for water supply purposes (TNRCC Dec 1999). Conservation storage capacity is used for water supply during drought conditions. Uses of the reservoir include water supply for municipal, industrial, steam-electric power generation, irrigation, and hydroelectric power generation, as well as flood protection and recreation. Diversions from Canyon Reservoir are currently authorized up to 90,000 acre-feet per year, as shown in Table 2.3.2-8. Water supplies are managed by the GBRA and made available to customers in their 10-county district as well as in adjacent counties and river basins (TWDB Jan 2006).

Coleto Creek Reservoir is located approximately 11 miles northwest of the site in Goliad County. The reservoir is operated by the GBRA and is a cooling reservoir for steam-electric power generation. Sources of water include runoff from the Coleto Creek watershed and diversions from the Guadalupe River, backed by storage in Canyon Reservoir when needed. The reservoir supplies water for steam-electric power generation at Coleto Creek Power Station in Goliad County, and as shown in Table 2.3.2-8, it has a permitted consumptive use of 12,500 acre-feet per year. (TWDB Jan 2006).

The San Antonio River is approximately 240 miles long and drains approximately 4180 square miles (SARA 2007). The San Antonio River drains into the Guadalupe River upstream of the GBRA Salt Water Barrier.

Besides the Lower Guadalupe River (which starts just below Canyon Lake in Comal County), the San Antonio River, and the Coleto Creek Reservoir, other notable surface water bodies located within 50 miles of the site in the Lower Guadalupe River hydrologic system include the Victoria Barge Canal, Coleto Creek, Green Lake, Linn Lake, the GBRA Calhoun Canal System, and the San Antonio Bay (which is an embayment of the Gulf of Mexico).

The Lower Guadalupe and San Antonio Rivers, Coleto Creek Reservoir, and Coleto Creek are used for recreational fishing and birding. Green Lake is a shallow lake (about 3 feet deep) that is privately owned with no public access. San Antonio Bay is used for commercial and recreational fishing, birding, and navigation. Linn Lake is a small, shallow cut-off meander of the Lower Guadalupe River and is privately used for recreational purposes; its remote location limits access to the public. The man-made sea-level Victoria Barge Canal connects Victoria to the Gulf Intracoastal Waterway and transports barge traffic for the local industry (VEDC 2008). The GBRA Calhoun Canal System is a water delivery system which

diverts water from the Lower Guadalupe River for delivery to customers, as described in Subsection 2.3.1.

2.3.2.2.1 Drought Management and Preparation

As discussed in Subsection 2.3.1.1.1, there have been major droughts in the Lower Guadalupe-San Antonio basin in almost every decade since stream gaging began in the 1930s. The most severe drought, referred to as the Drought of Record, occurred between 1950 and 1957 (TWDB Jan 2007c).

Under the requirements of Senate Bill 1, local public and private water suppliers and water districts are required by the TCEQ to adopt a Drought Contingency Plan that contains drought triggers and responses unique to each specific entity. These entities have the authority and responsibility to manage their particular water supply within the bounds created by applicable law.

Water supplies available from the Gulf Coast Aquifer are less subject to transient hydrologic drought conditions than the Edwards Aquifer. If depletion in the Gulf Coast Aquifer is occurring at an unacceptable pace (typically measured over many years, rather than a few months), there is likely to be sufficient time to amend groundwater district rules and/or develop alternative sources of supply.

Supplies from surface water sources as run-of-the-river water rights and reservoirs are determined on the basis of minimum year availability and firm yield, respectively. Hence, the current water supplies presented in the regional water plan adopted by Region L in 2006, by TWDB definition, are dependable during drought (TWDB Jan 2006).}

2.3.2.2.2 Local Surface Water Use

The discussion of local surface water use includes Victoria, Refugio, Calhoun, and Goliad Counties. Victoria County is discussed because it is the proposed location of the plant; Refugio County is discussed because it is included downstream in the same hydrologic system of the site; Calhoun County is discussed because the proposed site's water intake would be in that county. Goliad County is discussed because it is the location of the Coleto Creek Reservoir.

In addition to the associated major reservoirs, surface water rights have been issued by the TCEQ and predecessor agencies to individuals, cities, industries, water districts, and water authorities for diversion from flowing streams in the South Central Texas Region. Each right bears a priority date, diversion location, maximum diversion rate, and annual quantity of diversion. Some rights may include off-channel storage authorization, instream flow requirements, and various special conditions (such as a temporary water permit).

As of October 26, 2007, 23 active surface water withdrawals were permitted for surface water in Victoria and Calhoun Counties within the Lower Guadalupe River Basin. The TCEQ reported no surface water users in Refugio County within the Lower San Antonio River Basin (TCEQ Oct 2007b). As of January 3, 2008, 12 active surface water withdrawals were permitted for surface water in Goliad County within the Lower San Antonio River Basin (TCEQ 2008b). Tables 2.3.2-9 through 2.3.2-11 identify the surface water user, the body of water 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 plotted on Figure 2.3.2-4 using latitude and longitude information provided by the TCEQ (2008a).

Downstream of the site, surface water is withdrawn by a number of industries and private users. However, the largest downstream surface water user is the GBRA. The GBRA salt water barrier creates an impoundment that facilitates diversions under Certificate of Adjudication rights 18-5173 through 18-5178 and 18-3863 held either jointly or directly by the GBRA and Union Carbide Corporation (UCC). Although UCC now operates as Dow Chemical Corporation, the water rights are held under the UCC name. These rights total 175,501 acre-feet per year and are authorized for municipal, industrial, and irrigation use, as shown in Table 2.3.2-12 (GBRA Nov 2007).

The maximum reported water use under GBRA/UCC rights at the GBRA salt water barrier did not exceed 51,670 acre-feet per year from 2000 to 2006 (GBRA Nov 2007). Table 2.3.2-13 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.

As of January 23, 2008, the GBRA was not involved in any negotiations or pending water supply contracts for the supply of surface water from GBRA/UCC water rights outside of the current Exelon water reservation agreement (GBRA Jan 2008).

The TCEQ Pending Surface Water Rights Applications database had no pending applications for Victoria or Calhoun Counties, and only one pending application for Refugio and Gonzales Counties (TCEQ 2008d). The pending applicant is the San Marcos River Foundation, and their permit is for instream uses only (TCEQ Jan 2008).

2.3.2.2.3 Surface Water Availability Projections

Although the Guadalupe and San Antonio River Basins have been delineated as separate river basins, the two rivers join prior to discharge into San Antonio Bay, and the two watersheds are considered as one (the Guadalupe-San Antonio River Basin) when evaluating surface water supplies available under existing water rights. This arrangement is due, in part, to the large concentration of senior water rights below the confluence of the two rivers (TWDB Jan 2006).

Senior water right holders have priority when stream flows are low, as in periods of drought. This priority renders junior rights less reliable during droughts. The most junior water right holders may not be able to divert any water during severe droughts.

Surface water supplies for the Guadalupe and San Antonio River Basins have been quantified using the Guadalupe-San Antonio River Basin Water Availability Model prepared by HDR Engineering, Inc. (TNRCC Dec 1999). The Water Availability Model quantifies the firm diversion associated with run-of-the-river water rights, calculates the firm yields associated with Canyon Reservoir, and ensures the reliability of authorized consumptive uses associated with steam-electric power generation.

The South Central Texas RWPG conducted a detailed analysis of the projected water demands for various water users including municipal, industrial, irrigation, livestock, mining, and domestic use in each of the counties that comprise Region L. The RWPG used the Guadalupe-San Antonio River Basin Water Availability Model to evaluate the projected surface water demands for Victoria and Calhoun Counties. The modelers followed a procedure that accounts for historical hydrologic conditions from 1934–1989, seniority (priority) of water rights, and other factors to calculate surface water availability and reliability.

Projected surface water demands, supplies, and needs for Victoria and Calhoun Counties are summarized in Table 2.3.2-14. In that table, projected Calhoun County demands and projected Victoria County needs are compared against the GBRA/UCC water rights. The GBRA currently does not supply Victoria County with water from the GBRA/UCC water rights, but because of projected shortages of surface water for Victoria County industrial users, the GBRA will supply surface water to Victoria County starting in 2040 to offset the projected surface water shortages (GBRA Feb 2008). As shown in the table, after meeting the Calhoun County surface water demands and Victoria County surface water needs, a surplus of approximately 115,926 acre-feet per year remains in 2060 under the GBRA/UCC water rights excluding the proposed VCS water use.

2.3.2.2.4 Guadalupe Estuary Freshwater Inflows

The Texas Parks and Wildlife Department (TPWD) and TWDB jointly maintain a data collection and analytical study program focused on determining effects of and needs for freshwater inflow to the state's bays and estuaries pursuant to Section 16.058 of the TWC. The freshwater inflow studies are guided, in part, by TWC Section 11.147, which defines beneficial inflows as a salinity, nutrient, and sediment loading regime adequate to maintain an ecologically sound environment in the receiving bay and estuary system that is necessary for the maintenance of productivity of economically important and ecologically characteristic sport or commercial fish and shellfish species and estuarine life upon which such fish and shellfish are dependent. TWC Section 11.147 further provides direction to the TCEQ as to how it shall include, "to the extent practicable when considering all public interests, those conditions considered necessary to maintain beneficial inflows to any affected bay and estuary system" when considering a permit application. As water supplies for the proposed VCS are to be obtained by contract with holders of existing water rights, no new appropriation of surface water is expected to be necessary to supply water to the project. Authorization to store and impound the water appropriated under the terms of the existing water rights is expected to be obtained from the TCEQ by an application submitted under TWC Chapter 11.

In 1998, the TWDB and TPWD prepared *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas* (TPWD Dec 1998), a coastal studies technical report that "summarizes studies which form the basis for TPWD's recommendation of target freshwater inflows needed to maintain the unique biological communities and ecosystems characteristic of a healthy Guadalupe Estuary." As part of determining the estuary's freshwater inflow needs, the TWDB and TPWD incorporated hydrographic

surveys, hydrodynamic and salinity modeling, sediment and nutrient analyses, fisheries analyses, freshwater inflow optimization modeling, and verification of needs into the report.

Historical freshwater inflows to the estuary from 1941 to 1987 and available fisheries harvest data from 1959 to 1987 were used to develop functional relationships for seven selected species: blue crab, eastern oyster, red drum, black drum, spotted seatrout, brown shrimp, and white shrimp. The freshwater inflow–fisheries harvest relationships were then used in a mathematical optimization process to satisfy species harvest goals of maintaining greater than 80% of mean historical harvest more than 50% of the time, subject to various inflow and biomass ratio bounds. The results of the TPWD and TWDB models indicate the desired freshwater inflow to the Guadalupe Estuary for optimization of fisheries harvest is approximately 1.15 million acre-feet per year, with estimated monthly inflow needs ranging from 52,400 acre-feet (March, April, September, and October) to 222,600 acre-feet (May).

The study reports that the average annual inflow to the Guadalupe Estuary during the 1941-to-1987 period was greater than 2.1 million acre-feet at least 50% of the years. Only 23% of these years had less than the 1.15 million acre feet target volume (TPWD Dec 1998).

Past development of freshwater inflow recommendations for Texas estuaries, including the Guadalupe Estuary, has been accomplished by the TWDB and TPWD scientists with limited input from stakeholders outside of the agencies. Pursuant to passage of Senate Bill 3 by the 80th Texas Legislature, however, a new process has been established for TCEQ to adopt appropriate environmental flow standards for each bay system that are adequate to support a sound ecological environment to the maximum extent reasonable considering other public interests and other relevant factors [TWC 11.1471(a)(1)]. Bay and basin advisory groups, stakeholder committees, and expert science teams will work with technical support from the TPWD, TWDB, and TCEQ over the next few years to develop recommendations regarding environmental flow standards which TCEQ must consider in rulemaking. Recommendations of the expert science teams shall be developed through a collaborative process designed to achieve consensus and must be based solely on the best science available [TWC 11.02362(m)]. The TCEQ permitting decisions shall establish an amount of unappropriated water, if available, to be set aside to satisfy the Senate Bill 3 environmental flow standards to the maximum extent reasonable when considering human water needs. Although this process has been created to establish environmental flow standards and set-asides to be considered in evaluating applications for new water rights and amendments, the Texas Legislature has not chosen to apply the environmental flow standards to existing water rights.

2.3.2.3 References

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Table 2.3.2-1
Groundwater Use (Acre-Feet per Year) by County in 50-Mile Radius of VCS Site (2004)

County	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	Total
Aransas	308	76	0	0	81	4	469
Bee	2658	1	0	3458	15	69	6201
Calhoun	188	2081	30	0	12	195	2506
DeWitt	2357	414	0	96	40	112	3019
Goliad	659	0	98	1585	7	40	2389
Gonzales	2150	1332	0	1140	29	460	5111
Jackson	1439	39	0	44,599	72	205	46,354
Lavaca	2515	308	0	6009	1	227	9060
Matagorda	4955	4979	4656	32,196	131	362	47,279
Refugio	1002	0	0	527	6	62	1597
San Patricio	1449	3	0	8937	114	24	10,527
Victoria	9156	508	303	2966	2293	303	15,529
Wharton	5407	25	0	104,910	200	204	110,746
Total	34,243	9766	5087	206,423	3001	2267	260,787
Percent Use	13.1%	3.7%	2.0%	79.2%	1.2%	0.9%	100%

Source: TWDB 2007a

Table 2.3.2-2
Available and Allocated Groundwater Supplies (Acre-Feet per Year) in Victoria County, Texas (2000–2060)

Groundwater Supplies per Basin	2000	2010	2020	2030	2040	2050	2060
Available							
Guadalupe	18,669	18,669	18,669	18,669	18,669	18,669	18,669
Lavaca	271	271	271	271	271	271	271
Lavaca-Guadalupe	20,389	20,389	20,389	20,389	20,389	20,389	20,389
San Antonio	1800	1800	1800	1800	1800	1800	1800
Total Available	41,129	41,129	41,129	41,129	41,129	41,129	41,129
Allocated							
Guadalupe	16,467	17,330	17,687	17,924	18,174	18,441	18,642
Lavaca	9	9	9	9	9	9	9
Lavaca-Guadalupe	15,125	18,113	17,091	16,187	15,422	14,777	14,212
San Antonio	37	37	37	37	37	37	37
Total Allocated	31,638	35,489	34,824	34,157	33,642	33,264	32,900
Total Unallocated	9491	5640	6305	6972	7487	7865	8229

Source: TWDB Jan 2006
Note: Groundwater supply source is the Gulf Coast Aquifer.

Table 2.3.2-3
Available and Allocated Groundwater Supplies (Acre-Feet/Year) in Calhoun County, Texas (2000–2060)

	2000	2010	2020	2030	2040	2050	2060
Available							
Guadalupe Basin	42	42	42	42	42	42	42
Lavaca-Guadalupe Basin	1334	1334	1334	1334	1334	1334	1334
Colorado-Lavaca Basin	1467	1467	1467	1467	1467	1467	1467
San Antonio-Nueces Basin	97	97	97	97	97	97	97
Total Available	2940	2940	2940	2940	2940	2940	2940
Allocated							
Guadalupe Basin	14	16	17	18	18	19	19
Lavaca-Guadalupe Basin	840	841	842	842	842	842	842
Colorado-Lavaca Basin	1286	1286	1286	1286	1286	1286	1286
San Antonio-Nueces Basin	17	18	19	19	20	20	20
Total Allocated	2157	2161	2164	2165	2166	2167	2167
Total Unallocated	783	779	776	775	774	773	773

Source: TWDB Jan 2006
Note: Groundwater supply source is the Gulf Coast Aquifer.

Table 2.3.2-4
Available and Allocated Groundwater Supplies (Acre-Feet per Year) in Refugio County, Texas (2000–2060)

	2000	2010	2020	2030	2040	2050	2060
Available							
San Antonio Basin	1961	1961	1961	1961	1961	1961	1961
San Antonio-Nueces Basin	40,359	40,359	40,359	40,359	40,359	40,359	40,359
Total Available	42,320	42,320	42,320	42,320	42,320	42,320	42,320
Allocated							
San Antonio Basin	22	22	22	22	22	22	22
San Antonio-Nueces Basin	3820	3040	3041	3041	3041	3041	3041
Total Allocated	3842	3062	3063	3063	3063	3063	3063
Total Unallocated	38,479	39,259	39,258	39,258	39,258	39,258	39,258

Source: TWDB Jan 2006
Note: Groundwater supply source is the Gulf Coast Aquifer.

Table 2.3.2-5
TWDB Wells Located Within 6 Miles of the VCS Site

TWDB Well ID	Owner	Latitude	Longitude	Primary Use	Well Depth (feet)	Water Quality Data	Aquifer	Well Type
7924601	Pat Witte	284029	970018	Stock	40	Y	Chicot	Water
7924701	Rose Morris Estate	283803	970611	Domestic	84	N	Chicot	Water
7924801	Elmo Heller	283845	970430	Domestic	81	N	Chicot	Water
7924901	Pat Witte	283924	970202	Unused	90	Y	Chicot	Water
7924902	Pat Witte	283924	970203	Domestic	125	Y	Chicot	Water
7924903	Henry Witte	283948	970125	Stock	30	N	Chicot	Water
7924904	D.H. Braman	283759	970227	Domestic	254	Y	Chicot	Water
7932101	J.J. Murphy Estate	283554	970514	Unused	250	Y	Chicot	Water
7932102	J.J. Murphy	283533	970546	Unused	1475	N	L. Goliad	Water
7932103	Mary Murphy Greer	283554	970514	Domestic	142	Y	Chicot	Water
7932404	Gussie Smith	283354	970548	Domestic	100	Y	Chicot	Water
7932602	J.A. McFaddin Estate	283248	970020	Irrigation	595	Y	Chicot	Water
7932804	O'Connor Brothers	283231	970306	Stock	716	N	L. Goliad	Water
8025101	J.A. McFaddin Estate	283613	965813	Stock	888	N	Chicot	Water
8025102	J.A. McFaddin Estate	283631	965904	Stock	131	N	Chicot	Water
8025501	J.A. McFaddin Estate	283405	965701	Stock	700	N	Evangeline	Water

Source: TWDB 2007b

Table 2.3.2-6
TCEQ Public Water Supply Wells Located Within 10 Miles of the VCS Site

TCEQ PWS No.	State Well No.	System Name	Latitude	Longitude	Drill Date	Well Depth (feet)	Aquifer
TX-2350001	8017904	Victoria County WCID 1	28.64	96.90	1969	1001	Evangeline
TX-2350001	8017905	Victoria County WCID 1	28.65	96.90	1981	1010	Evangeline
TX-2350014	8017503	INVISTA S.A.R.L.—Victoria	28.68	96.95	1949	1062	Evangeline
TX-2350014	8017504	INVISTA S.A.R.L.—Victoria	28.68	96.95	1949	1059	Evangeline
TX-2350014	8017505	INVISTA S.A.R.L.—Victoria	28.68	96.95	1956	447	Evangeline
TX-2350036	7923301	Coleto Water Co.	28.72	97.14	1977	222	Evangeline
TX-2350044	N/A	Speedy Stop 46	28.70	97.05	1986	130	Chicot
TX-2350051	N/A	Victoria County Navigation District	28.70	96.95	2000	190	Chicot
TX-2350051	N/A	Victoria County Navigation District	28.69	96.95	2004	260	Chicot

Source: TCEQ Oct 2007a
NA = Not available
PWS = Public Water Supply
WCID = Water Control and Improvement District

Table 2.3.2-7
Surface Water Use (Acre-Feet per Year) by County in 50-Mile Radius of the VCS Site (2007)

County	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	Total
Aransas	2950	43	0	0	0	33	3026
Bee	3354	0	0	0	0	807	4161
Calhoun	2194	54,297	0	15,509	0	169	72,169
DeWitt	512	0	0	0	0	1813	2325
Goliad	0	0	2055	0	0	1100	3155
Gonzales	2289	162	0	360	0	4227	7038
Jackson	0	417	0	621	0	677	1715
Lavaca	3	0	0	591	0	2153	2747
Matagorda	0	9335	40,836	154,625	0	1140	205,936
Refugio	0	0	0	0	0	600	600
San Patricio	8190	14,453	0	223	57	403	23,326
Victoria	0	19,966	952	0	0	834	21,752
Wharton	0	0	0	211,126	437	1082	212,645
Total	19,492	98,673	43,843	383,055	494	15,038	560,595
Percent Use	3.5%	17.6%	8.0%	68.2%	0.09%	2.68%	100%

Source: TWDB 2007a

Table 2.3.2-8
List of major Guadalupe River Basin Reservoirs

Reservoir	Water Right Owner	Certificate of Adjudication Number	Authorized Diversion (ac-ft per yr)	Firm Yield (ac-ft per yr)	Purposes
Canyon Reservoir	GBRA	18-2074	90,000[a]	~90,000[a]	Municipal, industrial, steam-electric, hydropower, irrigation, flood protection
Coleto Creek Reservoir	Coleto Creek Power	18-5486	12,500[b]	>12,500[c]	Steam-electric power generation

a. The firm yield of Canyon Reservoir is dependent upon a number of factors including points of diversion for contracted supplies, Edwards Aquifer spring flow, term recreational flow agreements, and discharge of treated effluent throughout the Guadalupe – San Antonio River Basin. Subject to the hydrologic assumptions and operational procedures listed in Section 3.2.3.1 of the 2006 South Central Texas Regional Water Plan, estimates of Canyon Reservoir firm yield range from 88,232 acre-feet per year to 87,484 acre-feet per year in years 2000 and 2060, respectively.

b. Includes rights to divert up to 20,000 acre-feet per year from the Guadalupe River to Coleto Creek Reservoir and to consume up to 12,500 acre-feet per year.

c. The reservoir and supplemental authorized diversions from the Guadalupe River could support a firm yield in excess of the authorized consumptive use; however, operations of Coleto Creek Power steam- electric power generation facilities could be impaired.

Source: TWDB Jan 2006

Table 2.3.2-9 (Sheet 1 of 2)
Surface Water Users in Victoria County

Water Right Number	Type	Owner Name	Latitude	Longitude	River Basin	Stream Name	Amount in Ac-Ft per Yr	Use	Priority Date
3858	Cert of Adj	First Victoria Natl Bank Trust I	28.93	–97.15	Guadalupe	Guadalupe River	1000	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	3000	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	9676	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

Table 2.3.2-9 (Sheet 2 of 2)
Surface Water Users in Victoria County

Water Right Number	Type	Owner Name	Latitude	Longitude	River Basin	Stream Name	Amount in Ac-Ft per Yr	Use	Priority Date
4324	Permit	Spring Creek Development Co.	28.85	–97.01	Guadalupe	Spring Creek	__	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 Creek	2	Industrial	8/16/1991
5424	Permit	Housing Authority of City of Victoria	28.87	–97.01	Guadalupe	Unnamed Trib. Spring Creek	__	Recreation	7/23/1992
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 Creek	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

Source: TCEQ Oct 2007b

Table 2.3.2-10 (Sheet 1 of 5)
Surface Water Users in Calhoun County

Water Right Number	Type	Owner Name	Latitude	Longitude	River Basin	Stream Name	Amount in Ac-Ft/Year	Use	Priority Date	Remarks
3746	Permit	Patrick H. Welder, Jr.	28.55	–96.83	Lavaca-Guadalupe	Victoria Barge Canal	1284.3	Irrigation	10/1/1979	None
3746	Permit	Standard Oil Chemical Co.	28.55	–96.83	Lavaca-Guadalupe	Victoria Barge Canal	715.7	Irrigation	10/1/1979	None
3864	Cert of Adj	Texas Parks & Wildlife Dept.	28.49	–96.81	Lavaca-Guadalupe	Hog Bayou	50	Irrigation	12/31/1955	Guadalupe Delta WMA
4276	Permit	Del & Gloria Williams	28.46	–96.83	Guadalupe	Guadalupe River	272	Industrial	6/25/1985	Crawfish Farm
5173	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	2500	Irrigation	2/3/1941	Amend 5/21/04,9/27/04,5/1/2007:Stat Dist.
5173	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	8/12/1988	Amend. 5/21/04,9/27/04,5/1/2007:Stat Dist.
5173	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	2/3/1941	Amend. 5/21/04,9/27/04,5/1/2007:Stat Dist.
5173	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	2/3/1941	Part Owner with GBRA
5173	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	2/3/1941	Part Owner of 2500 Ac-Ft with GBRA
5173	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	8/12/1988	Amend 4/17/91. Part Owner with GBRA
5174	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	1870	Irrigation	6/15/1944	Amend. 5/21/04,9/27/04,5/1/2007:Stat Dist.

Table 2.3.2-10 (Sheet 2 of 5)
Surface Water Users in Calhoun County

Water Right Number	Type	Owner Name	Latitude	Longitude	River Basin	Stream Name	Amount in Ac-Ft/Year	Use	Priority Date	Remarks
5174	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	6/15/1944	Amend. 5/21/04,9/27/04,5/1/2007:Stat Dist.
5174	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	6/15/1944	Amend. 5/21/04,9/27/04,5/1/2007:Stat Dist.
5174	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	6/15/1944	Part Owner of 1870 Ac-Ft with GBRA
5174	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	6/15/1944	Part Owner with GBRA
5174	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	6/15/1944	Amend 4/17/91. Part Owner with GBRA
5175	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	940	Industrial	2/13/1951	Amend. 5/21/04,9/27/04,5/1/2007:Stat Dist.
5175	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	2/13/1951	Amend. 5/21/04,9/27/04,5/1/2007:Stat Dist.
5175	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Mining	2/13/1951	Amend. 5/21/04,9/27/04, 5/1/2007:Stat Dist.
5175	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Other (stockraising)	2/13/1951	Stockraising Amend 4/91,5/04,9/04, 5/1/2007
5175	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	2/13/1951	Amend 4/17/91. Part Owner with GBRA

Table 2.3.2-10 (Sheet 3 of 5)
Surface Water Users in Calhoun County

Water Right Number	Type	Owner Name	Latitude	Longitude	River Basin	Stream Name	Amount in Ac-Ft/Year	Use	Priority Date	Remarks
5175	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	2/13/1951	Amend 4/17/91. Part Owner with GBRA
5175	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Mining	2/13/1951	Amend 4/17/91. Part Owner with GBRA
5175	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Other	2/13/1951	Stockraising, Amend. 4/91,5/2004, 9/27/2004
5176	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	9944	Municipal/ Domestic	6/21/1951	Amend. 5/21/04,9/27/04,5/ 1/2007:Stat Dist.
5176	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	6/21/1951	Amend 4/91,5/04,9/04,5/1/ 2007:Stat. District
5176	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	6/21/1951	Amend 4/91,5/04,9/04,5/1/ 2007:Stat District
5176	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Municipal/ Domestic	6/21/1951	Part Owner of 9944 Ac-Ft with GBRA
5176	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	6/21/1951	Part Owner of 9944 Ac-Ft with GBRA
5176	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	6/21/1951	Part Owner of 9944 Ac-Ft with GBRA
5177	Cert of Adj	Guadalupe–Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	32,615	Municipal/ Domestic	1/3/1944	Amend 4/91,5/04,9/04,5/1/ 2007:Stat District

Table 2.3.2-10 (Sheet 4 of 5)
Surface Water Users in Calhoun County

Water Right Number	Type	Owner Name	Latitude	Longitude	River Basin	Stream Name	Amount in Ac-Ft/Year	Use	Priority Date	Remarks
5177	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	1/3/1944	Amend 4/91,5/04,9/04,5/1/2007:Stat District
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Municipal/ Domestic	1/3/1944	Part Owner of 3,2615 Ac-Ft with GBRA
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	1/3/1944	Part Owner of 3,2615 Ac-Ft with GBRA
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	1/3/1944	Part Owner of 3,2615 Ac-Ft with GBRA
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	10,000	Municipal/ Domestic	1/3/1944	1,0000 Ac-Ft Uses 1,2,3: Union Carbide Only
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	1/3/1944	1,0000 Ac-Ft Uses 1,2,3: Union Carbide Only
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	1/3/1944	1,0000 Ac-Ft Uses 1,2,3: Union Carbide Only
5177	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	8632	Industrial	1/26/1948	8632 Ac-Ft Uses 2 & 3.AM 1991,2004,5/1/2007
5177	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	1/26/1948	8632 Ac-Ft Uses 2&3 AM 1991,2004,5/1/2007
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	1/26/1948	Part Owner with GBRA, 8632 Ac-Ft Uses 2 & 3

Table 2.3.2-10 (Sheet 5 of 5)
Surface Water Users in Calhoun County

Water Right Number	Type	Owner Name	Latitude	Longitude	River Basin	Stream Name	Amount in Ac-Ft/Year	Use	Priority Date	Remarks
5177	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	1/26/1948	Part Owner with GBRA, 8632 Ac-Ft Uses 2 & 3
5178	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	106,000	Municipal/ Domestic	5/5/1954	Amend 4/91,5/04,9/04, 5/1/2007:Stat District
5178	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	5/5/1954	Amend 4/91,5/04,9/04, 5/1/2007:Stat District
5178	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	5/5/1954	Amend 4/91,5/04,9/04, 5/1/2007:Stat District
5178	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Municipal/ Domestic	5/5/1954	Seadrift Plant Part Owner of 106,000 Ac–Ft with GBRA
5178	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Industrial	5/5/1954	Seadrift Plant Part Owner of 106,000 Ac-Ft with GBRA
5178	Cert of Adj	Union Carbide Chem. & Plastics	28.51	–96.89	Guadalupe	Guadalupe River: Mission Bay, Green Lake, Hog Bayou, Goff Bayou	—	Irrigation	5/5/1954	Part Owner of 106,000 Ac-Ft with GBRA
5484	Cert of Adj	Guadalupe-Blanco River Authority	28.51	–96.89	Guadalupe	Guadalupe River	—	Industrial	5/15/1964	& Co 196. In Accordance w/5173-517 8
5639	Cert of Adj	Terry M. Whitaker et al.	28.59	–96.77	Lavaca-Guadalupe	Coloma Creek	40	Irrigation	8/23/1999	SC

Source: TCEQ Oct 2007b

Table 2.3.2-11
Surface Water Users in Goliad County

Water Right Number	Type	Owner Name	Latitude	Longitude	River Basin	Stream Name	Amount in Acre-Feet per Year	Use	Priority Date	Remarks
2193	Cert of Adj	James M. Pettus et al.	–97.603798	28.692085	San Antonio	San Antonio River	284	Irrigation	12/31/1963	None
2194	Cert of Adj	Julia Gannt Newton et al.	–97.581062	28.686396	San Antonio	San Antonio River	1020	Irrigation	11/14/1947	None
2195	Cert of Adj	Kenneth B. Perkins	–97.571136	28.685186	San Antonio	San Antonio River	410	Irrigation	1/13/1956	None
2196	Cert of Adj	Coleto Cattle Company	–97.565994	28.680069	San Antonio	San Antonio River	336	Irrigation	11/30/1950	None
2197	Cert of Adj	James M. Pettus et al.	–97.52832	28.653498	San Antonio	San Antonio River	86	Irrigation	1/31/1967	None
2198	Cert of Adj	San Antonio River Authority	–97.507668	28.647745	San Antonio	San Antonio River	333	Irrigation	4/25/1950	No land; subject to amendment
2199	Cert of Adj	Sam Houston Clinton et al.	–97.491386	28.642643	San Antonio	San Antonio River	325	Irrigation	1/20/1949	None
3820	Permit	June Pettus	–97.52449	28.649004	San Antonio	San Antonio River	950	Irrigation	4/20/1981	Jointly owns 950 acre-feet to irrigate 380 acre-feet
3820	Permit	Mrs. Joe Cohn	–97.52449	28.649004	San Antonio	San Antonio River	—	Irrigation	4/20/1981	Jointly owns 950 acre-feet to irrigate 380 acre-feet
2195	Cert of Adj	Kenneth B. Perkins	–97.571136	28.685186	San Antonio	San Antonio River	410	Irrigation	1/13/1956	None
5079	Permit	John Brooke	–97.539726	28.66877	San Antonio	San Antonio River	114	Irrigation	7/28/1986	None
5220	Permit	Clarence F. Schendel et al.	–97.459122	28.648272	San Antonio	San Antonio River	330	Irrigation	2/27/1989	None
5313	Permit	Edwin Jacobson et al.	–97.610405	28.707199	San Antonio	San Antonio River	100	Irrigation	8/30/1990	Amended 4/11/97: 181.6 acre-feet off-channel imp.
5478	Permit	Patricia Pittman Light	–97.486397	28.642387	San Antonio	San Antonio River	300	Irrigation	1/14/1994	Off-channel reservoir

Source: TCEQ 2008a

Table 2.3.2-12
Summary of GBRA/UCC Water Rights in the Lower Guadalupe River Basin

Permit Number	Certificate of Adjudication	Priority Date	Authorized Use	Owner	Authorized Diversion Ac-Ft per Yr
1319	18-5173 (1)	2/3/1941	Irrigation	GBRA/Union Carbide	1250
1319	18-5173 (2)	2/3/1941	Industrial	GBRA/Union Carbide	1250
1362	18-5174 (1)	6/15/1944	Industrial	GBRA/Union Carbide	0
1362	18-5174 (2)	6/15/1944	Irrigation	GBRA/Union Carbide	935
1362	18-5174 (3)	6/15/1944	Industrial	GBRA/Union Carbide	935
1564	18-5175 (1)	2/13/1951	Irrigation	GBRA/Union Carbide	470
1564	18-5175 (2)	2/13/1951	Industrial	GBRA/Union Carbide	470
1592	18-5176 (1)	6/21/1951	Irrigation	GBRA/Union Carbide	3315
1592	18-5176 (2)	6/21/1951	Municipal	GBRA/Union Carbide	3314
1592	18-5176 (3)	6/21/1951	Industrial	GBRA/Union Carbide	3315
1375	18-5177 (1)	1/3/1944	Industrial	GBRA/Union Carbide	10,763
1375	18-5177 (2)	1/3/1944	Irrigation	GBRA/Union Carbide	10,763
1375	18-5177 (3)	1/3/1944	Municipal	GBRA/Union Carbide	11,089
1375	18-5177 (4)	1/3/1944	Industrial	Union Carbide	10,000
1375	18-5177 (5)	1/26/1948	Industrial	GBRA/Union Carbide	4316
1375	18-5177 (6)	1/26/1948	Industrial	GBRA/Union Carbide	4316
1614	18-5178 (1)	1/7/1952	Municipal	GBRA/Union Carbide	70,000
1614	18-5178 (2)	1/7/1952	Industrial	GBRA/Union Carbide	30,525
1614	18-5178 (3)	1/7/1952	Irrigation	GBRA/Union Carbide	5475
1562	18-3863	3/1/1951	Municipal	GBRA	3000
2120	18-5484	5/15/1964	Diversion Dam & Salt Water Barrier	GBRA	0
Totals:					175,501

Source: GBRA Nov 2007; TWDB Jan 2006

Table 2.3.2-13
GBRA Record of Reported Calhoun Canal Water Use and Availability

	2000	2001	2002	2003	2004	2005	2006	Average
GBRA/UCC (Calhoun Canal) Water Rights[a]	175,501	175,501	175,501	175,501	175,501	175,501	175,501	175,501
Industrial Customers Ineos Nitriles (formerly BP Chemicals) DOW Chemical Company (formerly Union Carbide Corp [UCC]) Seadrift Coke	26,637	26,047	21,919	20,482	19,370	20,254	22,264	22,425
Municipal Customers City of Port Lavaca Port O'Connor Municipal Utility District (MUD) GBRA Calhoun County Rural Water System	4754	3849	5837	10,398	4882	8482	6946	6450
Irrigation Customers Rice Farmers Aquaculture Farmers Waterfowl Enhancement	18,539	21,774	23,893	14,030	15,508	19,809	15,813	18,481
Total GBRA Calhoun Canal Water Used	49,930	51,670	51,649	44,910	39,760	48,545	45,023	47,355
Total Underutilized GBRA/UCC Water Rights	125,571	123,831	123,852	130,591	135,741	126,956	130,478	128,146

Source: GBRA Nov 2007
[a]For a detailed breakdown of the GBRA/UCC water rights, see Table 2.3.2-12.

Table 2.3.2-14
Projected Surface Water Demands, Supplies, and Needs for Victoria and Calhoun Counties (Acre-Feet per Year) (2000–2060)

	Actual 2000	2010	2020	2030	2040	2050	2060
GBRA/UCC (Calhoun Canal) Water Rights[a]	175,501	175,501	175,501	175,501	175,501	175,501	175,501
Calhoun County							
Total Calhoun County Water Demands[b]	49,930[c]	69,243	72,564	75,795	79,489	82,816	87,247
Less Calhoun Eastern Industrial Demands met by Lake Texana[b]	–20,128	–23,392	–25,644	–27,861	–30,086	–31,917	–34,238
Calhoun County Water Demands	29,802	45,851	46,920	47,934	49,403	50,899	53,009
Victoria County							
Victoria County Industrial Needs[b]	0	0	0	0	1008	3624	6566
Total Underutilized GBRA/UCC Water Rights	145,699	129,650	128,581	127,567	125,090	120,978	115,926

a. For a detailed breakdown of the GBRA/UCC Surface Water Rights, see Table 2.3.2-12.

b. Source of projected demands, Lake Texana supplies, and needs is the 2006 South Central Texas Region L Water Plan. In the Region L Water Plan, “needs” are projected shortages or projected demands not met by existing supplies. GBRA currently does not supply Victoria County with water from the GBRA/UCC (Calhoun County) water rights, but due to projected shortages in Victoria County, GBRA will supply water to Victoria County starting in 2040 to offset the projected water shortages.

c. Total Calhoun County Water Demands for 2000 provided by GBRA Nov 2007 as shown in Table 2.3.2-13.

Source: HDR Feb 2008 except as noted

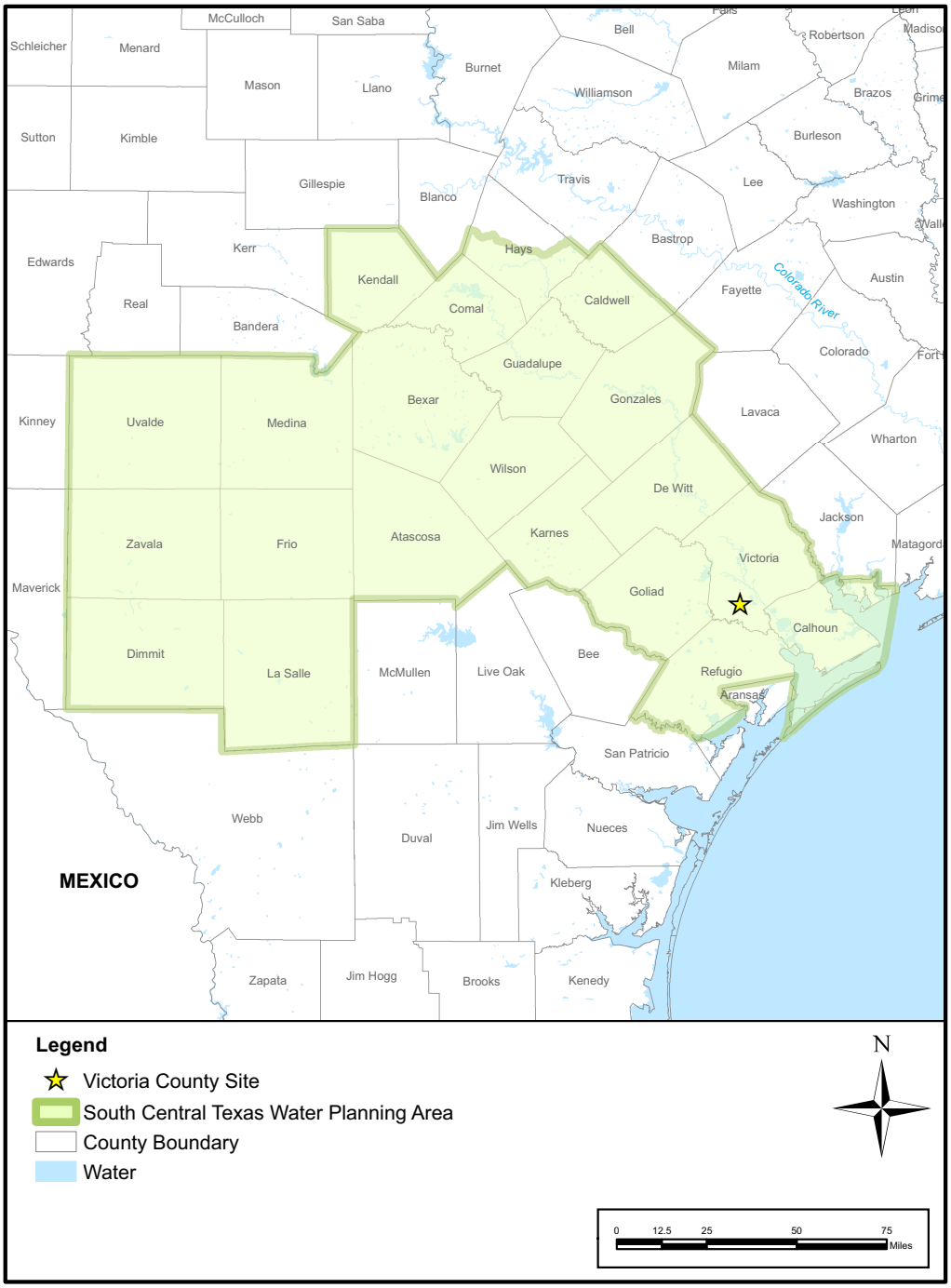

Figure 2.3.2-1 South Central Texas Water Planning Area (Region L)

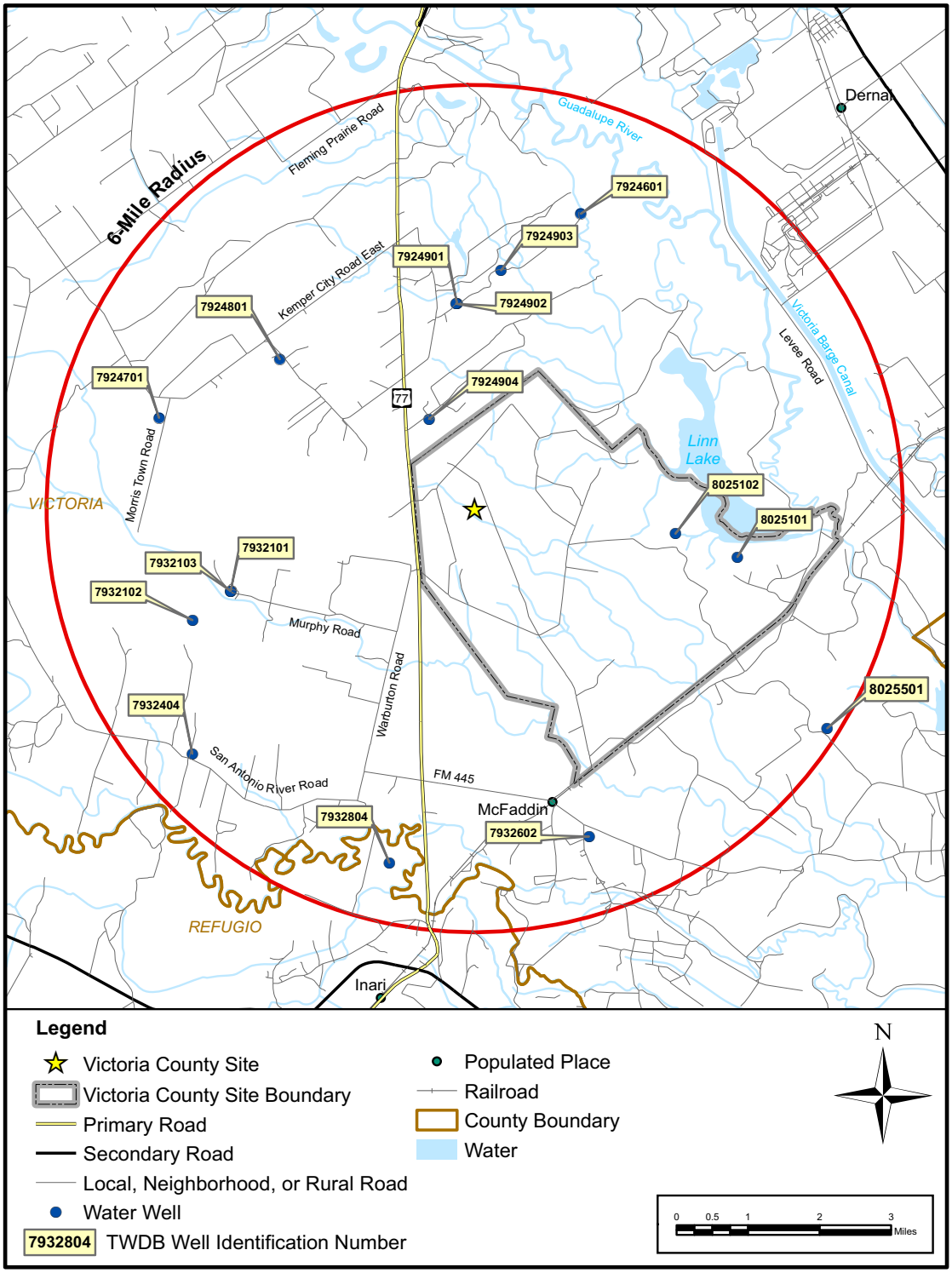

Figure 2.3.2-2 TWDB Well Location Map

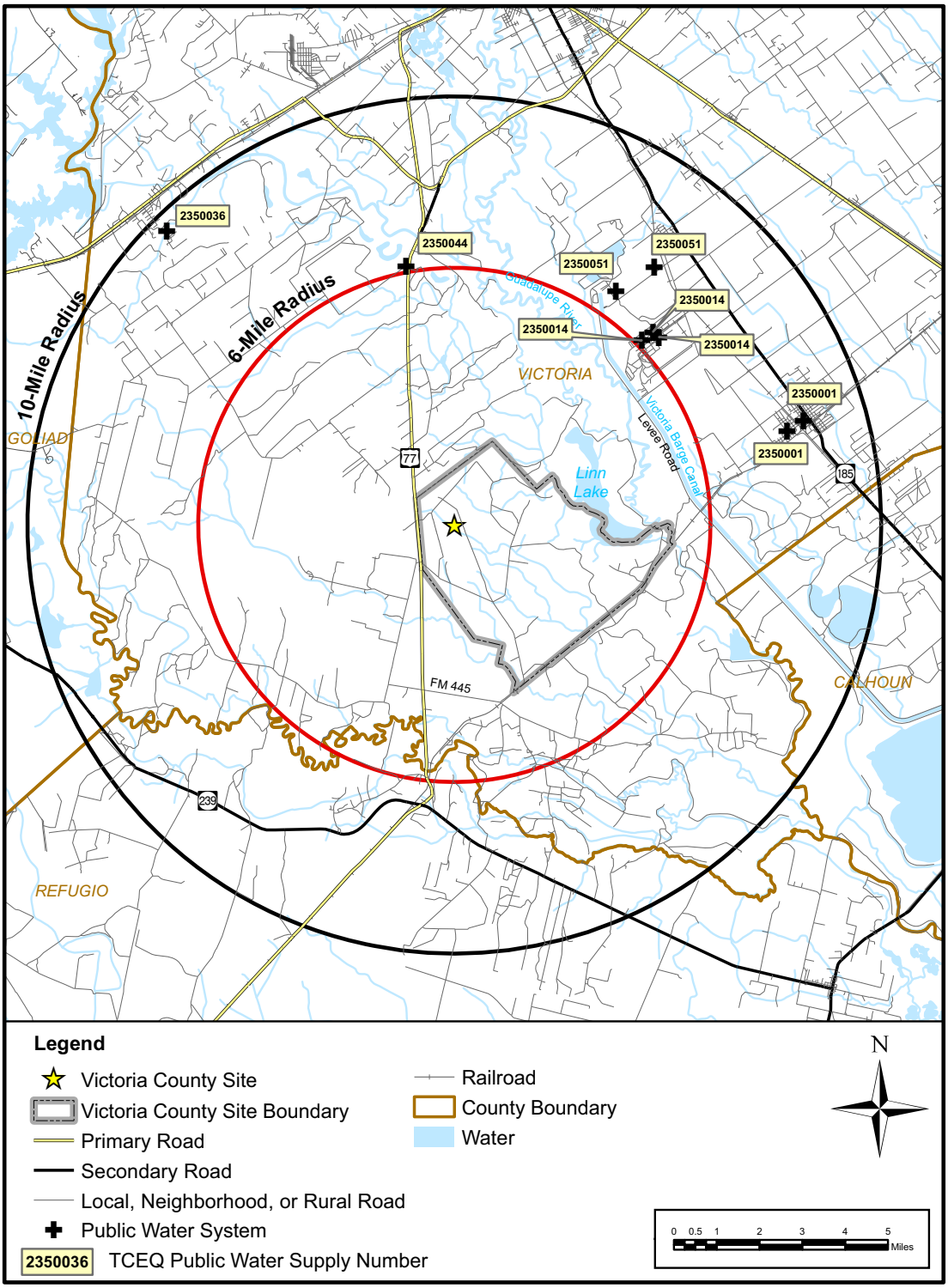

Figure 2.3.2-3 TCEQ Public Water System Wells within 10 Miles

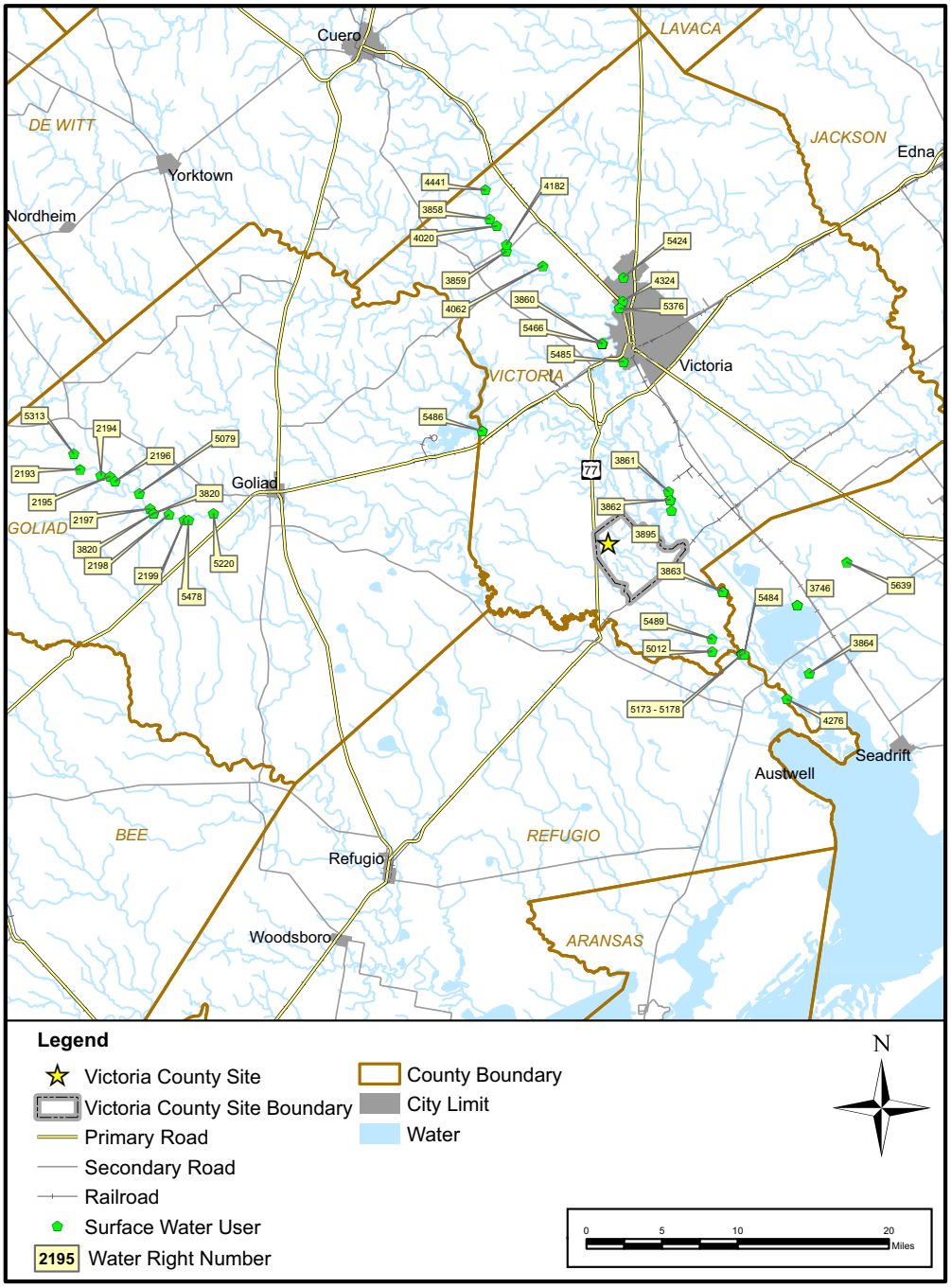

Figure 2.3.2-4 Surface Water Users in the Lower Guadalupe and Lower San Antonio River Basins

2.3.3 Water Quality

This subsection considers the water quality of surface water bodies and groundwater aquifers that could affect plant water use and effluent discharge, or be affected by the construction or operation of the proposed ESBWR units at the VCS site.

2.3.3.1 Groundwater

Groundwater quality in the Gulf Coast aquifer, consisting of the Chicot, Evangeline, and Jasper aquifers from youngest to oldest (TWDB Jan 2007), is generally good in the shallower portion of the aquifer. Groundwater containing less than 500 milligrams per liter (mg per L) total solids is usually encountered to a maximum depth of 3200 feet in the aquifer from the San Antonio River Basin northeastward. From the San Antonio River Basin southwestward, quality deterioration is evident in the form of increased chloride concentrations and saltwater encroachment along the coast (TWDB Jan 2006).

Groundwater from the Evangeline aquifer in areas south of Bee County, which is hydraulically downgradient of the site, has elevated concentrations of radioactivity relative to the rest of the aquifer system. Radioactivity generally increases from the northern part to the southern part of the Gulf Coast aquifer, occurs irregularly with depth, and shows no trend in composition. Radioactivity in the Texas Water Development Board (TWDB) Groundwater Database is mainly expressed as gross-alpha and gross-beta. Approximately 6.27% of 272 samples collected by the TWDB from the Evangeline Aquifer exceeded the EPA (U.S. EPA) maximum contaminant level (MCL) for alpha activity. The gross alpha activity was reported in the 272 TWDB water samples at a maximum concentration of 208 picocuries per liter (pCi per L), a mean concentration of 6.05 pCi per L and a median concentration of 2.60 pCi per L. Nearly all the samples analyzed for beta activity were below the MCL.

The Texas Water Commission (March 1989) reports, during a 1987 and 1988 study, anomalous radium concentrations of up to 65 pCi per L peaked at a depth of 585–1140 feet below the ground surface and were associated with wells near salt domes and/or streams. The study indicated that the proximity of salt domes and associated fault systems was an important predictor for the presence of radon and radium in the groundwater. Concentrations decreased as distance from the domes increased. It was concluded that radium and radon in the groundwater may have originated in the Catahoula Formation, a known source of uranium mineralization, and migrated upward into the shallower portion of the Gulf Coast aquifer. Avenues for migration may be located along flanks of piercement salt domes, along faults, and through permeable sediments deposited by streams. Alternatively, it was proposed that uranium could have migrated through the upper aquifer strata and concentrated in the reducing halo surrounding the domes (TWC Mar 1989).

Groundwater quality data for six of the TWDB wells located within 6 miles of the site (Figure 2.3.3-2) is summarized in Table 2.3.3-1**.** The data collected from the six wells includes a total of 12 samples collected between 1959 and 2005. The data indicates that chloride and total dissolved solids (TDS) concentrations in these wells exceed their EPA secondary maximum contaminant levels (SMCL).

Nitrate concentrations in some of the groundwater samples are also in excess of the EPA MCL for nitrate.

In November 2007, groundwater samples were collected from eight groundwater wells at the site. The wells included two McCan Ranch livestock wells and six VCS site observation wells, all of which are screened in the Chicot Aquifer. The depth of the livestock well referred to as the Southeast Windmill well is reportedly 135 feet deep (Banks Aug 2007), while the depth of the livestock well referred to as the Northwest Gate well is unknown. The VCS site observation wells that were included in the sampling program are screened at depths ranging from 56 feet to 142 feet below the ground surface.

In March 2008, an offsite well (TWDB #7932602) screened in the deeper Evangeline Aquifer was sampled.

In April 2008, a second groundwater sampling event was conducted for the same eight onsite wells sampled in November 2007, as well as one additional site observation well that was dry during the November sampling event.

The locations of the nine onsite and one offsite groundwater wells sampled in November 2007 and April 2008 are shown in Figure 2.3.3-1.

Each of the ten groundwater samples from the nine onsite wells and the offsite well was analyzed for the parameters selected from NRC guidance, as well as parameters used for permitting and plant design purposes. The parameter list for the nine onsite well samples and the offsite well sample is shown in Tables 2.3.3-2 and 2.3.3-3, respectively.

As shown in Table 2.3.3-1, the six TWDB wells located within 6 miles of the VCS site that have water quality data were analyzed for many of the same sample parameters as those in the November 2007 and April 2008 investigation (Table 2.3.3-2). The results from the recent (November 2007 and April 2008) groundwater investigation indicate that the general chemistry of groundwater at the site is within the ranges of concentrations seen in the TWDB wells from 1959 to 2005.

The April 2008 groundwater sampling results were compared to the analytical results of the November 2007 groundwater investigation to evaluate seasonal changes in groundwater quality of the nine onsite wells installed in the shallow Chicot Aquifer. Chloride concentrations increased in all the wells between the November and April sampling events. In November, the average chloride concentration in the wells was 173 milligrams per liter versus an average chloride concentration of 2098 mg per liter reported in April. Temperature, total hardness, alkalinity, sulfate, total silica, sodium, and total iron concentrations also increased in the water samples between November and April. The increase in these groundwater quality parameters is most likely a reflection of the lower groundwater levels in April and resultant stagnant groundwater flow regime. Dissolved oxygen, pH, and conductivity remained relatively constant between the two sampling events, while TDS, barium, magnesium and total coliform concentrations decreased.

Most of the parameters for site groundwater were within the MCL or SMCL, with the following exceptions: chloride, aluminum, arsenic, barium, iron, lead, manganese, TDS, and Ra-228. The metals strontium and potassium were detected in shallow groundwater at the site during the November sampling event (the parameters were not included in the April sampling event). Analytical results for the nine onsite groundwater wells are summarized in Table 2.3.3-2.

Analytical results from the March 2008 sampling of the offsite well (TWDB #7932602) are summarized in Table 2.3.3-3. TDS and sodium were reported in the well at concentrations higher than the onsite well concentrations reported in November and April.

High chloride in groundwater has been mapped for all the major aquifers of Texas. Chloride leaches into the groundwater from sedimentary rocks, soils, and salt deposits. The metals aluminum, arsenic, barium, iron, lead, and manganese also occur naturally by leaching from aquifer materials into the groundwater. The high TDS concentrations in groundwater are a result of the high levels of metals and organics in the groundwater. Radium is also found naturally in groundwater in parts of Texas and was reported in two of the TWDB wells located within 6 miles of the site (included in Gross Alpha analysis in Table 2.3.3-1). Strontium and potassium are also detected in groundwater, but neither has associated drinking water standards (MCL or SMCL). Both strontium and potassium are naturally occurring in rock. In addition, potassium can be attributed to contamination from animal waste.

2.3.3.2 Surface Water

Surface water bodies of primary interest include: Lower Guadalupe River, Lower San Antonio River, Guadalupe-Blanco River Authority (GBRA) Calhoun Canal (which receives water diverted from an impoundment formed by the GBRA saltwater barrier), and Kuy Creek. These water bodies are important because the proposed VCS will withdraw makeup water through a new intake structure on the GBRA Calhoun Canal and cooling basin blowdown will be discharged to the Guadalupe River. Kuy Creek will intercept runoff from the site's cooling basin spillway during storms that exceed the 100-year rain event. The Victoria Barge Canal is considered as an alternate source of makeup water in Section 9.4. Coleto Creek is a major tributary to the Guadalupe River upstream of the proposed cooling basin blowdown location.

The southern half of the site is bisected north to south by the intermittent/ephemeral Dry Kuy Creek, which drains into the intermittent Kuy Creek south of the site. Other surface water bodies on the site include several unnamed intermittent or ephemeral tributaries to Kuy Creek (along the western section of the site); several unnamed intermittent or ephemeral tributaries to Linn Lake (along the eastern section of the site); three isolated wetlands ranging in size from less than an acre to approximately 37 acres; and more than two dozen small, isolated stock ponds.

One important goal of both the TCEQ and EPA, through the Clean Water Act, is maintaining the quality of surface waters to provide for the survival and propagation of a balanced, indigenous, aquatic flora and fauna community. The TCEQ established five subcategories of aquatic life (limited, intermediate, high, and exceptional aquatic life, and oyster waters). The aquatic life subcategories recognize the

natural variability of aquatic community requirements and local environmental conditions. Biological data are considered to be a better indicator of water quality than chemical conditions. Therefore, if biological data shows a healthy, balanced community, the use is considered supported even if chemical parameters do not meet the applicable criteria. The criteria for “contact recreational use” are attained based on the frequency of E. coli and fecal coliform excursions. That is, the criteria are attained if E. coli does not exceed 126 organisms per 100 milliliters based upon the geometric mean of samples, with no single sample exceeding 394 per 100 milliliters, and fecal coliform organisms does not exceed 200 colonies per 100 milliliters based upon the geometric mean of samples, with no single sample exceeding 400 colonies per 100 milliliters (TCEQ 2000).

The TCEQ Surface Water Quality Segments located in the site’s hydrologic system are shown in Figure 2.3.3-2, and the designated uses of each segment are summarized in Table 2.3.3-4. The Lower San Antonio River Segment 1901 and the Guadalupe Bay Segment 2462-02 are included on the Draft 2008 Texas 303(d) List of Impaired Waters for high levels of bacteria (TCEQ 2008a).

Table 2.3.3-5 provides a list of 12 U.S. Geological Survey (USGS) and TCEQ surface water monitoring stations from which surface water quality data was collected. The locations of the monitoring stations are shown on Figure 2.3.3-3, and the water quality data is summarized in Tables 2.3.3-6 through 2.3.3-17.

In November 2007 and April 2008, surface water quality data were collected from a series of surface water bodies at and near the site as part of the site surface water characterization. The sample locations are shown in Figure 2.3.3-4**.** Each of the surface water samples was analyzed for a list of parameters that included those based on NRC guidance, as well as those used for permitting and plant design purposes. The parameters list and water quality data are summarized in Table 2.3.3-18.

The following paragraphs discuss water quality for the water bodies of interest for the VCS site.

2.3.3.2.1 **Guadalupe River**

Water quality data for two USGS and six TCEQ surface water quality stations located on the Lower Guadalupe River is summarized in Tables 2.3.3-6 through 2.3.3-14. Table 2.3.3-8 presents water quality data collected from the TCEQ Station 16579, which is located near the DuPont effluent discharge. TCEQ and GBRA discontinued collecting data at Station 16579 in 2006 because the integrity of the data was deemed suspect due to the station’s proximity to the industrial outfall (GBRA Nov 2007).

Downgradient of the confluence with the San Marcos River, the Guadalupe River flows through an area occupied by a number of large poultry farms and cattle ranches. To date, there have been no problems in the main segment associated with these land uses, although the tributary Sandies Creek and Peach Creek watersheds have been listed as impaired (GBRA May 2006). In early assessments, there were concerns for nutrient enrichment and depressed oxygen in the tidal segment of the river; however, the tidal segment was removed from the Draft 2006 List of Impaired Waters for aquatic life use.

In November 2007 and April 2008, surface water samples (SW-01 and SW-05) were collected from the Lower Guadalupe River as part of the Victoria County site surface water characterization. The locations of the river samples are shown in Figure 2.3.3-4, and the analytical data is summarized in Table 2.3.3-18.

Guadalupe River at Highway 59 (SW-05)

The November 2007 sampling event reported relatively high metal concentrations at SW-05, but the higher metals concentrations seen in November may be due to higher turbidity in the river resulting from a rain event during the sampling period. The turbidity of the sample collected at SW-05 during the November sampling event was 482 nepthelometric turbidity units (NTUs) compared to the high historical (from 2004 to 2007) turbidity of 384 NTUs reported from TCEQ 12590.

The river flow during the April 2008 sampling event was near normal, and as a result turbidity was much less than that measured in November. Other water quality parameters, including color, phosphorous, total and fecal coliform, and iron also decreased.

Comparison of historical surface water quality data from monitoring stations USGS Station 08176500, TCEQ Station 12590, and TCEQ Station 12581 indicates that the general chemistry of the surface water collected from SW-05 in April shows little discernible variation from the historical data (GBRA Undated, USGS 2008, U.S. EPA 2008b).

Guadalupe River at the GBRA Salt Water Barrier (SW-01)

Historical water quality data collected from TCEQ Station 12578, which is located at the GBRA saltwater barrier, is summarized in Tables 2.3.3-6 and 2.3.3-7.

The general chemistry of the November 2007 and April 2008 samples collected at the saltwater barrier is typical of the historical general chemistry of the river at that location. The April data show higher temperature, turbidity, TDS, TSS, chloride, sulfate and total coliform concentrations relative to the November data. The higher parameter concentrations are most likely a result of higher surface runoff and river flows observed during the April sampling event. The TCEQ Station 12578 also shows a trend of higher turbidity in the river samples during the month of April.

2.3.3.2.2 San Antonio River

Historical water quality data collected from TCEQ Station 12789 located on the Lower San Antonio River are summarized in Table 2.3.3-14.

In the past, water quality in the San Antonio Basin has varied from very good in the upper basin to relatively poor in the lower basin, particularly during periods of low flow. Since 1987, advanced water treatment has been instituted at the three major San Antonio area water recycling plants. As a result, dissolved oxygen concentrations in the San Antonio River have been maintained well above the state of Texas stream standard of 5.0 mg per liter and aquatic life has been significantly enhanced. Of the 13 TCEQ water segments comprising the San Antonio Basin, all but two segments are rated either high or excellent for aquatic life. Of the remaining two segments, Segment 1912 (Medio Creek) has a rating of

impaired and Segment 1913 (Mid Cibolo Creek) has a rating of limited aquatic life (TCEQ 2000). As shown in Table 2.3.3-14, the Lower San Antonio River Basin is impaired for high levels of bacteria (TWDB Jan 2006).

The TCEQ is currently conducting a total maximum daily load (TMDL) study to assess bacterial loading in the Lower San Antonio River Basin. The draft Lower San Antonio River TMDL study was available for public comment from May 2008 to June 21, 2008. The revised TMDL study, and the TCEQ's response to comments, will be published on their web site when available (TCEQ July 2008).

2.3.3.2.3 GBRA Calhoun Canal

Water quality data collected from USGS Station 08188600, located on the GBRA Calhoun Canal near the GBRA Relift #1 Station is summarized in Table 2.3.3-15. The parameters measured and reported at the USGS monitoring station include primarily pesticides and herbicides, of which none were detected.

In November 2007 and April 2008, surface water samples were collected from sample location SW-06, which is located on the GBRA Calhoun Canal as shown in Figure 2.3.3-4. The April water quality data collected at SW-06 indicated higher concentrations of TSS, alkalinity, chloride, sulfate, sodium, iron and magnesium than those reported during the November sampling event. However, turbidity, TDS, and hardness concentrations decreased.

2.3.3.2.4 Victoria Barge Canal

Water quality data collected from TCEQ Station 12536 located on the Victoria Barge Canal is summarized in Table 2.3.3-16.

All water quality standards and uses are supported on the Victoria Barge Canal. Although the canal has high aquatic life use (Table 2.3.3-4), phosphorous and chlorophyll-a levels are occasionally elevated. At certain times during the year the canal is very biologically productive and other parameters do not indicate water quality instability (TWDB Jan 2006).

2.3.3.2.5 Kuy Creek

In November 2007 and April 2008, surface water samples were collected at sample location SW-02, which is shown in Figure 2.3.3-4.

The April water quality data indicated higher TSS, chloride, iron and magnesium concentrations relative to the November data. However, turbidity and TDS concentration decreased from November to April. The creek had high total coliform concentrations during both sampling events that are assumed to result from cattle loitering in and around the creek.

Based on a review of surface water quality data from USGS and TCEQ monitoring stations located in the Lower San Antonio and Lower Guadalupe River Basins, the general chemical and biological characteristics of the Kuy Creek water samples are typical for the area (GBRA Undated and Dec 2007, USGS 2008, U.S. EPA 2008b). However, chloride, sulfate, sodium, iron and magnesium are relatively

elevated in Kuy Creek and may be a result of the constituents leaching into the water from the alluvial sediments that comprise the creek channel.

2.3.3.2.6 Coleto Creek

Historical water quality data for TCEQ Station 12622 located on Coleto Creek is summarized in Table 2.3.3-17.

In November 2007 and April 2008, surface water samples were collected at SW-04 at the location shown in Figure 2.3.3-4. Based on a comparison of the data sets, there is no discernible variability between the two water quality data sets, with the exception of an increase in total iron concentrations in April. Based on a review of surface water quality data from the TCEQ monitoring stations in Coleto Creek and the Lower Guadalupe River Basin, the general chemical, physical and biological characteristics of the surface water samples are typical for the area (GBRA Dec 2007, U.S. EPA 2008b).

2.3.3.2.7 Factors Affecting Water Quality

Several upstream factors have the potential to affect water quality at the GBRA saltwater barrier impoundment. The potential sources of pollution include wastewater discharges from municipal treatment, industrial, and manufacturing facilities, as well as agricultural runoff.

National Pollutant Discharge Elimination System (NPDES) permitted discharges were identified within the Lower Guadalupe River and Lower San Antonio River basins located within Victoria, Refugio, and Goliad Counties. There are seven permitted discharges that release effluent to the Lower Guadalupe River basin. The nearest to the GBRA saltwater barrier is the DuPont (INVISTA) facility, which is located approximately 5.5 miles northeast of the proposed VCS site. The facility is permitted to discharge 21.8 million gallons per day (mgd) into the Guadalupe River at a location on the opposite side of the river upstream from the proposed VCS discharge structure. According to files accessed on the EPA Envirofacts web site (U.S. EPA February 2008), the facility has had no NPDES violations in the past 5 years. The city of Victoria has two wastewater treatment plants that have combined permitted discharges of 11.8 mgd.

The city of Goliad wastewater treatment plant has a permitted discharge of 0.35 mgd. The second is a concrete plant with no recorded discharge volume. There are no NPDES permitted discharges to the Lower Guadalupe River or the Lower San Antonio River from Refugio County. Goliad County has two permitted discharges to the Lower San Antonio River. Table 2.3.3-19 provides a summary of permit numbers, facility information, flow rates, receiving streams and distances to the VCS site.

2.3.3.3 References

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Table 2.3.3-1
Summary of Groundwater Quality Data for TWDB Wells Located within 6 Miles of the VCS Site

State Well Number	7924601	7924601	7924901	7924901	7924901	7924902	7924902	7924902	7924904	7932404	7932602	7932602	{Mean}	{Maximum}
Date Sampled	4/11/01	3/30/05	2/5/59	6/28/79	8/25/83	3/26/97	4/11/01	3/22/05	2/4/59	2/4/59	4/28/59	4/14/71		
Parameter														
Temperature (ºCelsius)	22	22	–	–	–	23	23	23	–	–	–	28	23.5	28
Silica (mg per L)	34.4	36.6	30	45	44	19.7	42.4	46	31	34	15	15	32.8	46
Calcium (mg per L)	127	153	100	103	95	96.5	94.4	96.3	185	131	12	11.4	100.4	185
Magnesium (mg per L)	20.4	28.5	11	12	12	12.6	12.3	12.3	33	25	6.6	6.9	16.1	33
Sodium (mg per L)	169	235	94	79	94	92.7	87.4	92	177	106	404	384	168	404
Potassium (mg per L)	2.77	2.84	–	–	3	3.25	2.89	3.19	–	–	2.8	–	2.96	3.25
Strontium (mg per L)	0.92	1.14	–	–	–	0.41	0.42	0.4	–	–	–	–	0.66	1.14
Carbonate (mg per L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicarbonate (mg per L)	489.36	510.1	387	353.9	362.44	356.34	346.58	346.57	280	297	362.1	358.78	370.9	510.1
Sulfate (mg per L)	58.4	84.5	22	24	25	19.8	22.5	21.1	61	59	8.6	8.65	34.5	84.5
Chloride (mg per L)	**260**	**424**	111	115	128	102	125	120	**488**	**252**	**435**	**437**	**250**	**488**
Fluoride (mg per L)	0.31	0.52	0.5	0.3	0.4	0.26	0.38	0.56	0.3	0.3	0.7	0.5	0.42	0.7
Nitrate (mg per L)	<0.09	<0.09	2	8	5.01	9.3	**14.3**	**13.11**	0.8	<0.4	2	<0.4	6.8	14.3
pH (standard)	6.75	–	7.8	8.2	8.3	7.2	6.91	–	7.2	7.4	7.9	7.6	7.5	8.3
Total Dissolved Solids (mg per L)	**913**	**1217**	**560**	**560**	**584**	**531**	**572**	**575**	**1113**	**753**	**1064**	**1040**	**790**	**1217**
Total Alkalinity (mg per L)	401	418	317.12	290	297	292	284	284	229.44	243.37	296.72	294	303.9	418
Total Hardness (mg per L)	401	501	294	306	286	293	286	292	597	429	57	56	317	597
Sodium (percent)	47	51	40	35	41	40	39	41	39	34	93	93	49	93
Specific Conductance (µmhos per cm)	1646	2150	967	987	1072	918	1016	994	2050	1430	1940	2058	1436	2150
Gross Alpha (pCi per L)	1.8 ± 1.7	2.1 ± 4.6	–	–	–	–	2.6 ± 1.6	4.8 ± 3.2	–	–	–	–	–	–
Gross Beta (pCi per L)	4.9 ± 2.6	1.9 ± 4.2	–	–	–	–	4.1 ± 2.7	10 ± 2	–	–	–	–	–	–

Source: TWDB 2007
See Table 2.3.2-5 for well depths and aquifer for which well is screened.
µmhos per cm = micro-mhos per centimeter
mg per L = milligrams per liter
pCi per L = pico Curies per liter
– Not available

Table 2.3.3-2 (Sheet 1 of 7)
Summary of Exelon Victoria County Onsite Groundwater Analytical Results

Parameter	Analytical Method	MCL or *SMCL	OW-1U 11.29.07	OW-1U 04.15.08	OW-1L 11.29.07	OW-1L 04.15.08	OW-3L 11.29.07	OW-3L 04.15.07	OW-3L Duplicate 04.15.08	OW-8U 11.29.07	OW-8U 04.15.08
Chloride (mg per L)	SM 5220/USEPA 410	250*	69.8	**2100**	185	**3200**	147	**2180**	**3080**	11.6	**2180**
Chlorine Demand (mg per L)	HACH 10223	NE	1.58	NA	0.99	NA	3.21	–	–	2.63	–
Calcium (mg per L)	EPA 200.7	NE	114	222	119	115	124	118	121	159	119
Silica, Dissolved (mg per L)	USEPA 370.1	NE	32.6	–	34	–	33.6	–	–	29.7	–
Silica, Total (mg per L)	USEPA 6010B	NE	22.8	52.3	16.9	18.1	25.2	17.8	18.6	59.9	60.5
Silt Density Index	ASTM D4189	NE	0.28	–	IV	–	filter failed	–	–	IV	–
Sulfide (mg per L)	USEPA 376.1	NE	1.0	–	1.0	–	1.0	–	–	2.0	–
Sulfate (mg per L)	SM 4500/USEPA 375.3	250*	48.6	49.4	28.0	20.6	97.9	111	113	10.3	28
Sodium (mg per L)	USEPA 6010B	NE	135	106	103	131	171	172	178	116	115
Bacteria											
Total Coliform (CFUs per 100 mL)	SM 9223B/9221D	TCR	152	50	52	20	44	<10	<10	4200	1680
Fecal Coliform (CFUs per 100 mL)	SM 9222D	NE	<10	<10	<10	<10	<10	<10	<10	<10	<10
Fecal Streptococci (CFUs per 100 mL)	SM 9230C	NE	<10	<10	<10	<10	<10	<10	<10	<10	<10
Radionuclides (pCi per L)											
Potassium-40 (K-40)	USEPA 901.1	NE	-27.1	32.1	43.9	12.9	29.0	52.3	67.6	-22.6	14.4
Cesium-137 (Cs-137)	USEPA 901.1	NE	-0.891	0.629	-1.46	2.72	1.63	0.984	0.171	-0.38	1.54
Thallium-208 (Tl-208)	USEPA 901.1	NE	-1.23	0.14	-2.74	-2.22	-2.21	1.8	-3.77	1.48	8.34
Bismuth-212 (Bi-212)	USEPA 901.1	NE	-30.2	23.8	13.6	8.96	-13.3	28.5	8.77	0.01	50.2
Lead-212 (Pb-212)	USEPA 901.1	NE	-6.84	-1.18	-8.48	3.19	0.47	-1.08	0.01	-0.167	15.2
Bismuth-214 (Bi-214)	USEPA 901.1	NE	9.23	37.6	25.8	37.9	-0.93	27	22.3	13.4	37.7
Lead-214 (Pb-214)	USEPA 901.1	NE	5.21	48.9	17.7	38.9	14.1	35.3	23.2	15.0	29.9
Radium-226 (Ra-226)	USEPA 901.1	5.0	-10.7	-9.04	19.7	-3.14	-8.02	-14.4	-6.71	-11.0	7.08
Radium-228 (Ra-228)	USEPA 904.0	5.0	1.93	–	2.59	–	3.34	–	–	5.68	–
Tritium (H-3)	USEPA 906.0	NE	52.4	126	158	96	141	102	197	50.5	86.4
Metals (µg per L)											
Aluminum	USEPA 6010B	50 to 200*	488	–	290	–	2270	–	–	23,000	NA
Arsenic	USEPA 6010B	10	<2.7	6.6	<2.7	<2.8	<2.7	<2.7	3.1†	**12.2**	4.5†

Table 2.3.3-2 (Sheet 2 of 7)
Summary of Exelon Victoria County Onsite Groundwater Analytical Results

Parameter	Analytical Method	MCL or *SMCL	OW-1U 11.29.07	OW-1U 04.15.08	OW-1L 11.29.07	OW-1L 04.15.08	OW-3L 11.29.07	OW-3L 04.15.07	OW-3L Duplicate 04.15.08	OW-8U 11.29.07	OW-8U 04.15.08
Chloride (mg per L)	SM 5220/USEPA 410	250*	69.8	**2100**	185	**3200**	147	**2180**	**3080**	11.6	**2180**
Chlorine Demand (mg per L)	HACH 10223	NE	1.58	NA	0.99	NA	3.21	–	–	2.63	–
Calcium (mg per L)	EPA 200.7	NE	114	222	119	115	124	118	121	159	119
Silica, Dissolved (mg per L)	USEPA 370.1	NE	32.6	–	34	–	33.6	–	–	29.7	–
Silica, Total (mg per L)	USEPA 6010B	NE	22.8	52.3	16.9	18.1	25.2	17.8	18.6	59.9	60.5
Silt Density Index	ASTM D4189	NE	0.28	–	IV	–	filter failed	–	–	IV	–
Sulfide (mg per L)	USEPA 376.1	NE	1.0	–	1.0	–	1.0	–	–	2.0	–
Sulfate (mg per L)	SM 4500/USEPA 375.3	250*	48.6	49.4	28.0	20.6	97.9	111	113	10.3	28
Sodium (mg per L)	USEPA 6010B	NE	135	106	103	131	171	172	178	116	115
Bacteria											
Total Coliform (CFUs per 100 mL)	SM 9223B/9221D	TCR	152	50	52	20	44	<10	<10	4200	1680
Fecal Coliform (CFUs per 100 mL)	SM 9222D	NE	<10	<10	<10	<10	<10	<10	<10	<10	<10
Fecal Streptococci (CFUs per 100 mL)	SM 9230C	NE	<10	<10	<10	<10	<10	<10	<10	<10	<10
Radionuclides (pCi per L)											
Potassium-40 (K-40)	USEPA 901.1	NE	-27.1	32.1	43.9	12.9	29.0	52.3	67.6	-22.6	14.4
Cesium-137 (Cs-137)	USEPA 901.1	NE	-0.891	0.629	-1.46	2.72	1.63	0.984	0.171	-0.38	1.54
Thallium-208 (Tl-208)	USEPA 901.1	NE	-1.23	0.14	-2.74	-2.22	-2.21	1.8	-3.77	1.48	8.34
Bismuth-212 (Bi-212)	USEPA 901.1	NE	-30.2	23.8	13.6	8.96	-13.3	28.5	8.77	0.01	50.2
Lead-212 (Pb-212)	USEPA 901.1	NE	-6.84	-1.18	-8.48	3.19	0.47	-1.08	0.01	-0.167	15.2
Bismuth-214 (Bi-214)	USEPA 901.1	NE	9.23	37.6	25.8	37.9	-0.93	27	22.3	13.4	37.7
Lead-214 (Pb-214)	USEPA 901.1	NE	5.21	48.9	17.7	38.9	14.1	35.3	23.2	15.0	29.9
Radium-226 (Ra-226)	USEPA 901.1	5.0	-10.7	-9.04	19.7	-3.14	-8.02	-14.4	-6.71	-11.0	7.08
Radium-228 (Ra-228)	USEPA 904.0	5.0	1.93	–	2.59	–	3.34	–	–	5.68	–
Tritium (H-3)	USEPA 906.0	NE	52.4	126	158	96	141	102	197	50.5	86.4
Metals (µg per L)											
Aluminum	USEPA 6010B	50 to 200*	488	–	290	–	2270	–	–	23,000	NA
Arsenic	USEPA 6010B	10	<2.7	6.6	<2.7	<2.8	<2.7	<2.7	3.1†	**12.2**	4.5†

Table 2.3.3-2 (Sheet 3 of 7)
Summary of Exelon Victoria County Onsite Groundwater Analytical Results

Parameter	Analytical Method	MCL or *SMCL	OW-1U 11.29.07	OW-1U 04.15.08	OW-1L 11.29.07	OW-1L 04.15.08	OW-3L 11.29.07	OW-3L 04.15.07	OW-3L Duplicate 04.15.08	OW-8U 11.29.07	OW-8U 04.15.08
Barium	USEPA 6010B	200	**261**	**428**	**382**	**204**	<108	81.3†	84.7†	**436**	**229**
Cadmium	USEPA 6010B	5	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
Chromium	USEPA 6010B	100	<1.5	18	<1.5	<1.5	<2.6	<1.5	<1.5	19.8	2.3†
Cobalt	USEPA 6010B	NE	<9.6	–	<9.6	–	<9.6	–	–	<12.9	–
Copper	USEPA 6010B	1.0*	<5.9	–	<7.7	–	<7.9	–	–	<13.4	–
Iron (Dissolved)	USEPA 6010B	100*	<24	–	<24	–	<24	–	–	<24	–
Iron (Total)	USEPA 6010B	100*	**447**	**14,900**	**305**	55.8†	**1930**	68.9†	75.8†	**20,500**	**3,060**
Lead	USEPA 6010B	15	<2.8	12.4	<2.8	<2.8	3.4	<2.8	<2.8	19.0	6.9
Magnesium	USEPA 6010B	NE	18,900	20500	16,900	18600	17,800	16800	17300	17,300	12700
Manganese (Dissolved)	USEPA 6010B	50*	<12.8	–	6.6	–	<11.2	–	–	**270**	–
Manganese (Total)	USEPA 6010B	50*	<9.6	–	15.2	–	26.7	–	–	**541**	–
Mercury	USEPA 7470B	200	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094
Molybdenum	USEPA 6010B	NE	<1.2	–	<1.2	–	<1.2	–	–	<1.5	–
Nickel	USEPA 6010B	NE	<2.6	–	<2.6	–	<2.8	–	–	<15.0	–
Potassium	USEPA 7470B	NE	4800	–	3240	–	4990	–	–	7050	–
Selenium	USEPA 6010B	50	<2.3	–	<2.3	–	<3.8	–	–	<2.3	–
Silver	USEPA 6010B	100*	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Strontium	USEPA 6010B	NE	622	–	333	–	523	–	–	450	NA
Titanium	USEPA 6010B	NE	<4.1	–	<3.4	–	<15.0	–	–	67	NA
Vanadium	USEPA 6010B	NE	<9.6	–	<6.5	–	<12.1	–	–	51.5	NA
Zinc	USEPA 6010B	500*	<7.5	–	<7.5	–	<11.2	–	–	46.5	NA
Oil and Grease	USEPA 1664	NE	<1.4	–	<1.4	–	<1.4	–	–	<1.4	–

Table 2.3.3-2 (Sheet 4 of 7)
Summary of Exelon Victoria County Onsite Groundwater Analytical Results

Parameter	Analytical Method	MCL or *SMCL	OW-8L 11.29.07	OW-8L 04.15.08	OW-10U 04.15.08	OW-10L 11.29.07	OW-10L Duplicate 11.29.07	OW-10L 04.15.08	Northwest Gate Well 11.29.07	Northwest Gate Well 04.15.08	Southeast Windmill Well 11.29.07	Southeast Windmill Well 04.15.08	{Mean}	{Maximum}
General Chemistry														
Temperature (°C)	Field Measurement	NE	20.82	23.9	25.26	21.67	21.67	25.8	16.62	21.54	20.49	23.49	22.5	25.8
pH (standard units)	Field Measurement	6.5 - 8.5*	7.34	7.3	7.4	7.56	7.56	7.2	7.17	7.6	7.53	7.1	7.41	7.6
Salinity (percent)	Field Measurement	NE	0.04	0.1	0.1	0.06	0.06	0.1	0.07	0.1	0.09	0.1	0.1	0.1
Total Suspended Solids (mg per L)	SM[2] 2540/USEPA 160.2	NE	36.0	1850.0	2.7	<1.7	2.3	1.0†	8.7	2	<1.3	1.3†	590	7610
Total Dissolved Solids (mg per L)	SM 2540/USEPA 160.1	500*	**560**	**650**	**778**	**889**	**885**	**575**	**823**	**563**	**1290**	731	736	1290
Hardness, Total as $CaCO_3$ (mg per L)	USEPA 130.0	NE	292	850	270	232	424	480	268	150	500	590	395	850
Turbidity (NTU)	USEPA 180.1	0.3**	47.8	95.4	77.4	1.3	1.8	0.44†	46.2	5.9	<0.88	0.88†	39.2	119
Color, Apparent (Cobalt Units)	USEPA 110.2	15*	5	**20**	**20**	5	5	<5	10	**60**	5	<5	12	60
Odor (Threshold Odor Number)	USEPA 140.1	3*	**40**	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.1	40
Specific Conductance (µmhos per cm)	USEPA 120.1	NE	805	1030	1230	1440	1440	1310	1410	1030	1880	1740	1236	1880
Dissolved Oxygen (mg per L)	Field Measurement	NE	8.18	10.12	10.51	5.17	5.17	8.55	10.97	7.46	9.35	8.6	8.89	10.97
Biochemical Oxygen Demand (mg per L)	SM 5210/USEPA 405.1	NE	<9.0	<0.89	<0.89	<1.0	<8.0	1.0†	6.0	<0.89	2.0	<0.89	<2.4	9
Chemical Oxygen Demand (mg per L)	SM 5220/USEPA 410	NE	57.1	5.7†	5.7†	<4.5	<4.5	29.6	25.0	<4.5	<4.5	<4.5	<14.9	57.1
Total Organic Carbon (mg per L)	USEPA 415.1	NE	19.8	–	–	<0.39	<0.40	–	<0.20	–	<0.12	–	<2.5	19.8
Phosphorus, Total (mg per L)	SM 4500/USEPA 365	NE	0.051	0.25	0.048	0.023	0.043	<0.0060†	<0.015	0.0030†	<0.017	0.0090†	<0.08	0.55
Phosphorus, Orthophosphate (mg per L)	SM 4500/USEPA 365.2	NE	0.029	0.0030†	0.02	<0.019	<0.019	<0.0040†	<0.011	<0.0030	<0.011	<0.0030	<0.02	0.084
Nitrogen, Ammonia (mg per L)	SM 4500/USEPA 350.1	NE	0.17	0.11	<0.10	<0.25	<0.50	<0.10	<0.50	<0.10	0.24	<0.10	<0.17	0.5
Nitrogen, Nitrite (mg per L)	SM 4500/USEPA 353.2	100	<0.034	<0.010	0.025	<0.011	<0.011	<0.010	<0.011	<0.010	<0.011	<0.010	<0.01	0.053
Nitrate-N (mg per L)	SM 4500	10	<1.0	<0.11	0.6	<1.0	<1.0	0.45	<1.0	<0.11	<1.0	0.31	<0.74	1
Nitrogen, Total Kjeldahl (mg per L)	USEPA 351.2	NE	–	–	–	<0.13	2.0	–	–	–	–	–	<0.53	2
Nitrogen, Organic (mg per L)	SM 4500-N	NE	0.17	0.11	<0.10	<0.25	<0.50	<0.10	<0.50	<0.10	0.24	<0.10	<0.17	0.5
Carbon Dioxide (mg per L)	SM4500 CO2 D	NE	63.82	58.5	54.2	57.35	46.1	62.8	643.39	9.5	18.12	61	81.3	643.4
Bicarbonate Alkalinity (mg per L)	SM2320	NE	304.72	344	420	286.73	264.7	300	377.96	316	92.71	248	305	420
Alkalinity, Total as $CaCO_3$ (mg per L)	SM 2320/USEPA 310	NE	305	344	420	287	265	300	378	316	92.8	248	305	420
Fluoride	USEPA 340.2	4	0.56	–	–	0.12	0.18	–	0.55	–	0.41	–	0.35	0.56

Table 2.3.3-2 (Sheet 5 of 7)
Summary of Exelon Victoria County Onsite Groundwater Analytical Results

Parameter	Analytical Method	MCL or *SMCL	OW-8L 11.29.07	OW-8L 04.15.08	OW-10U 04.15.08	OW-10L 11.29.07	OW-10L Duplicate 11.29.07	OW-10L 04.15.08	Northwest Gate Well 11.29.07	Northwest Gate Well 04.15.08	Southeast Windmill Well 11.29.07	Southeast Windmill Well 04.15.08	{Mean}
Chloride (mg per L)	SM 5220/USEPA 410	250*	54	**2750**	**2680**	224	225	**1530**	175	**1300**	**462**	**1900**	**1287**
Chlorine Demand (mg per L)	HACH 10223	NE	31.22	–	–	1.08	0.98	–	20.42	–	1.05	–	7
Calcium (mg per L)	EPA 200.7	NE	92.2	331.0	84.3	153	153	148	66.5	235	162	174	148
Silica, Dissolved (mg per L)	USEPA 370.1	NE	26.6	–	–	25.4	25.9	–	<0.015	–	28.6	–	26.3
Silica, Total (mg per L)	USEPA 6010B	NE	18.1	118	24.2	16.1	15.8	15.7	13.5	4.37	16.7	170	37.1
Silt Density Index	ASTM D4189	NE	IV	–	–	IV	IV	–	0.62	–	0.01	–	0.30
Sulfide (mg per L)	USEPA 376.1	NE	13	–	–	2.0	2.0	–	3.0	–	3.0	–	3
Sulfate (mg per L)	SM 4500/USEPA 375.3	250*	12.8	45.7	70	60.5	59.7	68.3	89.3	14.8	93.4	105	59
Sodium (mg per L)	USEPA 6010B	NE	66.7	124	219	127	124	116	214	185	176	177	145
Bacteria													
Total Coliform (CFUs per 100 mL)	SM 9223B/9221D	TCR	80,000	12,400	180	166	256	<10	<10	60	100	160	<5240
Fecal Coliform (CFUs per 100 mL)	SM 9222D	NE	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Fecal Streptococci (CFUs per 100 mL)	SM 9230C	NE	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Radionuclides (pCi per L)***													
Potassium-40 (K-40)	USEPA 901.1	NE	-32.3	73.6	52.3	4.4	-44.3	1.8	6.18	68.5	-45.0	15.3	15.9
Cesium-137 (Cs-137)	USEPA 901.1	NE	0.73	-3.93	0.317	-4.22	-1.26	-2.02	1.18	-0.912	-0.705	-1.01	-0.36
Thallium-208 (Tl-208)	USEPA 901.1	NE	0.129	1.56	0.156	-2.52	-0.161	1.03	-0.988	0.28	3.20	3.32	0.29
Bismuth-212 (Bi-212)	USEPA 901.1	NE	6.88	10.1	-22.3	-1.72	5.0	9.21	-2.8	-13.9	28.9	-8.92	5.3
Lead-212 (Pb-212)	USEPA 901.1	NE	-4.2	20.9	5.29	0.51	18.8	16.5	-1.13	-1.52	-3.25	-4.98	2.53
Bismuth-214 (Bi-214)	USEPA 901.1	NE	-1.77	48.7	36.3	24.5	4.38	36.9	26	57.9	20	30.6	26
Lead-214 (Pb-214)	USEPA 901.1	NE	7.80	40.5	15.3	3.78	3.66	32.7	29.9	61	10.2	37.7	24.8
Radium-226 (Ra-226)	USEPA 901.1	5.0	-3.48	-5.52	-0.267	1.96	-8.68	23.6	-0.866	**10**	4.56	12.1	-0.15
Radium-228 (Ra-228)	USEPA 904.0	5.0	4.71	–	–	3.76	4.37	–	0.905	–	4.56	–	3.54
Tritium (H-3)	USEPA 906.0	NE	79.8	33.3	72.5	79.8	82.5	74.6	105	183	117	207	108
Metals (µg per L)													
Aluminum	USEPA 6010B	50 to 200*	**871**	NA	NA	<86	**1180**	NA	<86	NA	<86	NA	<3151
Arsenic	USEPA 6010B	10	29.5	**67.7**	<2.7	<2.7	<2.7	<2.7	<2.7	3.8†	<2.7	4.7†	<8.5

Table 2.3.3-2 (Sheet 6 of 7)
Summary of Exelon Victoria County Onsite Groundwater Analytical Results

Parameter	Analytical Method	MCL or *SMCL	OW-8L 11.29.07	OW-8L 04.15.08	OW-10U 04.15.08	OW-10L 11.29.07	OW-10L Duplicate 11.29.07	OW-10L 04.15.08	Northwest Gate Well 11.29.07	Northwest Gate Well 04.15.08	Southeast Windmill Well 11.29.07	Southeast Windmill Well 04.15.08	{Mean}	{Maximum}
Barium	USEPA 6010B	200	**506**	**1280**	91.8†	**348**	**341**	**210**	<50	50.8†	<117	119†	280	1280
Cadmium	USEPA 6010B	5	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	1.8
Chromium	USEPA 6010B	100	<7.5	15.8	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	4.5	19.8
Cobalt	USEPA 6010B	NE	<9.6	–	–	<9.6	<9.6	–	<9.6	–	<9.6	–	<10.0	12.9
Copper	USEPA 6010B	1.0*	<9.3	–	–	<6.2	<7.2	–	<10.2	–	<20.2	–	<9.8	20.2
Iron (Dissolved)	USEPA 6010B	100*	<24	–	–	<24	<24	–	<24	–	<24	–	<24	24
Iron (Total)	USEPA 6010B	100*	**1260**	**19,200**	**480**	<24	<24	33.4†	**2260**	**2130**	<24	**372**	**<3534**	**20,500**
Lead	USEPA 6010B	15	<2.8	15.3	3.6	<2.8	<2.9	3.6	6.1	<2.8	4.9	4.8	<5.5	19
Magnesium	USEPA 6010B	NE	13,600	21100	13300	23,100	22,800	21100	27,900	21400	36,900	37700	20826	37,700
Manganese (Dissolved)	USEPA 6010B	50*	**793**	–	–	<7.8	<7.9	–	31.9	–	<14.2	–	128.4	793
Manganese (Total)	USEPA 6010B	50*	**823**	–	–	<8.8	<9.2	–	33.3	–	15.7	–	164.7	823
Mercury	USEPA 7470B	200	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094
Molybdenum	USEPA 6010B	NE	<6.0	–	–	<1.2	<1.2	–	<8.4	–	<1.2	–	<2.6	8.4
Nickel	USEPA 6010B	NE	<3.3	–	–	<2.6	<2.6	–	<2.6	–	<2.6	–	<4.1	15
Potassium	USEPA 7470B	NE	8590	–	–	7380	7160	–	4550	–	5280	–	5893	8590
Selenium	USEPA 6010B	50	<2.3	–	–	<2.3	<2.6	–	<2.3	–	<2.8	–	<2.6	3.8
Silver	USEPA 6010B	100*	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Strontium	USEPA 6010B	NE	398	–	–	795	783	–	2140	–	1570	–	846	2140
Titanium	USEPA 6010B	NE	<5.0	–	–	<0.71	<1.7	–	<0.71	–	<0.71	–	<10.9	67
Vanadium	USEPA 6010B	NE	<5.2	–	–	<6.0	<6.2	–	<1.6	–	<9.4	–	<12	51.5
Zinc	USEPA 6010B	500*	<11.8	–	–	<17.1	21.6	–	**1310**	–	**814**	–	<250	1310
Oil and Grease	USEPA 1664	NE	<1.4	NA	NA	<1.4	<1.4	NA	<1.4	NA	<1.4	–	<1.4	<1.4

NE = Not established
SM = Standard Methods for Examination of Water and Waste Water, 19th Edition
NTU = Nepthelometric turbidity unit
µmhos = Micromhos per centimeter
CFU = Colony Forming Unit
TCR = Total Coliform Rule: No more than 5% of monthly samples may be positive for presence of coliforms
BOLD = Parameter concentration exceeds MCL or SMCL.
– = Parameter not analyzed
MCL = Maximum Contaminant Level (US EPA 2008a)
*SMCL = Secondary Maximum Contaminant Level (USEPA 2008a)

Table 2.3.3-2 (Sheet 7 of 7)
Summary of Exelon Victoria County Onsite Groundwater Analytical Results

*** = Radionuclide analyses usually required the subtraction of the instrument background counts from the sample counts. Even though both background and the sample values are positive, sometimes when the sample activity is low, variations in the two measurements can cause the sample value to be less than the background, resulting in a measured activity less than zero.
† = Parameter also detected in the laboratory method blank
> = Parameter detected at or below the method detection limit
IV = Insufficient volume of sample was provided by Accutest to their subcontract lab
OW-1U = Observation well screened in upper Chicot Aquifer
OW-1L = Observation well screened in lower Chicot Aquifer

Table 2.3.3-3 (Sheet 1 of 4)
Summary of Exelon Victoria County Offsite TWDB Well #7932602 Groundwater Analytical Results (03.25.08)

Parameter	Analytical Method	MCL or *SMCL	TWDB #7932602
General Chemistry			
Temperature (°C)	Field Measurement	NE	21.8
pH (standard units)	Field Measurement	6.5 - 8.5*	8.76
Salinity (percent)	Field Measurement	NE	0.1
Total Suspended Solids (mg per L)	SM 2540/EPA 160.2	NE	10
Total Dissolved Solids (mg per L)	SM 2540/EPA 160.1	500*	1120
Hardness, Total as $CaCO_3$ (mg per L)	EPA 130.0	NE	54
Turbidity (NTU)	EPA 180.1	0.3**	4.09
Color, Apparent (Cobalt Units)	EPA 110.2	15*	<5
Odor (Threshold Odor Number)	EPA 140.1	3*	<1
Specific Conductance (µmhos per cm)	EPA 120.1	NE	1820
Biochemical Oxygen Demand (mg per L)	SM 5210/EPA 405.1	NE	5.0†
Chemical Oxygen Demand (mg per L)	SM 5220/EPA 410	NE	12.5†
Total Organic Carbon (mg per L)	EPA 415.1	NE	49.5
Phosphorus, Total (mg per L)	SM 4500/EPA 365	NE	0.013†
Orthophosphate (mg per L)	SM 4500/EPA 365.2	NE	0.012†
Nitrogen, Ammonia (mg per L)	SM 4500/EPA 350.1	NE	<0.050
Nitrogen, Nitrite (mg per L)	SM 4500/EPA 353.2	100	<0.010
Nitrate-N (mg per L)	SM 4500	10	<0.11
Nitrogen, Total Kjeldahl (mg per L)	EPA 351.2	NE	0.20†
Carbon Dioxide (mg per L)	SM4500 CO2 D	NE	3.2†
Bicarbonate Alkalinity (mg per L)	SM 2320	NE	274
Alkalinity, Total as $CaCO_3$ (mg per L)	SM 2320/EPA 310	NE	274
Fluoride (mg per L)	EPA 340.2	4	0.34
Chloride (mg per L)	SM 5220/EPA 410	250*	1120
Chlorine Demand (mg per L)	HACH 10223	NE	0.68
Calcium (mg per L)	EPA 200.7	NE	11
Silica, Dissolved (mg per L)	EPA 370.1	NE	4.3
Silica, Total (mg per L)	EPA 6010B	NE	8.7
Silt Density Index	ASTM D4189	NE	0.26
Sulfide (mg per L)	EPA 376.1	NE	2
Sulfate (mg per L)	SM 4500/EPA 375.3	250*	4.1†

Table 2.3.3-3 (Sheet 2 of 4)
Summary of Exelon Victoria County Offsite TWDB Well #7932602
Groundwater Analytical Results (03.25.08)

Parameter	Analytical Method	MCL or *SMCL	TWDB #7932602
Sodium (mg per L)	EPA 6010B	NE	385
Cyanide, Total (mg per L)	EPA 335.4	0.2	<0.0050
Bacteria			
Sulfate Reducing Bacteria (units per L)	SM 9240C	NE	200
Iron Reducing Bacteria (units per mL)	SM 9240B	NE	9000
Bacteria Counts (Standard Units)	SM Sim Plate	NE	33
Total Coliform (CFUs per 100mL)	m-ColiBlue 24	TCR	***Positive
Fecal Coliform (CFUs per 100mL)	SM 9222D	NE	NA
Fecal Streptococci (CFUs per 100mL)	SM 9230C	NE	NA
Radionuclides (pCi per L)			
Potassium-40 (K-40)	EPA 901.1	NE	-9.1
Cesium-137 (Cs-137)	EPA 901.1	NE	1
Thallium-208 (Tl-208)	EPA 901.1	NE	-5.83
Bismuth-121 (Bi-212)	EPA 901.1	NE	-10.5
Lead-212 (Pb-212)	EPA 901.1	NE	2.79
Bismuth-214 (Bi-214)	EPA 901.1	NE	54.7
Lead-214 (Pb-214)	EPA 901.1	NE	74.6
Radium-226 (Ra-226)	EPA 903.1	5.0	0.341
Radium-228 (Ra-228)	EPA 901.1	5.0	**5.41**
Tritium (H-3)	EPA 906.0	NE	98.2
Metals (µg per L)			
Aluminum	EPA 6010B	50 to 200*	**838**
Antimony	EPA 6010B	6.0	<2.7
Arsenic	EPA 6010B	10	<2.7
Barium	EPA 6010B	200	**472**
Beryllium	EPA 6010B	4.0	<0.26
Boron	EPA 6010B	NE	408
Bromide	EPA 6010B	NE	3
Cadmium	EPA 6010B	5	<1.8
Chromium	EPA 6010B	100	<1.5
Cobalt	EPA 6010B	NE	<9.6
Copper	EPA 6010B	1.0*	<5.9
Iron (Dissolved)	EPA 6010B	100*	**345**
Iron (Total)	EPA 6010B	100*	**736**

Table 2.3.3-3 (Sheet 3 of 4)
Summary of Exelon Victoria County Offsite TWDB Well #7932602 Groundwater Analytical Results (03.25.08)

Parameter	Analytical Method	MCL or *SMCL	TWDB #7932602
Lead	EPA 6010B	15	<2.8
Magnesium	EPA 6010B	NE	6470
Manganese (Dissolved)	EPA 6010B	50*	<8.8
Manganese (Total)	EPA 6010B	50*	17.6
Mercury	EPA 7470B	200	<0.094
Molybdenum	EPA 6010B	NE	<1.2
Nickel	EPA 6010B	NE	<2.6
Potassium	EPA 7470B	NE	2760†
Selenium	EPA 6010B	50	<2.3
Silver	EPA 6010B	100*	<1.1
Strontium	EPA 6010B	NE	1160
Thallium	EPA 6010B	0.5	3.8†
Metals (µg per L) (continued)			
Vanadium	EPA 6010B	NE	1.7†
Zinc	EPA 6010B	500*	8.0†
Volatile Organic Compounds (VOCs) mg per L	EPA 8260B	Various	ND
Semi-Volatile Organic Compounds (SVOCs) mg per L	EPA 8270C	Various	ND
Pesticides & Herbicides (mg per L)	USEPA 8141/8151	Various	ND
PCBs (mg per L)	USEPA 8081	Various	ND
Oil and Grease (mg per L)	EPA 1664	NE	<1.4

TWDB = Texas Water Development Board

ND = Parameter Not Detected Above the Method Detection Limit

NE = not established

µg per L = micrograms per liter

mg per L = milligrams per liter

NTU = Nepthelometric turbidity unit

µmhos/cm = micromhos per centimeter

units per mL = units per milliliter

pCi per L = pico Curies per liter

PCBs = Polychlorinated biphenyls

CFU = Colony Forming Unit

TCR = Total Coliform Rule: No more than 5% of monthly samples may be positive for presence of coliforms

Table 2.3.3-3 (Sheet 4 of 4)
Summary of Exelon Victoria County Offsite TWDB Well #7932602
Groundwater Analytical Results (03.25.08)

(Notes Continued)

-9.1 = Radiochemical analyses usually require the subtraction of the instrument background counts from the sample counts. Even though both background and the sample values are positive, sometimes when the sample activity is low, variations in the two measurements can cause the sample value to be less than the background, resulting in a measured activity less than zero.

BOLD = Parameter concentration exceeds MCL or SMCL.

– = Parameter not analyzed

MCL = Maximum Contaminant Level

*SMCL = Secondary Maximum Contaminant Level (U.S. EPA 2008a)

** = Performance standard; no more than 5% of monthly samples may exceed 0.3 NTU

***Positive = Sample exceeded the 30-hour hold time due to lab error so colony counts were not possible

† - Parameter Also Detected in the Laboratory Method Blank

Table 2.3.3-4
TCEQ Water Quality Segment Designated Uses

Segment Number[1]	Segment Name[1]	Uses[2]		
		Recreation	Aquatic Life	Water Supply
1701	Victoria Barge Canal	Non-contract recreation	High aquatic life use	NA
1801	Guadalupe River Tidal (from GBRA Salt Water Barrier to Guadalupe Bay)	Contact recreation	Exception aquatic life use	NA
1802	Guadalupe River Below San Antonio River (below San Antonio and Guadalupe River confluence to GBRA Salt Water Barrier)	Contact recreation	High aquatic life use	Public water supply
1803	Guadalupe River Below San Marcos River (below San Marcos River to San Antonio River)	Contact recreation	High aquatic life use	Public water supply
1807	Coleto Creek	Contact recreation	High aquatic life use	Public water supply
1901	Lower San Antonio River (from Farm Road 791 near Falls City in Karnes County to the Confluence with the Guadalupe River)	Non-contact recreation	High aquatic life use	NA
2462	San Antonio/Haynes Bay/Guadalupe Bay	Contact recreation	Exception aquatic life use/Oyster Waters	NA

[1]TCEQ 2008a
[2]TCEQ 2000
NA = Not applicable

Table 2.3.3-5
Summary of USGS and TCEQ Surface Water Monitoring Stations

Agency/Station No.	Water Body	Latitude	Longitude
TCEQ 12622	Coleto Creek At Highway 77	28.711	–97.034
TCEQ 12536	Victoria Barge Canal	28.518	–96.804
TCEQ 12577	Guadalupe River Tidal Hwy 35	28.478	–96.862
TCEQ 12578	Guadalupe River at GBRA Salt Water Barrier	28.506	–96.885
TCEQ 16579	Guadalupe River at DuPont	28.658	–96.963
TCEQ 12581	Guadalupe River 0.5 mile N of Hwy 175 bridge S. of Victoria	28.752	–97.008
TCEQ 12590	Guadalupe River at Farm Market Road 447	28.790	–97.010
TCEQ 12789	Lower San Antonio River at Highway 77	28.531	–97.043
TCEQ 17942	Coleto Reservoir 0.4 km upstream from dam structure	28.731	-97.168
USGS 08176500	Guadalupe River at Victoria	28.793	–97.013
USGS 08188600	GBRA Calhoun Canal Uplift #1 Station	28.510	–96.752
USGS 08188800	Guadalupe River at GBRA Salt Water Barrier	28.505	–96.884

Table 2.3.3-6
Summary of Guadalupe River (TCEQ Station 12578) Surface Water Metals Data (1999–2006)

Parameter (µg per L)	Nov-99	Jul-01	Sep-02	Jun-03	Aug-04	Mar-05	Mar-06
Aluminum	3	5.69	<2	5.43	20.7	17.1	8.23
Arsenic	3.26	2.53	2.92	1.42	2.69	2.07	2.01
Barium	118	72.2	–	86.4	–	–	–
Cadmium	<0.05	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	4	<1	2.61	1.61	<1.0	<1.0	3.8
Copper	1.3	<1	1.42	1	0.87	1.03	0.892
Iron	191	<50	–	–	–	–	–
Lead	<0.05	<1.0	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	–	1.26	2.5	3.31	6.1	–	–
Mercury	<0.006	2.07	0.0148	0.0027	0.00179	0.00374	0.00161
Nickel	2.3	3.05	2.62	3.52	0.87	2.41	2.94
Selenium	0.67	<4.0	0.68	0.514	0.46	0.375	0.711
Silver	<0.05	<1.0	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	1.4	1.9	1.21	0.75	1.23	1	0.952

Source: GBRA Undated
– = Data not available
< = parameter was detected at or below the method detection limit
ug per L = microgram per liter

Table 2.3.3-7
Summary of Guadalupe River (TCEQ Station 12578) Surface Water General Chemistry Data (2004–2007)

Parameter	1/3/2004	4/14/2004	7/15/2004	10/18/2004	1/11/2006	4/5/2005	7/7/2005	10/4/2005	1/4/2006	4/5/2006	7/12/2006	10/12/2006	1/9/2007	3/6/2007	6/12/2007	2004–2007 Minimum	2004–2007 Average	2004–2007 Maximum
Flow (cfs)	1390	3080	–	–	2890	2920	1460	1140	1330	1070	1550	575	1960	1030	2890	575	1791	3080
E. coli (org per 100 mL)	130	1312	32	276	86	67	11	36	81	47	70	43	920	43	25	11	211	1312
Suspended Solids (mg per L)	40.7	382	111	142	67.1	74.6	85.9	31.7	38.7	30.3	97.3	36	176	42.7	62.7	30.3	94.6	382
Turbidity (NTU)	24.5	284	86.3	113	52.4	62	29.3	24	31.3	52.9	71.9	34.2	221	11.3	46.7	11.3	76.3	284
pH (standard)	8.14	8.26	7.79	7.85	7.77	7.82	8.04	8.07	8.13	8.17	7.65	7.99	7.95	8.19	7.72	7.65	7.97	8.26
Temperature (C)	14.1	18.1	29.4	24.6	18.2	21.4	31.4	29.3	17.5	24.8	29.4	25.8	13.6	16.8	28.3	13.6	22.8	31.4
Dissolved Oxygen (mg per L)	10.2	7.27	5.18	7.4	8.89	8.83	6.3	7.41	9.8	8.57	5.1	7.18	9.45	10.4	8.68	5.10	8.04	10.40
Conductivity (µmhos per cm)	823	450	628	618	811	739	749	711	821	815	605	798	670	828	586	450	710	828
Total Phosphorous (mg per L)	0.21	0.27	0.38	0.44	0.23	0.14	0.21	0.25	0.37	0.09	0.38	0.38	0.71	0.49	0.16	0.09	0.31	0.71
Nitrate-N (mg per L)	1.8	1.11	0.64	0.83	2.36	1.68	1.42	2.32	4.05	4.05	1.34	3.16	3.84	2.68	1.2	0.64	2.17	4.05
Chloride (mg per L)	66.5	40.7	43.4	49.1	53.9	49	61.3	54.3	65.5	73	43.8	76.8	32	69.6	40.7	32	54.6	76.8
Sulfate (mg per L)	56.6	30.9	52.3	44.6	65.7	50.4	56.6	47.5	56.2	61.5	36.6	55.6	43.2	59.6	41.4	30.9	50.6	65.7
Total Hardness (mg per L)	297	229	281	267	317	314	294	293	320	261	196	242	290	280	244	196	275	320
Ammonia-N (mg per L)	–	0.11	–	0.08	–	0.04	–	0.04	–	0.03	–	<0.02	–	–	0.04	<0.02	0.06	0.11
Chlorophyll a (mg per m^3)	<5	<5	11.9	1.9	6.5	38.3	17.4	7.6	4.2	4.3	6.5	7.1	2.1	6.5	5.5	<5	9.2	38.3
Pheophytin (mg per m^3)	<3	9.8	<3	<3	<3	<3	4.6	3.3	<1	2.3	<1	1.6	<1	1.4	<1	<1	3.8	9.8

Source: GBRA 2008
cfs = cubic feet per second
mL = milliliters
mg per L = milligrams per liter
mg per m^3 = milligrams per cubic meter
NTU = Nepthelometric turbidity unit
– = parameter not analyzed
< = parameter detected at or below the method detection limit.
µmhos per cm = micromhos per centimeter

Table 2.3.3-8
Summary of Guadalupe River (TCEQ Station 16579) Surface Water General Chemistry Data (2003–2006)

Parameter	2/24/2003	5/13/2003	7/15/2003	10/18/2003	2/17/2004	5/19/2004	8/10/2004	11/5/2004	2/7/2005	3/18/2005	7/7/2005	10/4/2005	2/2/2006	3/3/2006	6/7/2006	10/12/2006	2003–2006 Minimum	2003–2006 Average	2003–2006 Maximum
E. coli (org per 100mL)	2908	30	4	46	548	168	36	765	448	173	10	28	72	140	44	41	4	341.3	2908
Suspended Solids (mg per L)	194	67.4	39.6	24.8	54	94.3	48.7	216	87	75.9	79.5	37	9.3	38	35.7	5.3	5.3	69.2	216
Turbidity (NTU)	60	31	22.5	21.5	47.6	94.6	39.7	178	70.1	52.6	47.1	51	8.9	25.7	30.8	5.9	5.9	49.2	178
pH (standard)	7.98	7.74	8.3	8.2	8.15	7.93	8.26	7.75	7.75	7.92	8.08	8.02	8.35	8.21	8.2	7.63	7.63	8.03	8.35
Temperature (C)	14.6	28.3	32.5	24.3	13.1	25.5	31.5	20.7	13.1	17.9	32.1	29.4	19.5	22.2	30.5	29.6	13.1	24.1	32.5
Dissolved Oxygen (mg per L)	9.86	7.38	6.81	6.96	10.5	5.85	6.83	7.5	10.8	9.82	7.32	8.06	10.2	10.6	8.22	7.63	5.85	8.40	10.8
Conductivity (µmhos per cm)	335	727	739	601	500	347	697	373	483	609	555	541	1265	758	660	1024	335	638.4	1265
Total Phosphorous (mg per L)	0.54	0.18	0.16	0.15	0.16	0.25	0.19	0.7	0.21	0.16	0.24	0.11	0.33	0.17	0.3	0.35	0.11	0.26	0.7
Nitrate-N (mg per L)	0.44	1.83	0.67	0.37	0.59	0.64	0.19	0.63	1.08	1.14	0.85	1.02	12.2	2	0.18	11.2	0.18	2.19	12.2
Chloride (mg per L)	21.6	55.4	72.6	35	35.5	23.1	40.9	22.7	30.9	34.6	36.3	30.1	97	47	55.5	87.9	21.6	45.4	97
Sulfate (mg per L)	22.3	44.2	38.9	30.6	30	17.7	34.3	20.9	33.2	31.7	33.2	29.6	67	40.4	40.4	58.5	17.7	35.8	67
Total Hardness (mg per L)	199	288	223	261	208	148	256	234	220	276	256	276	296	254	185	242	148	238.9	296
Ammonia-N (mg per L)	0.12	0.06	0.04	<0.02	0.06	0.04	0.06	0.02	0.08	0.15	0.08	0.17	0.08	0.05	0.09	0.03	<0.02	0.08	0.17
Chlorophyll a (mg per m^3)	<1	<1	9.9	3.7	<5.0	<5.0	39.3	<1	<1	5.9	10.7	7.2	11.6	10.3	58.1	5.3	<1	16.2	58.1
Pheophytin (mg per m^3)	11.8	7.39	10.2	1.9	<3	<3	<3	<3	5.4	<3	3.7	2.1	5.2	3.2	7.7	2	1.9	5.5	11.8

Source: GBRA 2008
cfs = cubic feet per second
mL = Milliliters
mg per L = Milligrams per liter
mg per m^3 = milligrams per cubic meter
µmhos per cm = micromhos per centimeter
NTU = Nepthelometric turbidity unit
< = parameter detected at or below the method detection limit

Table 2.3.3-9
Summary of Guadalupe River (TCEQ Station 12590) Surface Water General Chemistry Data (2004–2007)

Parameter	1/13/2004	4/14/2004	7/5/2004	10/18/2004	1/11/2005	3/2/2005	6/7/2005	12/7/2005	4/5/2006	8/10/2006	11/1/2006	1/19/2007	4/3/2007	2004–2007 Minimum	2004–2007 Average	2004–2007 Maximum
Flow (cfs)	870	7630	6070	2390	3230	4970	2030	757	684	325	483	844	12000	325	3252	12000
E. coli (org per 100mL)	55	804	46	291	62	520	13	50	60	62	59	1540	2300	13	450	2300
Suspended Solids (mg per L)	14.6	375	197	88.2	37.5	114	51.7	15.3	31	11	1437	79.5	948	11	261	1437
Turbidity (NTU)	9.94	140	147	73	27.1	47.3	38.3	15.2	28.3	10.2	12.8	69.9	384	9.94	77.2	384
pH	7.9	8.1	7.84	7.5	7.49	7.65	8.11	8.09	8.13	8.03	8.17	7.94	7.61	7.49	7.89	8.17
Temperature (°C)	14.7	18.6	28.7	24.4	18.4	17.1	29.8	14.5	25.3	30	22.1	13.2	22.4	13.2	21.5	30
Dissolved Oxygen (mg per L)	11.6	9.16	6.78	7.95	9.91	10.47	8.03	11.1	9.81	7.81	7.57	9.68	7.13	6.78	9.00	11.6
Conductivity (umhos per cm)	647	411	641	440	661	657	536	594	585	521	569	548	302	302	547	661
Total Phosphorous (mg per L)	0.13	0.19	0.34	0.25	0.1	0.16	0.1	<0.05	<0.05	<0.05	<0.05	0.38	0.29	<0.05	0.22	0.38
Nitrate-N (mg per L)	1.04	0.68	0.55	0.34	1.39	1.2	1.24	1.54	1.08	0.18	0.76	1.28	0.57	0.18	0.91	1.54
Chloride (mg per L)	34.4	20.4	17.9	28.4	33.1	41	24.2	33	34.8	36.2	32.5	36.2	9.1	9.1	29.3	41
Sulfate (mg per L)	32.1	22	21.4	21.9	38	47.9	29.3	32.6	32.4	31.5	30.5	26.6	12.3	12.3	29.1	47.9
Total Hardness (mg per L)	268	345	296	193	297	304	260	271	205	204	232	170	232	170	252	345
Ammonia-N (mg per L)	0.02	0.12	0.02	0.05	0.02	0.09	0.27	0.02	0.02	0.04	0.03	0.07	0.06	0.02	0.06	0.27
Chlorophyll a (mg per m^3)	<5	<5	<5	<1	3.3	2.3	7.8	3.1	2.5	4.9	2.6	1.1	<1	<1	3.5	7.8
Pheophytin (mg per m^3)	<3	9.2	<3	<3	<3	<3	<3	<1	1.9	<1	<1	<1	<1	<1	5.6	9.2

Source: GBRA 2008
cfs = cubic feet per second
mL = milliliters
mg per L = milligrams per liter
mg per m^3 = milligrams per cubic meter
NTU = Nepthelometric turbidity unit
µmhos per cm = micromhos per centimeter

Table 2.3.3-10 (Sheet 1 of 2)
Summary of Guadalupe River Tidal (TCEQ Station 12577) Surface Water Quality Data (2002–2007)

Parameter	1/17/2002	4/1/2002	6/25/2002	12/19/2002	4/7/2003	9/11/2003	12/10/2003	3/4/2004	5/26/2004	9/14/2004	12/21/2004	4/21/2005	6/16/2005	9/7/2005	12/1/2005	4/19/2006	7/11/2006	10/11/2006	1/25/2007	2002–2006 Minimum	2002–2006 Average	2002–2006 Maximum
Sample Depth Interval: 0.3 Feet																						
Temperature (°C)	14.8	22.2	29.7	17.8	22.4	28.9	15	19.4	27.3	28.3	14.7	23	30.8	29.6	16.8	27.5	30	26.9	8.9	8.9	22.8	30.8
Specific Conductance (µmhos per cm)	8062	787	770	579	800	748	773	632	613	659	636	786	648	671	714	795	460	800	445	445	1072	8062
Dissolved Oxygen (mg per L)	9.5	7.84	6.73	7.51	7.2	6.4	9.8	8.2	5.7	6.2	9.4	7.81	6.49	6.62	6.74	7.6	5.1	6.7	12.3	5.1	7.57	12.3
pH (Standard Units)	8.14	8.23	–	7.68	7.8	8.1	8.3	8.1	7.9	8.2	7.8	7.75	7.85	8	7.96	8.2	7.6	8.1	8.3	7.6	8.00	8.3
Salinity (parts per 1000)	0.42	0.41	0.4	0.3	–	1	1	0.32	1	1	1	0.41	0.33	0.35	0.37	1	2	2	–	0.3	0.78	2
Alkalinity, Total (As CaCO3)(mg per L)	231	232	215	180	246	220	236	204	181	230	248	271	209	220	230	222	156	194	154	154	214	271
Residue, Total Nonfiltrable (mg per L)	44	74	77	135	72	183	44	84	131	102	91	96	39	76	20	61	4	44	160	4	80.9	183
Nitrite/Nitrate (mg per L)	2.25	2.3	1.88	–	–	–	–	–	–	–	–	2.17	1.5	2.62	4.09	2.29	0.06	2.75	2	0.06	2.17	4.09
Nitrite Nitrogen, Total (mg per L)	–	–	–	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	–	–	–	–	–	–	–	–	0.05	0.05	0.05
Nitrate Nitrogen, Total (mg per L)	–	–	–	2	2.03	4.72	3.1	1.84	1.59	2.06	1.84	–	–	–	–	–	–	–	–	1.59	2.40	4.72
Nitrogen as Ammonia (mg per L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.09	0.05	0.06	0.05	0.05	0.05	0.09	0.05	0.06	0.09
Nitrogen, KJELDAHL (mg per L)	0.44	0.59	0.59	0.92	0.59	1.15	0.73	0.62	0.82	0.5	0.38	0.51	0.81	0.62	0.4	0.68	0.5	0.58	0.91	0.38	0.65	1.15
Phosphorus, Total (mg per L)	0.2	0.16	0.26	0.29	0.16	0.44	0.2	0.19	0.3	0.23	0.19	0.22	0.23	0.32	0.42	0.32	0.06	0.46	0.42	0.06	0.27	0.46
Orthophosphate phosphorus, diss.(mg per L)	0.17	0.14	0.22	0.13	0.06	0.31	0.2	0.14	0.14	0.14	0.12	0.17	0.15	0.27	0.37	0.26	0.04	0.36	0.22	0.04	0.19	0.37
Total Organic Carbon	3	3	2	5	2	4	3	4	4	2	2	2	2	2	2	2	5	4	5	2	3.1	5
Sodium, Total (mg per L)	–	–	–	14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	14	14	14
Chloride (mg per L)	51	63	70	53	67	143	74	62	50	49	47	64	56	63	64	135	125	84	29	29	71	143
Sulfate (mg per L)	48	51	54	55	63	67	59	48	43	44	54	60	48	54	56	93	26	59	29	26	53	93
Fluoride, Total (mg per L)	0.27	0.28	0.33	0.36	0.35	0.38	0.41	0.32	0.28	0.29	0.27	0.24	0.27	0.32	0.33	1.32	0.27	0.36	0.25	0.24	0.36	1.32
Residue, Total Filtrable (mg per L)	420	470	460	372	500	438	508	388	374	408	460	488	408	430	466	472	484	462	472	372	446	508
Chlorophyll-A (µg per L)	10	10	–	10	10	10	11.3	10	10	10	10	12.8	30.7	19.2	10	27.1	3	12.3	3	3	12.2	30.7
Pheophytyn-A (µg per L)	15.2	22.3	–	5	42.8	5	5	5	5.79	5.98	5	5	17.9	8.44	–	–	–	–	–	5	11.42	42.8

Table 2.3.3-10 (Sheet 2 of 2)
Summary of Guadalupe River Tidal (TCEQ Station 12577) Surface Water Quality Data (2002–2007)

Parameter	1/17/2002	4/1/2002	6/25/2002	12/19/2002	4/7/2003	9/11/2003	12/10/2003	3/4/2004	5/26/2004	9/14/2004	12/21/2004	4/21/2005	6/16/2005	9/7/2005	12/1/2005	4/19/2006	7/11/2006	10/11/2006	1/25/2007	2002–2006 Minimum	2002–2006 Average	2002–2006 Maximum
Fecal Coliform (# per 100 mL)	56	32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	32	44.0	56
E. Coli, Colilert (mpn per 1000 mL)	–	–	–	–	–	–	–	–	–	–	–	–	–	25.6	–	5	3	61	722	3	163	722
Enterococci, Enterolert (mpn per 1000 mL)	41	41	10	52	41	–	–	31	10	51	10	10	10	–	6.1	–	–	–	–	6.1	26.1	52

Source: GBRA 2008
– = parameter not analyzed
per 100 mL = number of colony-forming units per 100 milliliters
mpn per 1000 mL = most probable number per 1000 milliliters

Table 2.3.3-11 (Sheet 1 of 2)
Summary of Guadalupe River (USGS Station 08188800) Water Quality Data (1980–1999)

Parameter	1/15/1980	8/5/1980	1/22/1985	8/20/1985	3/5/1990	7/24/1990	1/24/1995	8/23/1995	1/26/1999	8/24/1999	1980–1999 Minimum	1980–1999 Average	1980–1999 Maximum
Sample Depth Interval: 0.98 feet													
Temperature (°C)	15	30	7	28.6	18	28	13.5	30	19.5	—	7	21.1	30
Turbidity, Hach (Formazin Turb Unit)	26	36	140	—	—	—	—	—	—	—	26	67	140
Specific Conductance (µmhos per cm)	849	880	428	696	795	425	676	767	801	790	425	710	880
Oxygen, Dissolved (mg per L)	9.6	5.9	11.1	8.1	9.1	4.8	9.2	6.6	—	5.7	4.8	7.8	11.1
BOD, 5 day (mg per L)	1.8	1.4	3.1	1.9	2.2	2.4	1.5	3.7	—	—	1.4	2.3	3.7
Bicarbonate, Diss. Field as HCO3, (mg per L)	290	270	—	—	—	—	—	—	—	—	270	280	290
Nitrogen (mg per L)	2.1	1.6	3.3	2.1	4.1	1.7	—	—	—	—	1.6	2.5	4.1
Ammonia (mg per L)	0.05	0.02	0.15	0.07	0.13	0.17	—	—	—	—	0.02	0.10	0.17
Nitrite (mg per L)	0.04	0.04	0.07	0.01	0.09	0.24	—	—	—	—	0.01	0.08	0.24
Nitrate (mg per L)	0.87	0.71	1.33	1.09	3.41	0.46	—	—	—	—	0.46	1.31	3.41
Nitrite & Nitrate (mg per L)	0.91	0.75	1.4	1.1	3.5	0.7				—	0.7	1.39	3.5
Phosphate, Ortho (mg per L)	—	—	—	—	—	—	0.675	0.613	—	—	0.613	0.644	0.675
Phosphorus (mg per L)	0.68	0.57	0.63	0.36	1.4	0.53	—	—	—	—	0.36	0.70	1.4
Hardness, Total as CaCO3 (mg per L)	300	270	150	240	250	140	260	240	280	260	140	239	300
Calcium (mg per L)	89	77	45	69	72	44	76	68	83.3	75.6	44	69.9	89
Sodium (mg per L)	64	70	26	48	63	27	42	58	49.6	62.2	26	51.0	70
Potassium (mg per L)	3.7	4.7	3.5	3.9	5.1	7.7	3.8	4.2	2.99	4.32	2.99	4.39	7.7
Chloride (mg per L)	99	110	34	72	81	37	66	81	68.8	82	34	73.1	110
Sulfate (mg per L)	70	69	37	47	53	36	46	56	61.8	53.8	36	53.0	70
Silica (mg per L)	14	17	10	12	12	13	12	15	11.4	19	10	13.5	19
Arsenic (µg per L)	2	5	1	3	—	3	1	—	—	—	1	2.5	5
Barium (µg per L)	100	100	57	98	—	130	80	—	—	—	57	94	130

Table 2.3.3-11 (Sheet 2 of 2)
Summary of Guadalupe River (USGS Station 08188800) Water Quality Data (1980–1999)

Parameter	1/15/1980	8/5/1980	1/22/1985	8/20/1985	3/5/1990	7/24/1990	1/24/1995	8/23/1995	1/26/1999	8/24/1999	1980–1999 Minimum	1980–1999 Average	1980–1999 Maximum
Copper (µg per L)	0	—	—	3	—	< 10	< 10	—	—	—	0	1.5	3
Lead (µg per L)	—	—	< 1	< 1	—	< 10	< 100	—	—	—	<1	0	0
Manganese (µg per L)	—	—	—	9	—	9	2	—	—	—	2	6.7	9
Strontium (µg per L)	—	—	—	—	—	280	580		—	—	280	430	580

Source: USGS 2008
– = Parameter not analyzed
µg per L = micrograms per liter
< = parameter was detected at or below method detection limits

Table 2.3.3-12 (Sheet 1 of 2)
Summary of Guadalupe River (USGS Station 08176500) Water Quality Data (1980–1999)

Parameter	1/17/1980	7/9/1980	1/23/1985	7/10/1985	3/6/1990	5/24/1990	3/25/1994	8/25/1994	12/13/1999	1980–1999 Minimum	1980–1999 Average	1980–1999 Maximum
Sample Depth Interval: 0.98 feet												
Temperature (°C)	16.5	31.5	7	28	18.5	28.5	22.5	29	18	7	22.2	31.5
Turbidity, Hach (Formazin Turb Unit)	4.9	17	74	95	23	56	14	6.2	—	4.9	36.3	95
Specific Conductance (µmhos per cm)	649	544	434	415	601	416	579	590	629	415	539	649
Oxygen, Dissolved (mg per L)	9.9	7.4	8.6	6.8	8.6	7.1	8.6	6.8	—	6.8	8.0	9.9
BOD, 5 day (mg per L)	1.3	2.8	1.1	1	0.8	0.8	0.6	2	—	0.6	1.3	2.8
Bicarbonate, Diss. Field as HCO3, (mg per L)	280	240	—	—	—	—	—	—	—	240	260	280
Nitrogen (mg per L)	1.7	1.3	1.7	1.5	0.9	1.3		1	—	0.9	1.3	1.7
Ammonia (mg per L)	0.02	0.06	—	—	0.04	0.07	—	—	—	0.02	0.05	0.07
Nitrite (mg per L)	—	—	—	—	0.03	0.03	<0.010	<0.010	—	<0.010	0.03	0.03
Nitrate (mg per L)	—	—	—	—	0.67	0.97	—	—	—	0.67	0.82	0.97
Nitrite and Nitrate (mg per L)	0.91	0.67	0.76	0.55	0.7	1	1.1	0.7	—	0.55	0.80	1.1
Phosphate, Ortho (mg per L)		3.6	0.245	0.184	0.276	0.368	0.184	0.123	—	0.123	0.71	3.6
Phosphorus (mg per L)	0.09	0.06	0.18	0.23	0.12	0.21	0.09	0.05	—	0.05	0.13	0.23
Hardness, Total as CaCO3 (mg per L)	250	220	200	170	230	180	240	200	—	170	211	250
Calcium (mg per L)	75	61	55	53	64	52	68	57	—	52	60	75
Sodium (mg per L)	30	26	19	14	37	15	32	34	—	14	25	37
Potassium (mg per L)	2.1	2.3	2.9	4.1	3.1	3.6	2.6	2.9	—	2.1	3.0	4.1
Chloride (mg per L)	47	37	25	17	38	18	42	44	—	17	33	47
Sulfate (mg per L)	34	28	28	23	28	20	34	31	—	20	28	34
Silica (mg per L)	10	15	11	14	8.7	11	10	14	—	8.7	11.7	15
Arsenic (µg per L)	—	—	1	3	2	2	—	—	—	1	2.0	3

Table 2.3.3-12 (Sheet 2 of 2)
Summary of Guadalupe River (USGS Station 08176500) Water Quality Data (1980–1999)

Parameter	1/17/1980	7/9/1980	1/23/1985	7/10/1985	3/6/1990	5/24/1990	3/25/1994	8/25/1994	12/13/1999	1980–1999 Minimum	1980–1999 Average	1980–1999 Maximum
Barium (µg per L)	—	—	59	68	64	120	66	75	—	59	75.3	120
Copper (µg per L)	—	—	1	1	< 10	1	—	—	—	1	1	1
Manganese (µg per L)	—	—	< 1	2	2	1	4	5	—	<1	2.8	5
Strontium (µg per L)	—	—	420	350	530	350	520	470	—	350	440.0	530

Source: USGS 2008
– = Parameter not analyzed
< = parameter was detected at or below the method detection limit
µg per L = micrograms per liter

Table 2.3.3-13
Summary of Guadalupe River (TCEQ Station 12581) Water Quality Data (1990–1994)

Parameter	4/16/1990	6/7/1990	10/11/1990	1/29/1991	4/17/1991	7/22/1991	11/13/1991	2/3/1992	4/28/1992	7/1/1992	10/5/1992	5/7/1993	11/9/1993	4/13/1994	1990–1994 Minimum	1990–1994 Average	1990–1994 Maximum
Sampling Depth Interval: 0.98 Feet																	
Temperature (°C)	24.4	30.1	19.6	13.3	22.7	29.8	17.1	15.3	23.1	29	23.7	22.9	15.7	22.1	13.3	22.1	30.1
Specific Conductance (µmhos per cm)	598	524	541	424	306	551	637	440	702	633	646	333	544	632	306	536	702
Oxygen, Dissolved (mg per L)	7.7	6.8	8.5	9.6	5.7	6.2	9.5	9.3	7.3	6.6	8.2	6.4	10.4	8.7	5.7	7.9	10.4
pH (Standard Units)	8.7	8.2	8.1	7.9	7.6	8.2	8.4	—	7.8	7.9	8.1	7.9	8.1	8.4	7.6	8.1	8.7
Alkalinity, Total ($CaCO_3$) (mg per L)	216	198	194	152	169	226	214	205	260	234	202	124	216	225	124	202	260
Residue, Total nonfiltrable (mg per L)	64	61	18	76	462	68	23	304	192	35	30	292	38	46	18	122	462
Nitrogen as Ammonia, Total (mg per L)	0.32	0.33	0.08	0.24	0.18	0.21	0.39	0.1	0.16	0.17	0.15	0.02	0.03	0.03	0.02	0.17	0.39
Nitrite Nitrogen, Total (mg per L)	0.06	—	—	0.08	0.26	—	0.05	0.06	0.07	< 0.01	0.05	0.05	0.03	< 0.01	<0.01	0.08	0.26
Nitrate Nitrogen, Total (mg per L)	1.02	0.44	—	1.36	0.73	0.54	0.78	0.53	1.45	1.09	1.09	0.58	0.1	1.43	0.1	0.86	1.45
Phosphorus, Total (mg per L)	0.56	0.26	0.25	0.29	0.72	0.3	0.25	0.38	0.16	0.2	0.32	0.28	0.13	0.26	0.13	0.31	0.72
Phosphorus, Diss. Orthopohosphate (mg per L)	0.49	0.17	0.21	0.29	0.44	0.26	0.24	0.23	0.12	0.12	0.28	0.18	0.11	0.22	0.11	0.24	0.49
Carbon, Total Organic (mg per L)	5	6	4	8	13	6	4	10	5	6	2	10	2	—	2	6.2	13
Chloride, Total (mg per L)	34	32	30	19	9	34	35	23	40	37	38	24	33	45	9	31	45
Sulfate, Total (mg per L)	26	27	20	< 1	< 1	17	31	28	32	32	32	27	32	34	<1	28	34
Fecal Coliform, membrane filter (# per 100 mLl)	17	< 17	—	< 17	—	—	< 16	—	373	140	40	—	20	53	<17	107	373
Chlorophyll-A (µg per L)	1.7	4	1.6	1.2	5.1	< 1	1	< 1	7.8	3.6	2.8	8.62	3.78	3.2	<1	3.70	8.62
Pheophytin-A (µg per L)	2.3	2	0	<1	2	8.5	5.3	0	< 1	3.9	< 1	0	0	< 1	0	2.4	8.5

Source: USEPA, 2008b
— = Parameter not analyzed
µg per L = micrograms per liter
mg per L = milligrams per liter
< = parameter detected at or below the method detection limit
per 100 mL = number of colony-forming units per 100 milliliters
µmhos per cm = micromhos per centimeter

Table 2.3.3-14
Summary of Lower San Antonio River (TCEQ Station 12789) Water Quality Data (2003–2007)

Parameter	8/18/2003	12/17/2003	8/25/2004	12/8/2004	8/10/2005	12/21/2005	8/16/2006	12/20/2006	8/15/2007	2003–2007 Minimum	2003–2007 Average	2003–2007 Maximum
Flow rate, instantaneous (cfs)	512	505	511	2728	362	407	164	253	3260	164	966	3260
Temperature (°C)	30	13.3	29.8	18	30.6	12	30.4	20.7	29	12	23.8	30.6
pH (Standard Units)	8	8.1	8	8.1	8.2	8.2	8.3	8.1	8	8	8.1	8.3
Specific Conductance (µmhos per cm)	1206	1137	1080	777	1090	1100	1510	1220	805	777	1102	1510
Oxygen, Dissolved (mg per L)	6.8	10.5	7.2	8.9	8.6	11	7	8.6	6.7	6.7	8.4	11
Nitrogen, Total (Kjeldahl) (mg per L)	—	—	0.548	0.865	0.944	0.54	1.1	0.688	0.713	0.54	0.77	1.1
Ammonia (mg per L)	—	—	< 0.02	0.031	< 0.02	< 0.02	< 0.02	0.033	< 0.02	<0.02	0.032	0.033
Nitrite Nitrogen (mg per L)	—	—	< 0.02	< 0.02	0.021	< 0.02	0.042	< 0.02	< 0.02	<0.02	0.032	0.042
Nitrate Nitrogen (mg per L)	—	—	—	2.27	4.58	7.63	4.48	12.1	2.33	2.27	5.57	12.1
Carbon, Total Organic (mg per L)	—	—	2.18	3.18	3.51	2.9	3.37	2.88	2.79	2.18	2.97	3.51
Phosphorus (mg per L)	—	—	0.368	0.435	0.546	0.965	0.827	1.06	0.337	0.337	0.65	1.06
Chloride (mg per L)	—	—	108	62.1	126	130	206	164	54.4	54.4	121	206
Sulfate (mg per L)	—	—	107	69.2	105	106	171	115	66.3	66.3	105	171

Data downloaded from SARA, 2008
— = parameter not analyzed
cfs = cubic feet per second
mg per L = milligrams per liter
omhos per cm = micromhos per centimeter
< = parameter detected at or below the method detection limit

Table 2.3.3-15 (Sheet 1 of 2)
Summary of GBRA Calhoun Canal Pump Station (USGS Station 08188600) Water Quality Data (1995–2005)

Parameter (µg per L)	5/18/1995[1]	12/12/1996[2]	9/10/1997[2]	8/25/1998[2]	7/18/2000[2]	6/7/2005[2]
Trifluralin	–	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
Propachlor	–	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
Hexazinone	–	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
Butachlor	–	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
Carboxin	–	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
Butylate	–	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
Bromacil	–	< 0.05	< 0.05	0.14	< 0.02	0.12
Simatryn	–	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Cycloate	–	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Terbacil	–	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Diphenamid	–	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Vernolate	–	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Simazine	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02
Prometryn	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Prometon	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CEAT	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CIAT	< 0.05	< 0.05	< 0.05	< 0.05	< 0.04	< 0.02
Cyanazine	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Ametryn	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Propazine	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chlorpyrifos	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	–
Disulfoton	< 0.01	–	< 0.01	< 0.01	< 0.03	–
Phorate	< 0.01	< 0.10	< 0.1	< 0.1	<0.02	–
p,p'-Ethyl-DDD	< 0.1	< 0.1	< 0.1	< 0.1	–	–
Tribuphos	< 0.01	< 0.03	< 0.01	< 0.01	< 0.02	–
PCNs	< 0.1	< 0.1	< 0.1	< 0.1	–	–
Aldrin	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lindane	< 0.010	< 0.010	< 0.010	< 0.010	< 0.012	< 0.014
Chlordane technical	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
p,p'-DDD	< 0.010	< 0.010	< 0.010	< 0.010	< 0.014	< 0.016
p,p'-DDE	< 0.010	< 0.010	< 0.010	< 0.010	< 0.016	< 0.014
P,p'-DDT	< 0.010	< 0.010	< 0.010	< 0.010	< 0.017	< 0.010
Dieldrin,	< 0.010	< 0.010	< 0.010	< 0.010	< 0.009	< 0.008
Alpha Endosulfan	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Endrin,	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ethion	< 0.01	< 0.03	< 0.01	< 0.01	< 0.01	–

Table 2.3.3-15 (Sheet 2 of 2)
Summary of GBRA Calhoun Canal Pump Station (USGS Station 08188600) Water Quality Data (1995–2005)

Parameter (µg per L)	5/18/1995[1]	12/12/1996[2]	9/10/1997[2]	8/25/1998[2]	7/18/2000[2]	6/7/2005[2]
Toxaphene	< 1	< 1	< 1	< 1	< 1	< 1
Heptachlor	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Metolachlor	< 0.05	< 0.05	< 0.05	< 0.02	< 0.05	< 0.05
Helptachlorepoxide	< 0.006	< 0.007	< 0.008	< 0.009	< 0.009	<0.009

[1]USGS 2008
[2]URS Oct 2004
– = parameter not analyzed
ug per L = micrograms per liter
< = parameter detected at or below the method detection limit

Table 2.3.3-16
Summary of Victoria Barge Canal (TCEQ Station 12536) Water Quality Data (2004–2007)

Parameter	3/16/2004	5/26/2004	9/14/2004	12/21/2004	4/21/2005	6/16/2005	9/20/2005	12/1/2005	4/19/2006	7/11/2006	10/11/2006	1/25/2007	2004–2007 Minimum	2004–2007 Average	2004–2007 Maximum
Sampling Depth Interval: 0.3 Feet															
Temperature (°C)	26.867	27.9	28.8	15.9	24.4	31.9	31.4	19.02	27.5	31.4	28.6	9.9	9.9	25.3	31.86
Specific Conductance (µmhos per cm)	10,700	1050	2270	1810	1651	1896	6185	12,039	10,300	6220	5300	16,700	1050	6343	16700
Dissolved Oxygen (mg per L)	7.8	5.9	5.7	9.4	8.68	7.41	7.99	7.74	8.9	7.6	6.7	11.9	5.7	8.0	11.9
pH (Standard Units)	8.1	7.7	8.1	7.9	7.7	7.82	7.94	7.69	8.2	8	8	8.3	7.69	8.0	8.3
Salinity (parts per 1000)	6	1	2	1	0.88	1.01	3.42	6.89	5.8	3.4	2.9	9.8	0.88	3.7	9.8
Alkalinity, Total (As CaCO3)(mg per L)	188	110	166	209	187	155	172	120	196	120	132	120	110	156	209
Residue, Total Nonfiltrable (mg per L)	16	55	38	28	25	4	52	55	56	33	19	59	4	36.7	59
Nitrite/Nitrate (mg per L)	–	–	–	–	0.33	0.04	0.11	0.37	1.4	0.1	0.16	1.02	0.04	0.44	1.4
Nitrite Nitrogen, Total (mg per L)	0.25	0.05	0.05	0.05	–	–	–	–	–	–	–	–	0.05	0.10	0.25
Nitrate Nitrogen, Total (mg per L)	1.04	0.19	0.22	0.2	–	–	–	–	–	–	–	–	0.19	0.41	1.04
Nitrogen as Ammonia (mg per L)	0.18	0.1	0.06	0.06	0.08	0.05	0.05	0.13	0.05	0.05	0.05	0.1	0.05	0.08	0.18
Nitrogen, KJELDAHL (mg per L)	0.78	1.01	0.81	0.58	0.9	0.82	1.14	1.04	1.37	1.06	0.67	0.85	0.58	0.92	1.37
Phosphorus, Total (mg per L)	0.06	0.2	0.14	0.19	0.19	0.16	0.09	0.16	0.22	0.16	0.17	0.25	0.06	0.17	0.25
Orthophosphate, diss. (mg per L)	0.3	0.18	0.06	0.08	0.18	0.11	0.05	0.12	0.16	0.08	0.12	0.11	0.05	0.13	0.3
Total Organic Carbon (mg per L)	2	8	6	5	7	5	4	3	3	7	6	3	2	4.9	8
Chloride (mg per L)	3270	234	526	435	373	454	1900	3860	3330	974	1450	5060	234	1822	5060
Sulfate (mg per L)	491	35	104	82	76	99	313	540	488	311	228	709	35	289	709
Fluoride, Total (mg per L)	0.41	0.23	0.3	0.26	0.17	0.28	0.4	0.43	0.49	0.5	0.25	0.5	0.17	0.35	0.5
Residue, Total Filtrable (mg per L)	6240	648	1200	1160	940	1120		7580	6300	3550	2910	9310	648	3723	9310
Chlorophyll-a (µg per L)	10	10	20	10	21.9	16	22.4	12.2	59.7	24.9	8.52	8.61	8.52	18.7	59.7
Pheophytyn-a (µg per L)	5	5	5	5	5	7.65	5	5	–	–	–	–	5	5.3	7.65
Enterococci, Enterolert (mpn per 100mL)	10	10	10	20	10	10	10	14.5	4	48	1	1250	1	116	1250

Source: GBRA, 2007a
– = Parameter not analyzed
umhos per cm = micromhos per centimeter
mg per L = milligrams per liter
ug per L = micrograms per liter
MPN per 100 ml = most probable number per 100 milliliters

Table 2.3.3-17(Sheet 1 of 2)
Summary of Coleto Creek (TCEQ Station 12622) Water Quality Data (1994–1997)

Parameter	4/13/1994	10/25/1994	1/23/1995	4/18/1995	7/6/1995	10/24/1995	1/17/1996	4/15/1996	7/24/1996	10/29/1996	1/22/1997	4/22/1997	7/17/1997	12/16/1997	1990–1994 Minimum	1990–1994 Average	1990–1994 Maximum
Sampling Depth: 0.98 Feet																	
Temperature (°C)	25.3	24.6	15.91	23.7	30.66	24.65	19.23	24.31	33.58	—	15.97	25.71	33.68	15.74	15.74	24.1	33.68
Specific Conductance (µmhos per cm)	1002	878	678	929	881	1163	1053	1203	921	—	309	597	783	945	309	872	1203
Oxygen, Dissolved (mg per L)	10.2	4.8	8.29	7.12	6.89	8.95	8.64	9.39	9.09	—	6.65	8.8	7.8	9.75	4.8	8.18	10.2
pH (Standard Units)	8.1	7.3	7.79	7.93	8.23	8.24	8.02	8.28	8.83	—	8.92	7.9	8.38	8.37	7.3	8.18	8.92
Alkalinity, Total ($CaCO_3$) (mg per L)	247	146	180	222	174	210	243	—	130	153	76	154	186	—	76	177	247
Salinity (parts per 1000)	—	< 2	0.3	0.5	0.5	—	—	—	—	—	< 1	< 1	< 1	< 1	0.3	0.4	0.5
Residue, Total nonfiltrable (mg per L)	10	15	13	37	8	8	8	—	24	—	100	15	5	—	5	22.1	100
Nitrogen as Ammonia, Total (mg per L)	< 0.01	0.04	< 0.01	0.01	0.05	< 0.01	< 0.01	—	0.02	0.03	0.01	0.07	< 0.05	—	<0.01	0.03	0.07
Nitrite Nitrogen, Total (mg per L)	< 0.01	0.04	—	—	—	—	—	—	—	—	—	—	—	—	<0.01	0.04	0.04
Nitrate Nitrogen, Total (mg per L)	0.08	0.15	—	—	—	—	—	—	—	—	—	—	—	—	0.08	0.12	0.15
Nitrogen, KJELDAHL, Total (mg per L)	0.4	0.62	0.44	0.41	0.51	0.26	0.25	—	0.69	0.62	1.74	0.89	0.65	—	0.25	0.62	1.74
Nitrite & Nitrate, Total (mg per L)	—	—	0.03	0.03	< 0.01	0.01	< 0.1	—	< 0.1	< 0.1	0.44	< 0.1	< 0.1	—	<0.01	0.13	0.44
Phosphorus, Total (mg per L)	< 0.01	0.08	0.04	0.04	0.05	0.04	0.02	—	0.07	0.05	0.21	0.07	0.02	—	<0.01	0.06	0.21
Phosphorus, Diss. (mg per L)	< 0.01	0.06	0.01	0.02	0.02	0.04	—	—	—	—	0.21	—	—	—	<0.01	0.06	0.21
Phosphorus, Total (mg per L)	—	—	—	—	—	—	<0.1	—	< 0.1	< 0.2	—	< 0.06	< 0.06	—	<0.06	0	0
Carbon, Total Organic, (mg per L)	2	6	5	3	4	5	3	—	5	7	12	6	5	—	2	5.3	12
Chloride, Total (mg per L)	152	57	82	102	122	57	138	—	139	174	40	75	113	—	40	104	174
Sulfate, Total (mg per L)	27	13	18	23	28	33	30.1	—	35	32	< 1	12	17	—	< 1	24.4	35
Fecal Coliform (# per 100 mL)	673	107	33	7	20	< 7	20	73	73	—	1560	84	12.2	65	< 7	227	1560

Table 2.3.3-17 (Sheet 2 of 2)
Summary of Coleto Creek (TCEQ Station 12622) Water Quality Data (1994–1997)

Parameter	4/13/1994	10/25/1994	1/23/1995	4/18/1995	7/6/1995	10/24/1995	1/17/1996	4/15/1996	7/24/1996	10/29/1996	1/22/1997	4/22/1997	7/17/1997	12/16/1997	1990–1994 Minimum	1990–1994 Average	1990–1994 Maximum
Chlorophyll-A (µg per L)	12.1	< 1	< 1	2.4	2.04	< 1	< 1	—	7.61	< 1	< 1	11.8	7.82	—	< 1	7.3	12.1
Pheophytin-A (µg per L)	0	13.6	6.09	< 1	2.04	10.2	< 1	—	< 1	0	< 1	12.2	< 1	—	0	6.3	13.6

Source: USEPA 2008b
— = parameter not analyzed
µg per L = micrograms per liter
mg per L = milligrams per liter
< = parameter detected at or below the method detection limit
per 100 ML = number of colony-forming units per 100 milliliters
µmhos per cm = micromhos per centimeter

Table 2.3.3-18 (Sheet 1 of 5)
VCS Site Surface Water Analytical Results

Parameter	Analytical Method	GBRA Uplift #1 Calhoun Canal	GBRA Uplift #1 Calhoun Canal SW-06	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier Duplicate	Linn Lake SW-03	Linn Lake Duplicate	Kuy Creek SW-02	Kuy Creek SW-02	Coleto Creek at Hwy 77 SW-04	Coleto Creek at Hwy 77 SW-04	Guadalupe River at Hwy 59 SW-05	Guadalupe River at Hwy 59 SW-05
		11.27.07	4.16.08	11.27.07	4.16.08	4.16.08	11.27.07	11.27.07	11.28.07	4.16.08	11.28.07	4.16.08	11.28.07	4.16.08
General Chemistry														
Temperature (°C)	Field Measurement	13.82	24.73	14.07	23.44	23.44	13.85	13.85	17.14	19.33	19.18	21.63	15.14	20.66
pH (standard units)	Field Measurement	7.34	8.18	8.11	8.11	8.11	8.54	8.54	7.53	7.77	8.03	8.16	8.37	8.21
Salinity (percent)	Field Measurement	0.02	0	0.03	0	0	0.03	0.03	0.08	0.1	0.04	0	0.01	0
Total Suspended Solids (mg per L)	SM 2540/USEPA 160.2	21.3	47.3	31.0	89.5	89.3	20.0	21.0	2.0	63.6	4.0	3.3	40.0	79.3
Total Dissolved Solids (mg per L)	SM 2540/USEPA 160.1	323	509	398	530	523	987	336	1020	847	539	592	219	371
Hardness, Total as $CaCO_3$ (mg per L)	USEPA 130.2	200	300	260	320	320	220	226	486	464	258	284	144	264
Turbidity (NTU)	USEPA 180.1	91.3	23.5	197	8.4	9.9	88.2	60.5	16.5	7.9	2.1	2.2	482	7.5
Color, Apparent (Cobalt Units)	USEPA 110.2	40	15	25	10	10	25	25	35	25	5	10	240	10
Odor (Threshold Odor Number)	USEPA 140.1	2	<1	4	<1	<1	4	4	>1	<1	>1	<1	>1	<1
Conductivity (mS per cm)	Field Measurement	0.604	0.741	0.716	0.759	0.759	0.565	0.565	1.74	1.44	0.903	0.820	0.363	0.542
Dissolved Oxygen (mg per L)	Field Measurement	5.12	102.3	12.32	10.47	10.47	14.79	14.79	16.22	11.29	10.76	9.34	14.22	9.53
Biochemical Oxygen Demand (mg per L)	SM 5210/USEPA 405.1	2.0	<0.89	2.0	<0.89	<0.89	2.0	2.0	7.0	<0.89	2.0	<0.89	7.0	17
Chemical Oxygen Demand (mg per L)	SM 5220/USEPA 410	28.6	<4.5	<4.5	<4.5	5†	35.5	24.1	35.5	59.2	<14.9	15.3†	20.1	7.6†
Total Organic Carbon (mg per L)	USEPA 415.1	8.3	–	5.2	–	–	5.3	5.4	–	–	–	–	–	–
Phosphorus, Total (mg per L)	USEPA 365.2	0.11	0.099	0.27	0.27	0.27	0.11	0.12	0.040	0.094	0.038	0.003†	0.25	0.057
Orthophosphorus (mg per L)	USEPA 365.2	0.14	0.11	0.22	0.21	0.19	0.12	0.1	0.023	0.018†	<0.013	<0.003	0.29	1.6
Nitrogen, Ammonia (mg per L)	SM 4500/USEPA 350.1	0.10	<0.05	<0.050	<.010	<0.10	<0.050	<0.050	<0.1	0.13	<0.10	<0.10	0.28	0.21
Nitrogen, Nitrate (mg per L)	SM18 4500N03E/NO2B	0.50	1.60	2.4	2.6	2.6	0.89	0.91	–	<0.11	–	<0.11	–	0.86
Nitrogen, Nitrate, Nitrite (mg per L)	SM18 4500N03E	0.76	1.7	2.4	2.6	2.6	0.89	0.91	–	<0.10	–	<0.10	–	0.87

Table 2.3.3-18 (Sheet 2 of 5)
VCS Site Surface Water Analytical Results

Parameter	Analytical Method	GBRA Uplift #1 Calhoun Canal	GBRA Uplift #1 Calhoun Canal SW-06	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier Duplicate	Linn Lake SW-03	Linn Lake Duplicate	Kuy Creek SW-02	Kuy Creek SW-02	Coleto Creek at Hwy 77 SW-04	Coleto Creek at Hwy 77 SW-04	Guadalupe River at Hwy 59 SW-05	Guadalupe River at Hwy 59 SW-05
		11.27.07	4.16.08	11.27.07	4.16.08	4.16.08	11.27.07	11.27.07	11.28.07	4.16.08	11.28.07	4.16.08	11.28.07	4.16.08
Nitrogen, Nitrite (mg per L)	USEPA 352.2	0.26	0.051	<0.24	0.019	0.02	<0.050	<0.026	<0.011	<0.10	<0.041	<0.10	<0.043	0.015
Nitrate, Nitrite (mg per L)	SM 4500/NO3	–	–	–	–	–	–	–	<1.0	–	<1.0	–	<1.0	–
Nitrogen, Total Kjeldahl (mg per L)	USEPA 351.2	0.80	–	0.88	–	–	0.56	0.58	<0.1	–	<0.1	–	0.72	–
Nitrogen, Organic (mg per L)	SM 4500-N	0.70	–	0.88	<.010	<0.10	0.56	0.58	<0.1	0.13	<0.1	<0.10	–	<0.10
Alkalinity, total as $CaCO_3$ (mg per L)	SM 2320/USEPA 310	168	268	223	232	316	205	200	440	392	261	252	119	224
Carbon Dioxide (mg per L)	SM4500 CO2 D	168	5.6	223	3.4†	3.5†	205	200	440	18.7	261	4.9†	119	4.7†
Bicarbonate Alkalinity (mg per L)	SM2320	167.42	268	221.31	232	316	202.65	198.04	438.01	392	258.63	252	118.44	224
Chloride (mg per L)	SM 5220/USEPA 325.3	48.8	77.5	48.3	73.5	74.5	31.2	31.7	196	204	98.2	124	21.3	24.8
Sulfide (mg per L)	USEPA 376.1	2.0	–	2.0	–	–	3.0	2.0	0.0	–	0.0	–	0.0	–
Sulfate (mg per L)	SM 4500/USEPA 375.3	12.8	66.77	11.9	63.4	69.1	<3.3	<5.4	81.1	15.6	10.3	22.6	10.3	33.3
Sodium (mg per L)	USEPA 6010B	36.6	58.7	44.9	58.7	59.1	25.5	25.4	155	107	69.9	82.4	17.5	30.4
MBAS as LAS (mg per L)	SM 5540C	<0.02	–	<0.02	–	–	–	–	–	–	–	–	–	–
Fluoride (mg per L)	USEPA 340.2	0.18	–	0.30	–	–	0.23	0.25	–	–	–	–	–	–
Calcium (mg per L)	USEPA 200.7	58.2	81.5	88.2	87.9	91.3	–	–	–	150	–	98.4	–	753
Silica (Dissolved) (mg per L)	USEPA 370.1	6.7	–	9.8	–	–	35.7	5.3	–	–	–	–	–	–
Silica (Total) (mg per L)	USEPA 6010B	10.9	11.1	14.2	10.6	11.2	–	–	–	10.3	–	13.4	–	71.5
Bacteria and Plankton														
Total Coliform (CFUs per 100 mL)	SM 9223B/9221D	6590	>2000	10,910	>2000	>2000	7820	6240	810	>2000	1900	900	10,000	>2000
Fecal Coliform (CFUs per 100 mL)	SM 9222D	–	10	–	90	210	–	–	40	250	40	20	140	10
Fecal Streptococci (CFUs per 100 mL)	SM 9230C	–	<10	–	50	100	–	–	10	20	2200	10	60	10

Table 2.3.3-18 (Sheet 3 of 5)
VCS Site Surface Water Analytical Results

Parameter	Analytical Method	GBRA Uplift #1 Calhoun Canal	GBRA Uplift #1 Calhoun Canal SW-06	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier Duplicate	Linn Lake SW-03	Linn Lake Duplicate	Kuy Creek \SW-02	Kuy Creek SW-02	Coleto Creek at Hwy 77 SW-04	Coleto Creek at Hwy 77 SW-04	Guadalupe River at Hwy 59 SW-05	Guadalupe River at Hwy 59 SW-05
		11.27.07	4.16.08	11.27.07	4.16.08	4.16.08	11.27.07	11.27.07	11.28.07	4.16.08	11.28.07	4.16.08	11.28.07	4.16.08
Chlorophyll-a (mg per m^3)	SM 10200	<0.1	HT	<0.1	HT	HT	—	—	—	HT	—	HT	—	HT
Phytoplankton (cells per 5 ml)	Palmer-Maloney	4.33	600	0	2902	3854	—	—	—	632	—	2371	—	2239
Radionuclides (pCi per L)**														
Potassium-40 (K-40)	USEPA 901.1	39.2	-4.88	-9.67	81.3	20.1	-5.27	23.6	-35.9	31.6	-21.2	39.5	-22.6	29.8
Cesium-137 (Cs-137)	USEPA 901.1	1.04	-1.8	-1.75	0.85	-1.26	0.988	1.55	3.67	-4.17	1.98	1.07	-0.712	0.019
Thallium-208 (Tl-208)	USEPA 901.1	-1.96	9.61	-3.62	0.957	-1.14	2.74	-0.862	5.79	-6.02	-1.84	-1.73	1.04	1.87
Bismuth-212 (Bi-212)	USEPA 901.1	15.2	40.4	-32.2	18.6	-27.5	-6.93	1.49	17.2	-25.7	-19.4	-25.5	-6.24	-33.7
Lead-212 (Pb-212)	USEPA 901.1	-0.042	12	-5.05	3.87	-0.003	3.05	0.168	14.8	-0.813	0.991	3.33	2.26	3.93
Bismuth-214 (Bi-214)	USEPA 901.1	-2.74	88.3	1.64	36.2	30.6	15.9	19.3	17.6	2.23	-2.18	8.52	1.57	24.9
Lead-214 (Pb-214)	USEPA 901.1	-4.71	55.4	4.32	12.4	19.6	1.31	15.2	6.96	-0.348	-5.15	13	10.6	27.2
Radium-228 (Ra-228)	USEPA 901.1	6.04	-1.21	2.12	-7.65	-4.32	-0.915	-16.8	7.15	0.465	-3.9	-16.8	-3.47	-0.459
Radium-228 (Ra-228)	USEPA 904.0	0.250	—	0.956	—	—	70.7	0.556	1.69	—	0.752	—	76.6	—
Tritium (H-3)	USEPA 906.0	73.3	126	107	131	148	0.64	27.6	77.6	76	148	181	2.21	145
Metals (µg per L)														
Aluminum	USEPA 6010B	1240	—	4940	—	—	701	1760	<86	—	<86	—	3090	—
Antimony	USEPA 6010B	<2.7	—	<2.7	—	—	<2.7	<2.7	<2.7	—	<2.7	—	<2.7	—
Arsenic	USEPA 6010B	<3.4	<2.7	<2.9	<2.7	<2.7	<2.7	<2.7	<4.6	7.5	<3.7	10.1	<2.7	<2.7
Barium	USEPA 6010B	<79.2	109†	<99.3	92.6†	99.8†	<86.0	87.4	495	433	422	455	<71.5	82.3†
Beryllium	USEPA 6010B	<0.26	—	<0.26	—	—	<0.26	<0.26	<0.26	—	<0.26	—	<0.26	—
Boron	USEPA 6010B	<65.7	—	127	—	—	<64.1	<66.3	208	—	140	—	<62.2	—
Cadmium	USEPA 6010B	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
Chromium	USEPA 6010B	<1.5	<1.5	<1.8	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.7	<1.5
Chromium +6	USEPA 7195	<0.0040	—	<0.0040	—	—	<0.0040	<0.0040	<0.0040	—	<0.0040	—	<0.0040	—

Table 2.3.3-18 (Sheet 4 of 5)
VCS Site Surface Water Analytical Results

Parameter	Analytical Method	GBRA Uplift #1 Calhoun Canal	GBRA Uplift #1 Calhoun Canal SW-06	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier Duplicate	Linn Lake SW-03	Linn Lake Duplicate	Kuy Creek SW-02	Kuy Creek SW-02	Coleto Creek at Hwy 77 SW-04	Coleto Creek at Hwy 77 SW-04	Guadalupe River at Hwy 59 SW-05	Guadalupe River at Hwy 59 SW-05
		11.27.07	4.16.08	11.27.07	4.16.08	4.16.08	11.27.07	11.27.07	11.28.07	4.16.08	11.28.07	4.16.08	11.28.07	4.16.08
Cobalt	USEPA 6010B	<9.6	–	<9.6	–	–	<9.6	<9.6	<9.6	–	<9.6	–	<9.6	–
Copper	USEPA 6010B	<5.9	–	<5.9	–	–	<5.9	<5.9	<11.5	–	<18.3	–	<12.8	–
Iron (Dissolved)	USEPA 6010B	<24	–	<24	–	–	–	–	–	–	–	–	–	–
Iron (Total)	USEPA 6010B	800	1990	2800	1260	2010	434	1090	519	1250	<63.7	184	3080	865
Lead	USEPA 6010B	<2.8	3	<2.8	<2.8†	3.2	<2.8	<2.8	<2.8	<2.8	<2.8	4.9	4.4	<2.8
Magnesium	USEPA 6010B	13,600	18900	16,600	18900	19600	13,200	13,300	20,600	16300	9800	10600	8960	17900
Manganese (Total)	USEPA 6010B	50.2	–	58.8	–	–	43.8	45.8	920	–	62.5	–	60.5	–
Manganese (Dissolved)	USEPA 6010B	<4.1	–	<4.8	–	–	–	–	–	–	–	–	–	–
Mercury	USEPA 7470B	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094
Molybdenum	USEPA 6010B	<1.2	–	<1.4	–	–	<1.2	<1.2	<1.2	–	<1.2	–	<1.2	–
Nickel	USEPA 6010B	<2.6	–	<2.6	–	–	<2.6	<2.6	<4.7	–	<2.6	–	<3.7	–
Potassium	USEPA 7470B	6540	–	6720	–	–	4200	4360	7840	–	2660	–	6460	–
Selenium	USEPA 6010B	<2.3	–	<2.3	–	–	<2.3	<2.3	<2.3	–	<2.3	–	<2.3	–
Silver	USEPA 6010B	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Strontium	USEPA 6010B	362	–	576	–	–	406	404	576	–	288	–	231	–
Tin	USEPA 6010B	<3.2	–	<2.6	–	–	<2.4	<3.2	<1.9	–	<1.9	–	<1.9	–
Titanium	USEPA 6010B	9	–	45.4	–	–	<5.4	<14.0	<0.71	–	<0.71	–	21.1	–
Vanadium	USEPA 6010B	<5.1	–	<10.3	–	–	<4.7	<5.8	<0.04	–	<1.8	–	<7.0	–
Zinc	USEPA 6010B	<9.3	–	<15.6	–	–	<7.8	<9.8	<9.5	–	<12.9	–	20.2	–
Volatile Organic Compounds (VOCs) (mg per L)	USEPA 8260B	<0.0073	–	<0.0073	–	–	–	–	–	–	–	–	–	–

Table 2.3.3-18 (Sheet 5 of 5)
VCS Site Surface Water Analytical Results

Parameter	Analytical Method	GBRA Uplift #1 Calhoun Canal	GBRA Uplift #1 Calhoun Canal SW-06	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier SW-01	GBRA Salt Water Barrier Duplicate	Linn Lake SW-03	Linn Lake Duplicate	Kuy Creek SW-02	Kuy Creek SW-02	Coleto Creek at Hwy 77 SW-04	Coleto Creek at Hwy 77 SW-04	Guadalupe River at Hwy 59 SW-05	Guadalupe River at Hwy 59 SW-05
		11.27.07	4.16.08	11.27.07	4.16.08	4.16.08	11.27.07	11.27.07	11.28.07	4.16.08	11.28.07	4.16.08	11.28.07	4.16.08
Semi-Volatile Compounds (SVOCs) (µg per L)	USEPA 8270C	<0.025	–	<0.025	–	–	–	–	–	–	–	–	–	–
Pesticides & Herbicides (mg per L)	EPA 8141/8151	<0.050	–	<0.050	–	–	–	–	–	–	–	–	–	–
Polychlorinated biphenyls (mg per L)	USEPA 8081A	<0.050	–	<0.050	–	–	–	–	–	–	–	–	–	–
Oil and Grease (mg per L)	USEPA 1664	<1.4	–	<1.4	–	–	–	–	–	–	–	–	–	–
Tributylin (nanograms per L)	Unger Method	16*	–	87*	–	–	–	–	–	–	–	–	–	–
Cyanide (Total) (mg per L)	USEPA 335.2	<0.0050	–	<0.0050	–	–	–	–	–	–	–	–	–	–
Asbestos (mg per L)	USEPA 100.1/100.2	ND	–	ND	–	–	–	–	–	–	–	–	–	–

NA = Not available due to equipment malfunction
mS per cm= milli-Siemens per centimeter
MBAS as LAS = Methylene blue active substances as standardized against Lineares Alkybenzosulfonate
mg per L = Micrograms per liter
µg per L = Micrograms per liter
CFU = Colony-Forming Units
HT = Sample exceeded holding time due to lab error and was therefore not analyzed
– = Parameter not analyzed
* = tributylin was detected at a concentration of 90 nanograms per liter in each of the three blanks as a result of lab contamination. Therefore, the three sample concentrations were “normalized” by using the standard method of simply subtracting the blank concentration from the samples’ reported concentrations.
** = Radionuclide analyses usually required the subtraction of the instrument background counts from the sample counts. Even though both background and the sample values are positive, sometimes when the sample activity is low, variations in the two measurements can cause the sample value to be less than the background, resulting in a measured activity less than zero
† = Parameter also detected in the Laboratory Method Blank
< = parameter was detected at or below the method detection limit

Table 2.3.3-19
NPDES Sites in Lower Guadalupe and Lower San Antonio River Basins (Victoria, Refugio, and Goliad Counties)

NPDES Permit Number	Permit Status	County	Facility Name	Receiving Stream	Permitted Flow (mgd)	Approximate Distance/ Direction to the VCS Site (mi)	Up Gradient/ Down Gradient with Respect to SWB
TXG110085	Active	Victoria	Alamo Concrete Products, LTD	Guadalupe River	NA	13-N	Up
TXG110086	Active	Victoria	Alamo Concrete Products, LTD	Guadalupe River	NA	20-N	Up
TX0003603	Active	Victoria	AEP Texas Central CO (CPL Victoria Power Station)	Guadalupe River	202	12-N	Up
TX0006050	Active	Victoria	INVISTA S.A.R.L.	Guadalupe River	21.8	5-NE	Up
TX0005118	Active	Victoria	South Texas Electric Cooperative	Guadalupe River	34.26	31-N	Up
TX0025186	Active	Victoria	Victoria Regional Wastewater Treatment Plant	Guadalupe River	9.6	9-N	Up
TX0025194	Active	Victoria	Victoria Willow Plant	Guadalupe River	2.5	12-N	Up
TX0022411	Active	Goliad	City of Goliad Wastewater Treatment Plant	San Antonio	0.35	24-W	Up
TXG110075	Active	Goliad	Goliad Plant NO. 81 (Alamo Concrete Products, LTD)	San Antonio	NA	24-W	Up

Source: USEPA Feb 2008
SWB = GBRA Salt Water Barrier
NA = Data not available

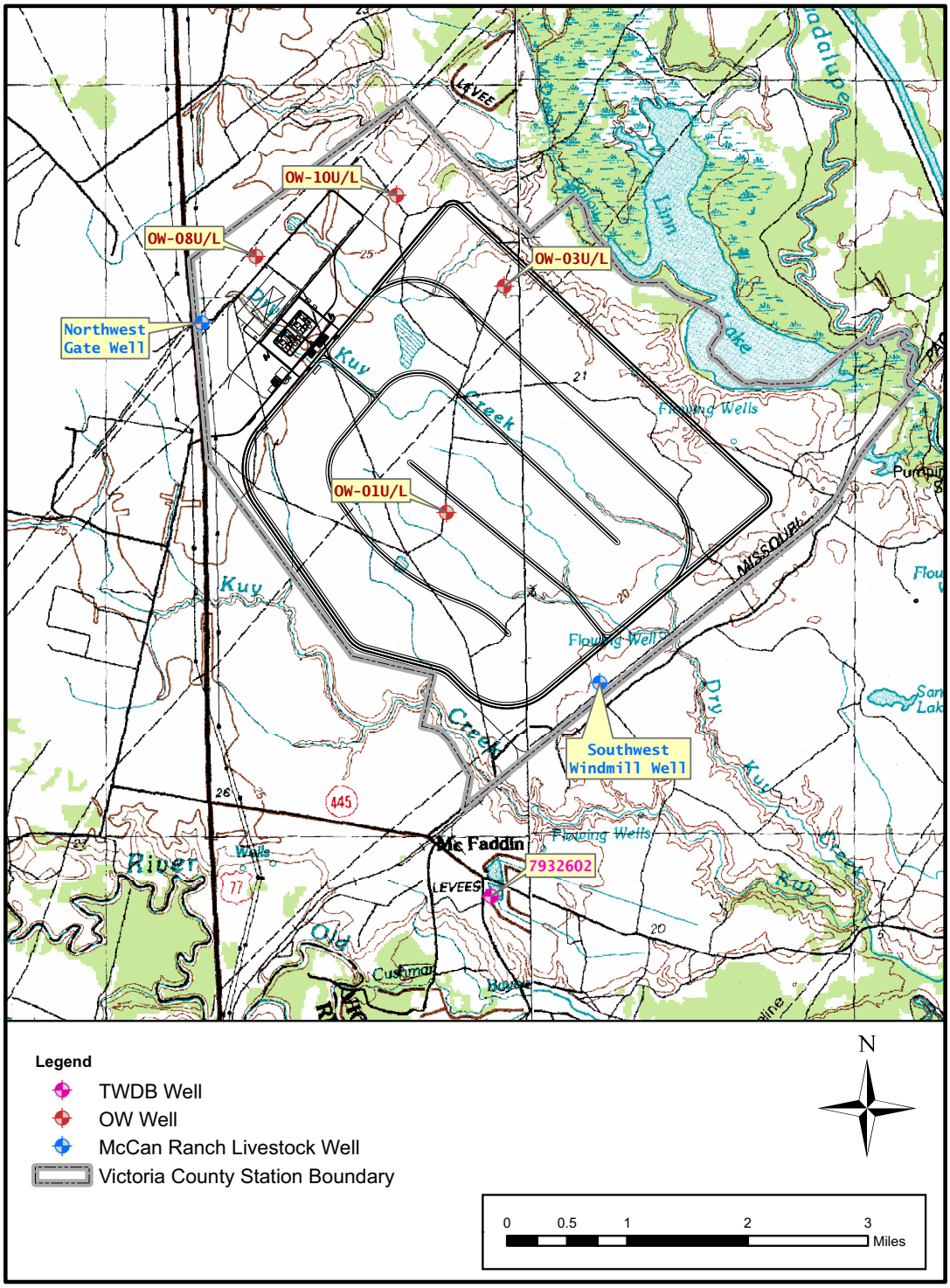

Figure 2.3.3-1 VCS Site Groundwater Well Sample Locations

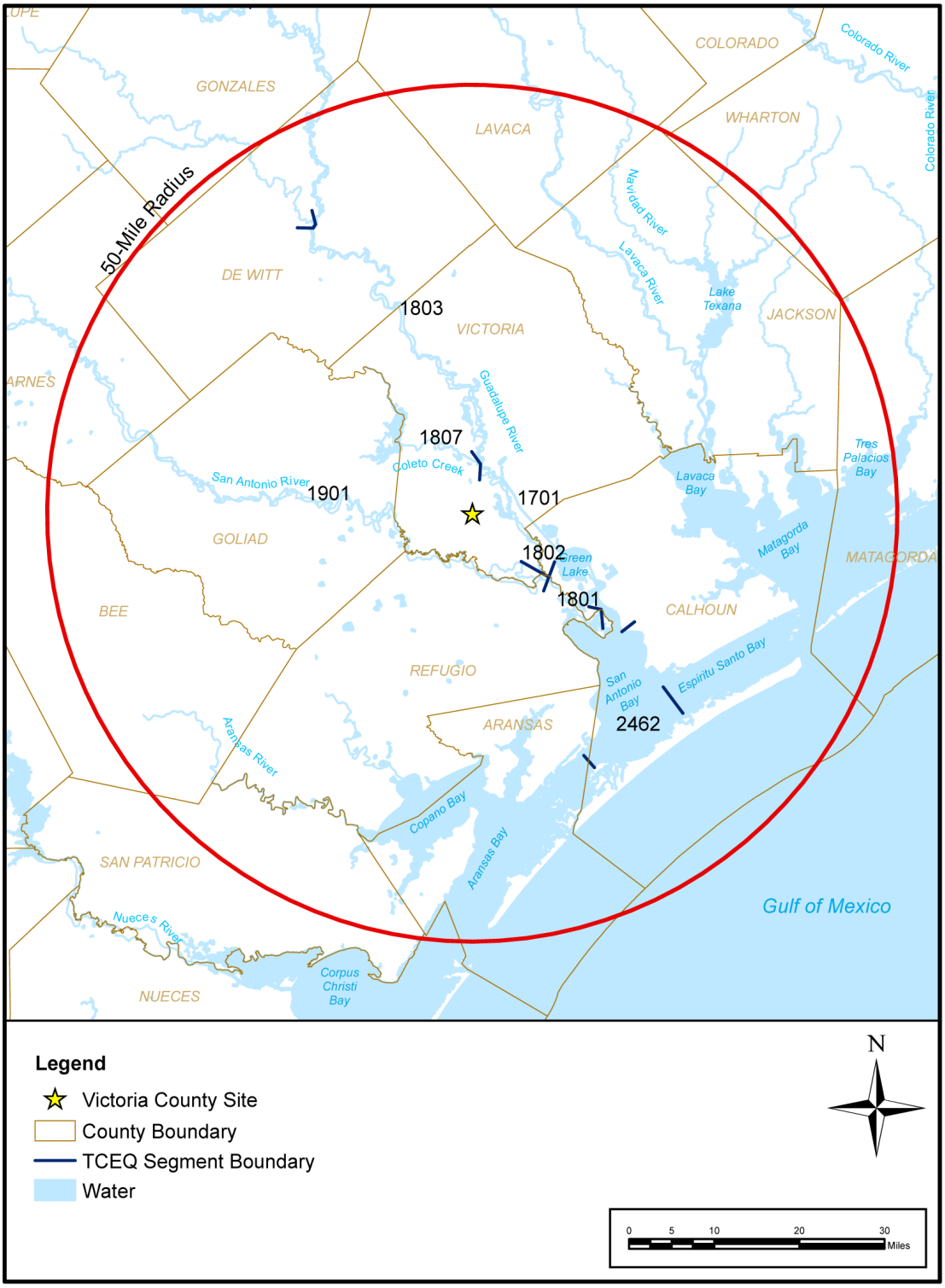

Figure 2.3.3-2 TCEQ Surface Water Segments in the VCS Site Hydrologic System

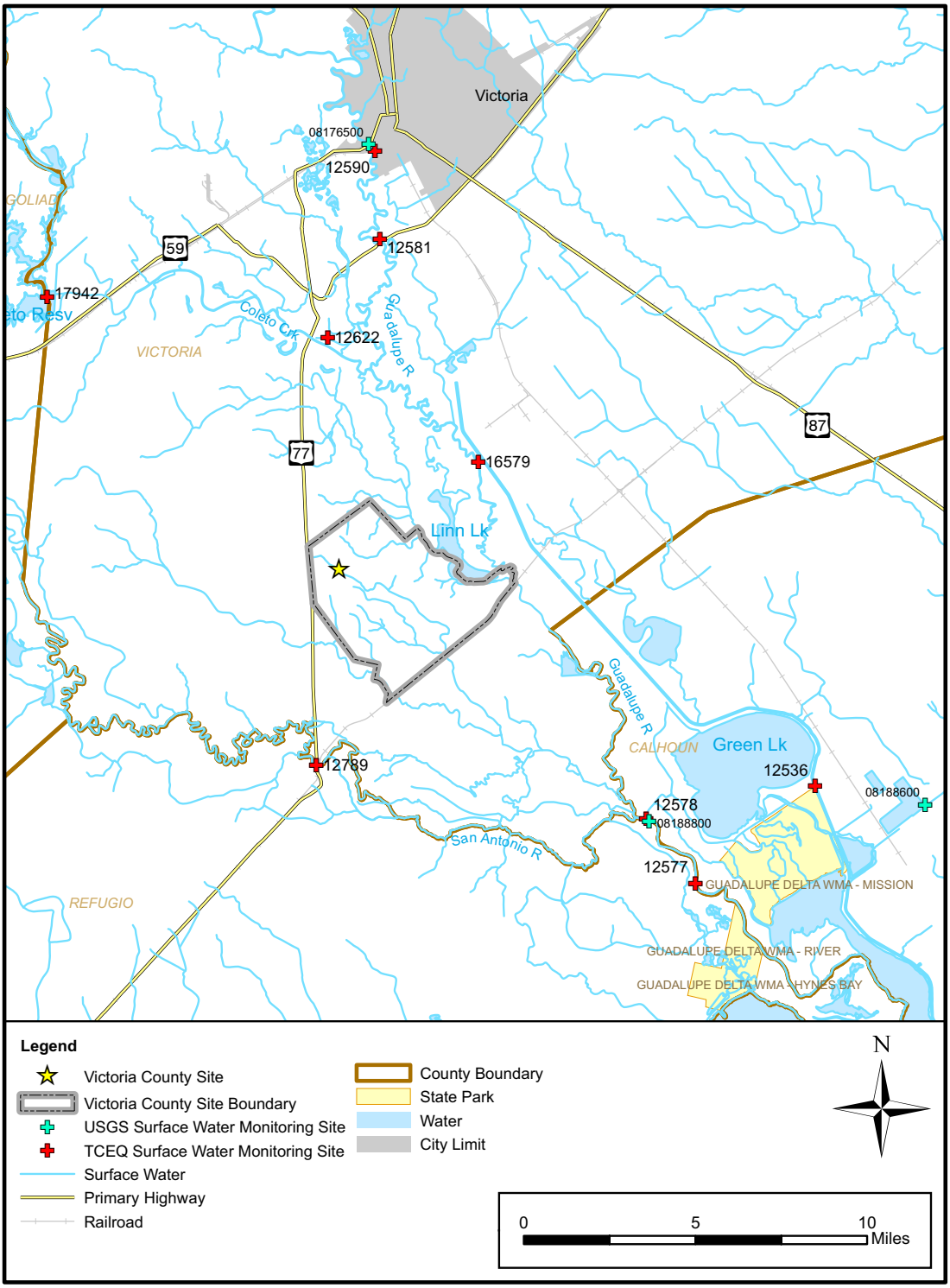

Figure 2.3.3-3 TCEQ and USGS Surface Water Monitoring Station Locations

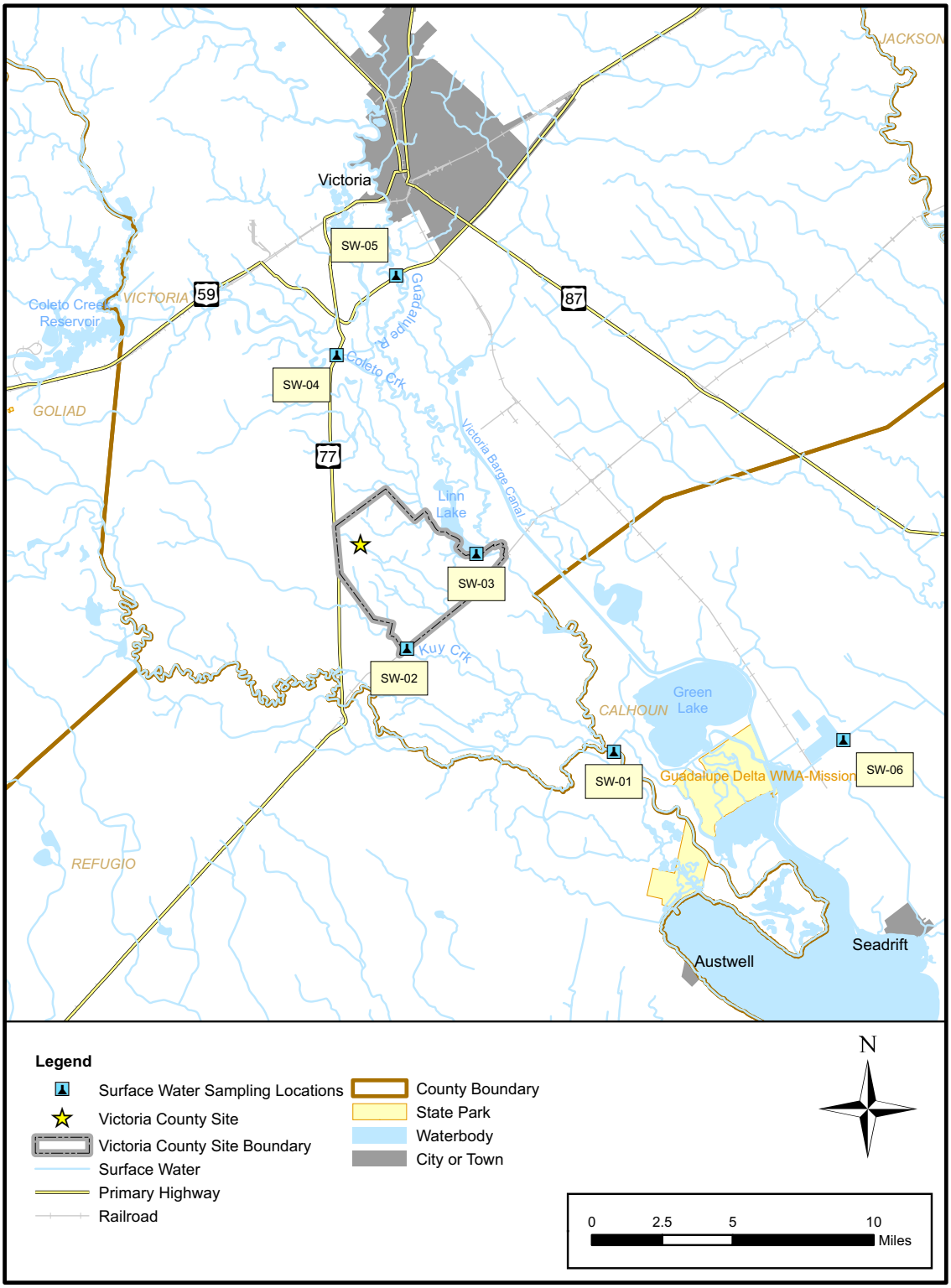

Figure 2.3.3-4 VCS Site Surface Water Sample Locations

2.4 Ecology

This section addresses resources for the two ecological environments: terrestrial (Subsection 2.4.1) and aquatic (Subsection 2.4.2).

2.4.1 Terrestrial Ecology

2.4.1.1 Regional Landscape

VCS is located within the coastal prairie ecosystem of east Texas, the southernmost tip of the tallgrass prairie system prevalent in the Midwest (USGS 2000). This area is typified by low elevation with native, open prairie grasses interspersed with post oak savannahs or live oak mottes (groves). Most uplands support Bluestem Grasslands, comprised of bushy bluestem (*Andropogon glomeratus*), slender bluestem (*Dichanthium tenue*), little bluestem (*Schizachyrium scoparium*), silver bluestem (*Bothriochloa saccharoides*), three-awn (*Aristida* spp.), buffalograss (*Buchloe dactyloides*), Bermudagrass (*Cynodon dactylon*), brownseed paspalum (*Paspalum plicatulum*), single-spike paspalum (*Paspalum monostachyum*), smutgrass (*Sporobolus poiretti*), sacahuista (*Nolina microcarpa*), windmillgrass (*Chloris cucullata*), southern dewberry (*Rubus trivialis*), live oak (*Quercus virginiana*), mesquite (*Prosopis* spp.), huisache (*Acacia farnesiana*), baccharis (*Baccharis* spp.), and MacCartney rose (*Rosa bracteata*) (McMahan et al. 1984). Much of the original coastal prairie in Victoria County has been converted to croplands or rangeland (TSHA 2001).

Inland freshwater marshes in this region typically support Maidencane-Alligator Weed Marsh vegetation. Commonly associated plants include water hyacinth (*Eichhornia crassipes*), cattail (*Typha* spp.), water-pennywort (*Hydrocotyle ranunculoides*), pickerelweed (*Pontederia cordata*), arrowhead (*Sagittaria* spp.), white waterlily (*Nymphaea odorata*), cabomba (*Cabomba furcata*), coontail (*Ceratophyllum demersum*), and duckweed (Family Lemnaceae) (McMahan et al. 1984).

The larger drainages often have bottomland forests. Bottomlands in the Guadalupe River basin commonly support Pecan-Elm Forest, including pecan (*Carya illinoesis*), American elm (*Ulmus americana*), cedar elm (*Ulmus crassifolia*), cottonwood (*Populus deltoides*), sycamore (*Platanus americanus*), black willow (*Salix nigra*), live oak, Carolina ash (*Fraxinus caroliniana*), bald cypress (*Taxodium distichum*), water oak (*Quercus nigra*), hackberry (*Celtis occidentalis*), virgin's bower (*Clematis* spp.), yaupon (*Ilex vomitoria*), greenbrier (*Smilax* spp.), mustang grape (*Vitis mustangensis*), poison oak (*Toxicodendron pubescens*), Johnson-grass (*Sorghum halipense*), Virginia wildrye (*Elymus submuticus*), Canada wildrye (*Elymus canadensis*), rescuegrass (*Bromus catharticus*), frostweed (*Helianthemum* spp.), and western ragweed (*Ambrosia* spp.) (McMahan et al. 1984).

2.4.1.2 General Site Description

The VCS construction landscape, as described in Subsection 2.2, consists of a proposed cooling basin in combination with a Guadalupe-Blanco River Authority (GBRA) storage water reservoir (total 7110 acres disturbed), and approximately 1300 additional acres for the power block, ancillary facilities, parking, and laydown areas. Associated offsite areas include a heavy haul road between VCS and the

Port of Victoria Turning Basin, a cooling basin blowdown discharge line parallel to the heavy haul road to the Guadalupe River, a rail spur, and an approximately 19.5-mile-long raw water makeup (RWMU) system pipeline between the RWMU pumphouse in Calhoun County and VCS (Figures 2.2-4 and 2.2-5). New transmission corridors would be established to connect VCS with the existing power grid, but the exact route of these corridors has yet to be determined (Subsection 2.2.2.1). See also Subsection 2.4.1.7.

The main facility site consists primarily of rangeland (generally Bluestem Grasslands) with scattered oak mottes and encroaching thickets of invasive/nuisance shrubs, predominantly huisache (Figure 2.4.1-1). This rangeland receives varying levels of use by livestock, as approximately 1100 cattle and 150 horses are rotated among fenced parcels for grazing. Three management strategies are employed on the site to produce good forage for cattle and control the spread of invasive shrubs. Parcels of the property are burned on a 2.5-to-4.0 year rotation. Grazing by livestock is also used to maintain ground cover in an earlier stage of succession. Some portions of this rangeland have not been grazed in 3 to 4 years, and, thus, they can appear as tall “old field vegetation.” Finally, in some areas, encroaching shrubs are removed by mechanical and/or chemical (herbicidal) methods. The presence of livestock, the management of the property for these animals, and the general lack of upper level predators (see below) result in the classification of this landscape as a rangeland/grazing ecosystem. Such systems are dominated by plants and herbivores, and their productivity tends to be driven by climatic factors, primarily annual rainfall.

This rangeland is interspersed with ephemeral/intermittent streams and low-lying depressional wet areas (Figure 2.4.1-1). The largest ephemeral stream is Dry Kuy Creek, which originates in the northwest corner of the site and exits the south-central site boundary. According to U.S. Geological Survey 7.5-minute topographic maps, Kuy Creek is a perennial stream from north of the VCS site to its confluence with the Guadalupe River; however, based on field observations from October 2007 to July 2008, the portion of Kuy Creek located on the VCS site appears to flow intermittently (see below). Consequently, Kuy Creek is characterized as an "intermittent stream.” Several other un-named ephemeral/intermittent streams occur on the site as tributaries of Dry Kuy Creek, Linn Lake, Black Bayou, and Kuy Creek. The ephemeral/intermittent streams have irregular flows, typically flowing after heavy rainfall events, but maintaining puddles through a portion of the year in low-lying areas near culverts, etc. It should be noted that sustained dry conditions existed in the region during these surveys. Flowing waters were observed in Dry Kuy Creek during only one (March) of four seasonal wildlife surveys. Bands of vegetation, primarily senna bean (*Sesbania drummondii*), border these stream channels. Flowing waters were observed in Kuy Creek during only two of four surveys, with only widely-dispersed isolated pools present during the May and July wildlife surveys. Depressional wet areas occur throughout the site and their presence may be related to road beds and other landscape features impeding flows through the natural site topography (Figure 2.4.1-1). The four largest isolated wetlands are 6, 7, 34, and 37 acres in size. The hydroperiod of these depressions can be affected by drainage area, vegetative community, frequency of use by cattle, and rainfall amounts/patterns. Most

ephemeral/intermittent streams and/or depressions are typically bordered by senna bean, and a few of the drier depressions have senna bean throughout. Herbaceous vegetation in both moist soil habitats (ephemeral streams and depressional wetlands) is typified by sedges, switchgrass, delta arrowhead (*Sagittaria platyphylla*), squarestem spikerush (*Eleocharis quadrangulata*), smartweed (*Polygonum* spp.), and brushy bluestem.

The primary open water habitat associated with VCS is Linn Lake, on the eastern boundary of the site (Figure 2.4.1-1). Linn Lake is a natural oxbow lake fed by Black Bayou and the Guadalupe River and is relatively shallow with highly variable water levels. The only persistent open water habitats on the site are stock watering ponds. There are approximately 24 of these small rectangular ponds scattered across the site. Some ponds are associated with windmill pumps as water sources, whereas others are excavated in natural depressions. Many of these ponds have 4- to 6-foot-tall berms adjacent to them. The berms are typically planted with fast-growing trees like salt cedar (*Tamarix* spp.) and function as windbreaks for livestock.

Wetland habitats on the VCS site were examined in January 2008 employing U.S. Army Corp of Engineers (USACE) methods to assess for occurrence of hydrophytic vegetation, hydric soils, and wetland hydrology, as indicative that wetlands were jurisdictional. The assessment resulted in the determination that some jurisdictional wetlands or waters of the United States likely occur on site and/or may be affected by site construction. Black Bayou and shoreline habitat associated with Linn Lake are likely jurisdictional wetlands, but both are subject to severe fluctuations resulting from rainfall amounts/patterns. The jurisdictional status of the intermittent/ephemeral streams and depressional wetlands has not yet been determined by the USACE. Thus, the acreage of jurisdictional wetlands and waters associated with VCS is pending final determination by the USACE.

The site topography is generally flat, with the terrain becoming more rolling near the eastern boundary before sloping sharply downward to the Guadalupe River basin, specifically the slope in the eastern part of the site. The forest vegetation is dominated by live oak with a dense understory of saw palmetto (*Serenoa repens*). Many of the live oaks are large, greater than 2 feet in diameter at breast height. The forest edge is not abrupt. Scattered live oak trees occur amid the grassland vegetation close to the forest. Little or no grassland vegetation occurs within the closed-canopy forest areas.

At the base of the slope, the upland forest vegetation transitions to bottomland forest (Figure 2.4.1-1) with a dense tree canopy dominated by black willow and green ash. Occasional bald cypress trees are present. Saw palmetto is largely absent except near the base of the slope. The bottomland forest vegetation extends several hundred feet eastward from the slope to Black Bayou but is present as a narrow band generally less than 500 feet wide along the shore of Linn Lake. A few widely scattered bald cypress trees grow in shallower parts of Linn Lake.

2.4.1.3 Offsite Areas

The location of the RWMU pipeline corridor is shown in Figure 2.2-5, originating at a new RWMU pumphouse intake structure immediately adjacent to the GBRA re-lift station south of the Dow Chemical

plant. The underground line will run parallel to Highway 185 (approximately 7500 feet to the northeast) for approximately 2 miles before angling through cultivated fields for approximately 3.4 miles to Highway 185. The intake piping corridor will then parallel the highway corridor for approximately 4.7 miles through cultivated lands and rangeland in varying stages of use. The corridor then angles away from the highway to the west-northwest for approximately 1.2 miles through rangeland and cultivated fields before angling southwest for approximately 2.5 miles. It then traverses the Victoria Barge Canal, angles to the northwest for approximately 1.5 miles, then crosses the Guadalupe River and the Victoria Barge Canal. Drilling will be used to install the pipeline under the canal and river. The corridor then angles away from the railroad through approximately 2.5 miles of VCS site rangeland. The primary land uses traversed by this offsite corridor include crop and rangelands (144 acres), forestland (51 acres), and wetlands/streams/reservoirs (48 acres). Assessment of impacts to jurisdictional waters has yet to be determined (pending delineation and USACE confirmation).

The heavy haul road and blowdown discharge generally parallel each other to the Guadalupe River, exiting the northeast corner of the VCS site to the east through the river floodplain to the Victoria Barge Canal (Figure 2.2-4). Offsite, this corridor traverses forests (116 acres), mapped wetlands/open water (127 acres), and rangeland/agricultural lands (30 acres) en route to the Victoria Barge Canal (see Table 2.2-3). A bridge will be constructed to allow crossing the Guadalupe River. The heavy haul road will then angle to the northwest parallel to the canal to an existing barge slip at the Port of Victoria turning basin. The blowdown discharge will be routed along the west side of the river to the diffuser location. Vegetation along this corridor is similar to that characterized for the bottomland portion of the VCS site, essentially a dense tree canopy of ash and other hardwood in the less disturbed areas, with an understory of saw palmetto. Bald cypress trees occur in the wetter habitats. Assessment of impacts to jurisdictional waters has yet to be determined (pending delineation and USACE confirmation).

2.4.1.4 Terrestrial Wildlife

2.4.1.4.1 Avifauna

Surveys were conducted seasonally starting in late 2007 and 2008 to document avifauna use of the VCS site, covering late fall, late winter, late spring, and late summer. An additional survey will occur in September 2008 and will be reported separately. The avian monitoring consisted of 2 days (minimum 18 hours) per season of vehicular and pedestrian surveys of the various habitats of the proposed VCS site (see habitats in Figure 2.4.1-1) to determine seasonal species composition and estimate relative abundance of avian species. Approximately 100 avian species were observed on the VCS site during the various surveys (Table 2.4.1-1). Avian species such as bobwhite quail (*Colinus virginianus*), scissor-tailed flycatcher (*Tyrannus forficatus*), northern cardinal (*Cardinalis cardinalis*), and mockingbird (*Mimus polyglottos*) were considered abundant spring/summer species and likely nest on the site. Species such as sandhill cranes (*Grus canadensis*) and cliff swallows (*Petrochelidon pyrrhonata*) were abundant in specific seasons and likely responding to favorable environmental conditions. Abundance categories were intuitively based on species encounters within the project area.

Regional data concerning occurrence of birds during the breeding season are derived during the annual North American breeding bird survey, conducted in June of each year. These surveys are 24.5 miles long with 3-minute stops every 0.5 mile to document avian species presence within 0.25 miles (Sauer et al. Jul 2007). The two closest breeding bird surveys to the VCS site are the Schroeder (No. 83014) and Indianola (No. 83013) routes. The Schroeder route lies west-northwest of Victoria, Texas and the Guadalupe River, approximately 20 miles northwest of the VCS site, and contains the following primary habitat types: grassland (35%), shrubland (28%), deciduous forests (17%), and pasture (14%) (Sauer et al. Jul 2007). Eighty-one avian species were observed along this route during the latest breeding bird survey. The Indianola route lies east of Green Lake and extends to the marshes below Port Lavaca. The route starts approximately 7.5 miles east-southeast of the VCS site. It contains the following primary habitat types: row crops (53%), emergent wetlands (16%), pasture (13%), and grassland (7%) (Sauer et al. Jul 2007). One hundred and nine species were observed during the latest (2007) breeding bird survey along this route.The higher number of species observed compared with the Schroeder route was likely a result of the presence of aquatic habitats and row crops along the Indianola route, which are more conducive to waterbird and waterfowl use. The numbers and types of birds documented for the VCS site in late May 2008 were more similar to the breeding bird survey results for the Schroeder route. This is expected, given the greater similarity in habitat types between the VCS site and the Schroeder breeding bird survey route.

The east coast of Texas, including the VCS site, is located at the terminus of the Central Flyway migration route, resulting in the occurrence of many different species of avifauna during the fall, winter, and spring months (Shackelford et al. Nov 2005). Thousands of migrating birds from the cooler regions of the continent visit or winter in the coastal zone of Texas annually. Other migrants traveling to or from Central and South America use this region of Texas as a stopover point before continuing their travels. Christmas Bird Counts (CBCs) are one measure of avian diversity during the winter period. During these counts, attempts are made to identify and count all birds within a 15-mile-diameter circle on one day during the winter season. The two CBCs nearest to the VCS site are the Guadalupe River Delta/McFaddin Family Ranches (TXGF) and the Victoria (TXVI) counts. TXGF is centered on the northwest corner of nearby Green Lake and the circle boundary extends to the railroad tracks on the southeastern boundary of the VCS site. The circle includes a wide variety of habitats, including Guadalupe River riparian forest, rangeland, marshes, state Wildlife Management Areas, two chemical plants, and portions of Hynes and Guadalupe bays. The number of avian species observed during the TXGF CBC from 2004 through 2006 ranged from 212 to 225 species (NAS 2007). The number of avian species observed during the TXVI CBC from 2004 through 2006 ranged from 126 to 152 species (NAS 2008.

Another measure of diversity associated with migration is the Great Texas Birding Classic. It is held annually in mid-April during spring migration along the Texas Gulf Coast. VCS, and Victoria County, are in the “central coast” region of this Classic, along with 18 other counties south to, and including, the

Corpus Christi area. In 2007, 218 avian species were observed in the central coast region (GCBO 2008).

Avian surveys of the VCS site suggest a reduced avian diversity when compared to the long-term avian studies of this region. However, this is likely because of differences in size and complexity of areas surveyed, with most of the long-term studies covering larger areas with more diverse habitats, and having greater surveying efforts (numbers of observers documenting birds). The findings of the VCS surveys were thus a subset of the other, larger studies.

2.4.1.4.1.1 Mammals

Mammals either observed or indicated by tracks and other signs on the site during seasonal avian surveys include armadillo (*Dasypus novemcinctus*), white-tail deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), wild hog (*Sus scrofa*), bobcat (*Lynx rufus*), opossum (*Didelphiis virginiana*), eastern cottontail (*Silvilagus floridanus*), swamp rabbit (*S. aquaticus*), Attwater's pocket gopher (*Geomys attwateri*), fox squirrel (*Sciurus niger*), gray squirrel (*S. carolinensis*), and coyote/dog (*Canis spp.*). Specific surveys for mammals were conducted in April/May of 2008. These were one-time surveys during the peak of activity of these species to document species presence and relative abundance. Abundance categories were intuitively based on species encounters within the project area and regional knowledge. Surveys included 800 total trap-nights (Sherman live traps) in the various habitats of the VCS site (for small mammals), with trapping effort apportioned based on habitat abundance (grassland habitats were trapped for 400 trap nights and the remaining four habitat types were trapped for 100 trap nights each) (see Table 2.4.1-2). Additionally, five remote game cameras were established at scent stations on site to document larger animals. Two of these were set for 25 days each in the grassland habitat, and one each were set in the bottomland, oak forest, and oak motte habitats (cameras could not be set in the wetland habitat type). A single nighttime spotlight survey occurred along the existing site roads, and two mist nets were deployed one night in the bottomland habitats for bats. Sixteen total mammal species were observed on the VCS site during all surveys combined (Table 2.4.1-2). The greatest diversity of small mammals (N=5 species), based on the Sherman live trap survey, was found in the bluestem grasslands, followed by depressional wetlands (two species) and one species each for the oak forest and oak motte habitats. No small mammals were recorded in the bottomland hardwood areas with the Sherman traps; however, five larger mammal species were documented in bottomland habitat by a game camera. These bottomland hardwood areas are inundated for extended periods after heavy rains and small mammals are likely displaced by these events. Although not documented during the various survey methods, pocket gopher mounds are abundant on the upland portions of the site. These were confirmed to be Attwater's pocket gophers (*Geomys attwaterii*). Mammals considered abundant within the available habitats included Attwater's pocket gopher, white-tailed deer (*Odocoileus virginiana*), raccoon (*Procyon lotor*), fox squirrel (*Sciurus niger*), and cotton rat (*Sigmodon hispidus*). No bats were captured with the mist nets and none were observed during evening hours around aquatic habitats during other surveys.

2.4.1.4.1.2 Herpetofauna

The eastern garter snake (*Thamnophis sirtalis sirtalis*), broad-banded watersnake (*Nerodia fasciata confluens*), western diamondback rattlesnake (*Crotalus horridus*) and alligator (*Alligator mississippiensis*) were the only reptiles observed onsite during the seasonal avian surveys. Specific surveys for reptiles and amphibians were conducted in May 2008. These were one-time surveys during the peak of activity of these species to document species presence and relative abundance. Abundance categories were intuitively based on species encounters within the project area and regional knowledge. Herpetological surveys included timed searches of the various habitat types (28 total hours) with searching effort apportioned based on habitat abundance (grassland habitats were searched for 12 hours and the remaining four habitat types were searched for 3 to 5 hours each) (see Figure 2.4.1-2). Other surveying techniques included audible call counts during all surveying efforts, six funnel traps deployed for three nights each in aquatic habitats and a nocturnal road cruise on site roads. A total of 22 herpetological species were observed on the VCS site during all surveys combined, including eight snake, seven frog, three turtle, two lizard and one salamander species, as well as the alligator (Table 2.4.1-3). The greatest diversity (based on the timed searches) was found in the depressional wetland habitat type. No herpetological species were found within the bluestem grasslands during these timed searches, although a few species were observed in this habitat during the other surveys. Species considered abundant within the available habitats during these surveys included southern leopard frog (*Rana sphenocephala*) and diamondback water snake (*Nerodia rhombifer rhombifer*), with both species found primarily in the site's depressional wetlands.

2.4.1.5 **Threatened and Endangered Species**

The U.S. Fish and Wildlife Service (USFWS) is responsible for designating lands as "critical habitat" for federally-listed endangered and threatened species. Such lands are protected to aid the recovery of the species and may require special management activities. No area designated by the USFWS as critical habitat is found within or adjacent to the VCS site. The nearest critical habitat is the primary wintering area for federally endangered whooping cranes (*Grus americana*), located approximately 18 miles south of the VCS site in Aransas and Calhoun Counties (CWS & USFWS Mar 2007) (Figure 2.4.1-3). Wintering habitat for the threatened piping plover (*Charadrius melodus*) is located along the shoreline of Matagorda Island (66 FR 36038-36086), approximately 25 miles south of the VCS site. Portions of the VCS site were included in a Safe Harbor Agreement for Attwater's prairie chicken (*Tympanuchus cupido attwateri*), a federally endangered species that was formerly known in Victoria County, with the landowner agreeing to manage vegetation on this property for this species until 2009 or until the property is sold. Because of this Safe Harbor Agreement and resulting site management activities, as well as the site's proximity to historical (currently unoccupied) breeding grounds, the VCS site lies within a priority management zone for this species (USFWS Sept 2007). However, based on discussions with the USFWS, this species does not reside on the proposed VCS site, and no experimental birds have been released there (the closest release was greater than 7 miles to the west in Goliad County).

Eighteen animal species that are either federally or state-listed as endangered or threatened have been recorded or historically occurred in Victoria County (Table 2.4.1-4). No federal- or state-listed plants have been recorded for Victoria County. Counties containing portions of the intake and transmission corridors include Calhoun, DeWitt, Goliad, Jackson, Matagorda, Victoria, and Wharton. It should be noted that occurrences of federally-listed species on the state and federal Web sites occasionally differ. The state Web sites include all counties within the historical range of these species and the federal Web sites include only counties with recent sightings. As a conservative approach, Exelon has included species in counties from both Web sites. Also, Exelon acknowledges that Table 2.4.1-4 reflects only recorded or historical occurrences. Exelon has initiated correspondence with the appropriate federal and state agencies (National Marine Fisheries Service, Texas Parks and Wildlife Department, and USFWS) regarding endangered and threatened species (Appendix A).

The only federally listed species observed on the VCS site during the avian surveys was a single bald eagle (*Haliaeetus leucocephalus*) soaring near Linn Lake in October 2007. Although de-listed under the Endangered Species Act, it remains protected under the Bald and Golden Eagle Protection Act (72 FR 37346-37372). Only two state-listed “threatened” species were observed on the VCS site during the various wildlife surveys. The white-tailed hawk (*Buteo albicaudata*) was observed in low numbers (fewer than five) during all surveys of the VCS site. They typically use shrubby rangeland habitats in eastern Texas, but nesting was not observed on site. The wood stork (*Mycteria americana*) is a large wading bird that is also listed as federally endangered in other portions of their range (southeastern United States). They have bred in Texas occasionally within the past few decades, but most current sightings are presumed to be post-breeding season birds dispersing from populations in Mexico. Wood storks feed in shallow open-water wetlands and the two sightings (one bird each) on the VCS site were associated with the riverine bottomlands.

Whooping cranes (*Grus americana*) are listed as endangered by both federal and state agencies because of population declines first noted in the 1800s. These declines were thought to have been caused by human colonization of the northern Great Plains and subsequent conversion of native prairies and potholes to pasture and crop production (Campbell 2003). The population may have dropped below 30 cranes in the late 1930s, but multinational recovery efforts now estimate a population of over 400 birds. The majority of these cranes nest in the Wood Buffalo National Park in the Northwest Territories, Canada, and winter at the Aransas National Wildlife Refuge (NWR) on the coast of Texas, approximately 18 miles south of the VCS site. The Aransas area is listed as critical wintering habitat for the whooping crane (Figure 2.4.1-3; CWS & USFWS Mar 2007).

Whooping cranes migrate from their breeding grounds in the fall, generally arriving on the Texas coast between late October and mid December (Campbell 2003). They use an approximately 200-mile-wide migration path en route, then spend almost 6 months on the wintering grounds on and near the Aransas NWR. While on the wintering grounds, they typically forage in brackish bays, marshes, and salt flats, feeding primarily on blue crabs (*Callinectes sapidus*). They leave their Texas wintering grounds in late March and early April, returning to Canada.

One threat to whooping cranes is the restriction of freshwater inflows into San Antonio Bay and resulting potential impacts to blue crab populations (CWS & USFWS Mar 2007). Blue crabs are sensitive to salinity levels and significant reductions of freshwater inflows from the Guadalupe and/or San Antonio Rivers could result in increased salinities and fewer crabs, thus impacting an important food resource for the wintering cranes. Another threat to the wintering cranes includes impacts of disturbance (noise, human presence, etc.), a concern resulting from access to the wintering grounds (most areas are public domain) and the continued development along the Texas coast.

The major cause of mortality of the current whooping crane population is collisions with transmission and distribution lines, especially lines within the migratory pathway (CWS & USFWS Mar 2007). Tower guy-wires are also a concern, although to a lesser degree. The USFWS required a transmission company to mark transmission lines with highly visible “aviation balls” within a Texas portion of the whooping crane migratory pathway (AEP 2007). “Spiral markers” are installed on some transmission lines to reduce avian collisions.

The brown pelican (*Pelecanus occidentalis*) is a large gray-brown bird with a characteristic long bill and pouch, known to forage on fish in coastal areas (Campbell 2003). Historically present in large numbers along the Atlantic and Gulf coasts, the brown pelican population dropped dramatically by the mid-1970s primarily owing to insecticide (DDT) impacts on egg quality, and it was classified as federally-endangered throughout its range. Around 1900, an estimated 5000 brown pelicans nested on the Texas coast, but the population declined to less than 10 breeding pairs by 1970, partially as the result of disturbance at their nesting areas by fishermen. Control of insecticide use and other recovery activities (e.g., nesting site protection) have resulted in recovery of segments of the population. In 1985, pelicans along the Atlantic and Florida coasts had recovered sufficiently to be de-listed, whereas brown pelicans in Louisiana, Texas, and California remain classified as endangered. Currently, the Texas population is at or near historical levels (USFWS 2007a). Primary threats to Texas pelicans are loss of their nesting habitat, typically dredge spoil islands, which are subject to loss during hurricanes, and pollution from either off-shore oil wells or shipping. The closest nesting locations to the VCS site are in Aransas, Calhoun, and Matagorda counties (USFWS 2007b).

Piping plovers (*Charadrius melodus*) are small stocky shorebirds that nest on shoreline beaches in the northern Great Plains, Great Lakes, and Atlantic coast areas. All populations are listed as either federally-threatened or endangered. Piping plovers are a migratory species, wintering along the Gulf Coast and other southern locations. Critical wintering habitat for the piping plover is designated along the Texas Gulf coast, with the closest area to the VCS site located in Matagorda Island bayside habitats in Calhoun County, approximately 25 miles south of the VCS site (Figure 2.4.1-3).

Five species of sea turtles are federally listed for Calhoun County (Table 2.4.1-4) including: loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), and the Kemp’s Ridley sea turtle (*Lepidochelys kempii*). Three species are known to nest on Texas barrier island beaches (TSTNR 2007), and all five could possibly occur in San Antonio Bay.

Sightings and strandings of endangered West Indian manatees (*Trichechus manatus*) have been recorded over the last 100 years across the entire Texas coast (Schmidly 2004). A live stranding of a manatee occurred near Galveston, Texas, as recently as 2007 (TMMSN 2007). However, there is no evidence that a breeding population ever existed along the Texas coast; individuals sighted/stranded in Texas probably represent migrants from Mexico (Schmidly 2004), possibly as the result of cool northern Gulf waters.

Several endangered or threatened species in Table 2.4.1-4 have become extirpated in the counties associated with the VCS site resulting from the loss of their specific habitats as humans settled the area and altered the natural landscape to a more open and managed agricultural landscape. Once found throughout eastern Texas, the red wolf's (*Canis rufus*) decline was linked to these land use changes, which reduced their more forested habitats and enhanced that of the coyote (*Canis latrans*), resulting in a population overlap. Subsequent interbreeding between the two canine species has effectively resulted in the extirpation of the red wolf from Texas (Schmidly 2004). The ocelot (*Leopardus pardalis*) and jaguarundi (*Felis yagouaroundi cacomitli*) are neotropical cats that typically inhabit large, dense thickets of thorny shrubs. With the loss of vast areas of this habitat by conversion to agricultural lands, both species are now limited to a few isolated areas in more southern portions of Texas (Campbell 2003). The Louisiana black bear (*Ursus americanus luteolus*), one of 16 subspecies of American black bear, was once common in forested areas of eastern Texas. As the result of hunting and habitat loss, this subspecies was presumed to be extirpated from this area by the 1940s, and any recent sightings are thought to be dispersing juveniles from Louisiana (Campbell 2003). Attwater's prairie chickens are medium-sized grouse that historically inhabited Texas coastal tallgrass prairies. With the loss of much of this habitat type to agriculture, pastures, and overgrazing, fewer than 100 of this species are thought to exist in populations in Galveston and Colorado counties. The Eskimo curlew (*Numenius borealis*), another species affected by the conversion of open and coastal prairie habitats to agriculture and over-hunting, was once an abundant migrant of the Texas prairie that may now be extinct. The last verified sighting of an Eskimo curlew occurred on the "coast of Texas" in 1987 (Campbell 2003).

2.4.1.6 Other Important Species and Habitats

"Important species" are defined in NUREG-1555, the *Standard Review Plan for Environmental Reviews for Nuclear Plants* (U.S. NRC Oct 1999), as those that are federally or state-listed as threatened or endangered, proposed for listing as threatened or endangered (see Table 2.4.1-4), commercially or recreationally valuable, essential to the maintenance or survival of species that are rare or commercially or recreationally valuable, critical to the structure and function of the local terrestrial ecosystem, or that serve as biological indicators. Listed/protected species observed on or near the VCS site include bald eagles, white-tailed hawks, and wood storks. Whooping cranes have not been observed on site, but the main facility and associated corridors lie within their migratory pathway (CWS & USFWS Mar 2007). Game species fall within the "commercially or recreationally valuable" species category. The primary game species observed on the VCS site include white-tail deer, feral pigs, rabbits, northern bobwhites, various species of doves, and waterfowl.

There are an estimated 1000 deer onsite (based on spotlight counts and hunter encounters), and 60 to 90 are harvested annually. One northern bobwhite is estimated to occur per 2 to 3 acres onsite, based on call counts and hunter encounters. No major “travel corridors” for game species are known to cross the VCS site. However, wintering waterfowl use nearby Linn Lake and Black Bayou and may traverse between there and any onsite depressional wetlands that contain water. The only land management activities for wildlife on this property are the burning, grazing, and shrub control practices described above. Nuisance plants observed on the VCS site include huisache, and invasive salt cedar has been planted as windbreaks on some berms on the property. No nuisance animals other than feral hogs have been observed on the site. Although the proposed VCS site hosts such potential disease vectors as ticks and mosquitoes, Exelon is unaware of any vector-borne diseases resulting from them.

Important habitats, as defined under NUREG-1555, include wildlife refuges, sanctuaries, or preserves, habitats identified by federal or state agencies as rare or to be protected, wetlands, floodplains, other resources specifically protected by federal or state regulation, or land areas identified as critical habitat for threatened or endangered species. Ephemeral/intermittent streams and depressional wetlands exist within the boundaries of the VCS site, whereas potentially jurisdictional waters (Linn Lake and Black Bayou) exist adjacent to the site. The proposed intake corridor and heavy haul road will cross bottomland habitats which may contain jurisdictional wetlands (Figures 2.2-4 and 2.2-5). USACE determination of any/all of these wetlands or waters as jurisdictional is pending.

The Guadalupe River Delta Wildlife Management Area (WMA) is managed by the Texas Parks and Wildlife Department (TPWD) and is located approximately 11 miles southeast of the proposed site near the junction of Calhoun, Refugio, and Victoria counties (Figure 2.4.1-2). The WMA consists of approximately 6200 acres of fresh and brackish water marshes, impoundments, bottomland areas, and bayous, largely fed by freshwater flows from the Guadalupe River. These lands have been used by various state and federal threatened and endangered avian species, migratory waterfowl and neotropical songbirds, and the estuary portions provide valuable spawning and nursery habitat for marine fish, shrimp, and blue crab (TPWD 2007a).

The Aransas NWR is composed of approximately 115,000 acres in five units in Aransas, Calhoun, and Refugio counties, approximately 18 miles south of the VCS site (USFWS 2008b). A mixture of mainland, bay, and barrier island habitats, much of this refuge is classified as critical wintering habitat for endangered whooping cranes. The refuge hosts a multitude of wildlife species in addition to whooping cranes.

The Welder Flats Coastal Preserve consists of approximately 1500 acres of largely submerged land near the junction of the Victoria Barge Canal and the Gulf Intracoastal Waterway, approximately 26 miles southeast of the proposed site. The preserve is owned by the Texas General Land Office and is managed by the TPWD. The entire preserve is classified as critical wintering habitat for endangered whooping cranes. It contains beds of submerged aquatic vegetation, is used by waterfowl, wading birds and shorebirds, and is a valuable nursery ground for red drum and sea trout. The TPWD uses the

shoreline as a stocking location for red drum and sea trout because of its high nursery value (TPWD 2007b).

2.4.1.7 Transmission Line Corridor Habitats and Communities

As described in Subsection 2.2.2, three new transmission corridors would be constructed from VCS to link to the existing transmission system (Figure 2.2-3). One corridor would traverse approximately 20 miles to the northwest and link in with the Coleto Creek substation. This corridor would cross habitat similar to that of the VCS site, largely rangeland and some forested lands, as well as some agricultural fields. A second corridor would connect the VCS site with a proposed Cholla substation approximately 20 miles to the northwest in DeWitt County. The new corridor would co-locate with existing transmission corridors, where practical, but would require additional corridor width. The third corridor would traverse approximately 60 miles between the VCS site and both the Hillje substation in Wharton County and the Blessing substation in Matagorda County. This corriddor would also contain an approximately 10-mile connection between VCS and the existing STP-Whitepoint line. The habitat types to be traversed by this corridor would likely be similar to those of the VCS site, with the possible inclusion of agricultural fields and riverine bottomlands.

The routes of the new transmission lines have not been finalized; thus, a macro-corridor approach (3-mile-wide corridor within which the transmission corridors will likely fit) was employed to examine for sensitive habitats (see Subsection 2.2.2). This methodology attempts to reduce impacts on human populations and ecological resources by avoiding sensitive areas such as wetlands and towns and using existing corridors (transmission and others) to the extent possible. Several inland water bodies/drainages within the macro-corridor are artificial (irrigation ponds/ditches/canals, aquaculture impoundments, etc.), but some natural drainages are present in the corridor toward Hillje and Blessing, including the Guadalupe, Lavaca, and Navidad Rivers. Land use within the macro-corridor is listed in Table 2.2-3 and is dominated by rangeland, pasture, and agricultural land. Thus, most land incorporated in the proposed expansions is already human altered and unlikely to be affected significantly by this activity. No areas designated by the USFWS as critical habitat for endangered or threatened species are crossed by these proposed corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas. These corridor expansions likely occur within the migratory pathway of waterfowl and whooping cranes. Potential wetlands within these corridors will be assessed upon finalization of the routes.

Endangered and threatened species known to occur in the counties within the macro-corridors are listed in Table 2.4.1-4. A species of concern within these counties as the result of the addition/expansion of transmission corridors is the migratory whooping crane. Cranes and other protected species (for Victoria County) are described in detail in Subsection 2.4.1.5. The list is based on classifications by the USFWS (2008a) and Texas Parks and Wildlife Department (2008). Exelon acknowledges that these lists are based on either recorded occurrences or historical ranges of species.

The transmission line corridors would be constructed and maintained in accordance with the established procedures of the company responsible for these tasks, AEP Texas Central Company.

2.4.1.8 References

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Table 2.4.1-1 (Sheet 1 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

		Abundance[c]			
Avian Group	**Species**	**Oct**	**Mar**	**May**	**Jul**
Wading Birds	Roseate spoonbill (*Ajaia ajaja*)	Uncom	Uncom	Uncom	Com
	Great egret (*Ardea alba*)	Com	Com	Uncom	Com
	Great blue heron (*Ardea herodias*)	Com	Com	Uncom	Uncom
	American bittern (*Botaurus lentiginosus*)[d]	—	—	—	—
	Cattle egret (*Bubulcus ibis*)	—	—	Com	Uncom
	Green heron (*Butorides virescens*)[d]	—	—	—	—
	Little blue heron (*Egretta caerulea*)	Uncom	Uncom	Uncom	Uncom
	Snowy egret (*Egretta thula*)	Uncom	—	Uncom	—
	Tricolored heron (*Egretta tricolor*)	Uncom	—	Uncom	—
	White ibis (*Eudocimus albus*)	Com	Com	Com	Com
	Least bittern (*Ixobrychus exilis*)[d]	—	—	—	—
	Wood stork (*Mycteria americana*)	—	—	—	Uncom
	Yellow-crowned night-heron (*Nyctanassa violacea*)	—	Uncom	Uncom	—
	Black-crowned night-heron (*Nycticorax nyctocorax*)[d]	—	—	—	Uncom
	Whitefaced or glossy ibis (*Plegadis chihi or falcinellus*)	—	Com	—	Uncom
Shoredbirds	Spotted sandpiper (*Actits macularia*)[d]	—	—	—	—
	Western sandpiper (*Calidris mauri*)[d]	—	—	—	—
	Least sandpipier (*Calidris pusillus*)[d]	—	—	—	—
	Mountain plover (*Charafrius montanus*)	—	Uncom	—	—
	Killdeer (*Charadrius vocifeous*)	Com	Com	Uncom	—
	Black-necked stilts (*Himantopus mexicanus*)[d]	—	—	—	—

Table 2.4.1-1 (Sheet 2 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

		Abundance[c]			
Avian Group	**Species**	**Oct**	**Mar**	**May**	**Jul**
Shoredbirds (cont.)	Short-billed dowitcher (*Limnodromus griseus*)[d]	—	—	—	—
	Long-billed dowitcher (*Limnodromus scolopaceus*)[d]	—	—	—	—
	Stilt sandpiper (*Micropalma himantopus*)[d]	—	—	—	—
	American avocet (*Recurviristra americana*)	Uncom	—	—	—
	Lesser yellowlegs (*Tringa flavipes*)[d]	—	—	—	—
	Greater yellowlegs (*Tringa melanocleuca*)	—	Uncom	—	—
	Solitary sandpiper (*Tringa solitaria*)[d]	—	—	—	—
Other Waterbirds	Wood duck (*Aix sponsa*)[d]	—	—	—	—
	Northern shoveler (*Anas clypeata*)	—	Uncom	—	—
	Blue-winged teal (*Anas discors*)[d]	—	—	—	—
	Mottled duck (*Anas fulvigula*)[d]	—	—	—	—
	Anhinga (*Anhinga anhinga*)	Com	Com	—	—
	Yellow rail (*Coturnicops novaboracensis*)[d]	—	—	—	—
	Black-bellied whistling duck (*Dendrocygna autumnalis*)	—	—	Uncom	Uncom
	Fulvous whistling duck (*Dendrocygna bicolor*)	Uncom	—	—	—
	White pelican (*Pelecanus erythrorhynchos*)	Com	Com	Uncom	—
	American coot (*Fulicia americana*)	—	Uncom	—	—
	Sora (*Porzana carolina*)[d]	—	—	—	—
	Cormorant spp. (*Phalacrocorax sp*)	Uncom	Uncom	—	—
Upland Game Birds	Northern bobwhite quail (*Colinus virginianus*)	Uncom	Uncom	Abun	Abun
	Common ground dove (*Columbina passerina*)	—	—	Uncom	Uncom

Table 2.4.1-1 (Sheet 3 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

		Abundance[c]			
Avian Group	**Species**	**Oct**	**Mar**	**May**	**Jul**
Upland Game Birds (cont.)	Sandhill crane (*Grus canadensis*)	Com	Abund	—	—
	Wild turkey (*Meleagris gallapavo*)	Uncom	Uncom	Uncom	—
	Mourning dove (*Zenaida macroura*)	Com	Com	Abun	Com
Passerines & Other Birds	Red-winged blackbird (*Agelaius phoeniceus*)	—	Uncom	Com	Uncom
	Ruby-throated hummingbird (*Archilochus colubris*)	—	—	—	Uncom
	Tufted titmouse (*Baeolophus bicolor*)	—	Uncom	Uncom	Uncom
	Great horned owl (*Bubo virginiana*)[d]	—	—	—	—
	Northern cardinal (*Cardinalis cardinalis*)	Com	Com	Abun	Abun
	Chimney swift (*Chaetura pelagica*)[d]	—	—	—	—
	Lark sparrow (*Chondestes grammacus*)[d]	—	—	—	—
	Yellow-billed cuckoo (*Coccyzus americanus*)	—	—	Uncom	Uncom
	Northern flicker (*Colaptes auratus*)	—	Uncom	—	—
	American crow (*Corvus brachyrhynchos*)	—	Uncom	Uncom	Uncom
	Yellow-rumped warbler (*Dendroica coronata*)	—	Uncom	—	—
	Pileated woodpecker (*Dryocopus pileatus*)	—	—	—	Uncom
	Blue grosbeak (*Guiraca caerulea*)	—	—	—	Uncom
	Barn swallow (*Hirundo rustica*)	Com	—	—	—
	Loggerhead shrike (*Lanius ludovicianus*)	Com	Com	—	Uncom
	Red-bellied woodpecker (*Melanerpes carolin*us)	—	Uncom	Uncom	Uncom
	Song sparrow (*Melospiza melodia*)	—	Com	—	—
	Mockingbird (*Mimus polyglottos*)	Com	Com	Abun	Com
	Black-and-white warbler (*Mniotitla varia*)	—	—	—	Uncom
	Brown-headed cowbird (*Molothrus ater)*	—	Uncom	Com	Uncom

Table 2.4.1-1 (Sheet 4 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

		Abundance[c]			
Avian Group	**Species**	**Oct**	**Mar**	**May**	**Jul**
Passerines & Other Birds (cont.)	Great crested flycatcher (*Myiarchus crinitus*)	—	—	Uncom	—
	Ladder-backed woodpecker (*Picoides scalaris*)	—	—	Uncom	—
	Painted bunting (*Passerina ciris*)	—	—	Uncom	Uncom
	Indigo bunting (*Passerina cyanea*)[d]	—	—	—	—
	Savannah sparrow (*Passerculus sandwichensis*)	—	Com	—	—
	Cliff swallow (*Petrochelidon pyrrhonata*)	—	—	Com	Abun
	Vesper sparrow (*Pooecetes gramineus*)[d]	—	—	—	—
	Carolina chickadee (*Poecile carolinensis*)	—	Uncom	Uncom	Uncom
	Blue-gray gnatcatcher (*Poliotila caerula*)	—	Uncom	—	—
	Prothonotary warbler (*Prothonotaria citrea*)[d]	—	—	—	—
	Great-tailed grackle (*Quiscalus mexicanus*)	—	—	—	Uncom
	Common grackle (*Quiscalus quiscala*)	—	Uncom	—	—
	Eastern phoebe (*Sayornis phoebe*)	—	Com	—	—
	Eastern bluebird (*Siala sialis*)	—	Uncom	—	—
	Dickcissel (*Spiza americana*)	—	—	Uncom	—
	Field sparrow (*Spizella pusilla*)	—	Uncom	—	—
	Barred owl (*Strix varia*)	—	Uncom	Uncom	Uncom
	Eastern or western meadowlark (*Sturnella spp.*)	Com	Com	Uncom	Abun
	Tree swallow (*Tachycineta bicolor*)	Com	Uncom	—	—
	Scissor-tailed flycatcher (*Tyrannus forficatus*)	Uncom	—	Abun	Com
	Eastern kingbird (*Tyrannus tyrannus*)[d]	—	—	—	—
	White-eyed vireo (*Vireo griseus*)	—	Com	Com	Com
	Red-eyed vireo (*Vireo olivaceus*)[d]	—	—	—	—

Table 2.4.1-1 (Sheet 5 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

		Abundance[c]			
Avian Group	**Species**	**Oct**	**Mar**	**May**	**Jul**
Birds of Prey/Soaring Birds	White-tailed hawk *(Buteo albicaudatus*)	Uncom	Uncom	Uncom	Uncom
	Red-tailed hawk (*Buteo jamaicensis*)	Com	Com	Uncom	Uncom
	Red-shouldered hawk (*Buteo lineatus*)	—	Uncom	Uncom	Uncom
	Crested caracara (*Caracara plancus*)	Uncom	Com	Uncom	Uncom
	Turkey vulture (*Cathartes aura*)	Com	Com	Com	Abun
	Northern harrier *Circus cyaneus*)	—	Uncom	—	—
	Black vulture (*Coragyps atratus*)	Uncom	Uncom	Uncom	Uncom
	Merlin (*Falco columbarius*)	Uncom	—	—	—
	Kestrel (*Falco sparverius*)	Com	Com	—	—
	Bald eagle (*Haliaeetus leucocephalus*)	Uncom	—	—	—

a. Survey periods were October 22–24; March 11–13, 2008, May 28-29, 2008, and July 15-16, 2008.
b. The site includes the VCS site, Black Bayou, and Linn Lake.
c. Estimated abundances (within expected habitats) were classified as Abun = Abundant; Com = Common; and Uncom = Uncommon/Rare. “-“ indicate birds were not observed during the specified survey and thus relative abundance was not determined. Abundance classifications were intuitively based on species encounters within the project area.
d. These species were not observed during the four seasonal surveys but were observed during other site visits/surveys.

Table 2.4.1-2 (Sheet 1 of 2)
Mammals of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Northern pygmy mouse	*Baiomys taylori*	G	O
Ringtail	*Bassariscus astutus*	B, F, M	—
Coyote	*Canis latrans*	G, F	U
American beaver	*Castor canadensis*	I	—
Hispid pocket mouse	*Chaetodipus hispidus*	G	—
Least shrew	*Cryptotis parva*	G, F	—
Nine-banded armadillo	*Dasypus novemcinctus*	G, F	C
Virginia opossum	*Didelphis virginiana*	G, B, F, I	C
Big brown bat	*Eptesicus fuscus*	G, B, F, I	—
Attwater's pocket gopher	*Geomys attwateri*	G	A
Southern flying squirrel	*Glaucomys volans*	B, F, M	—
Silver-haired bat	*Lasionycteris noctivagans*	G, B, F, I	—
Red bat	*Lasiurus borealis*	G, B, F, I	—
Hoary bat	*Lasiurus cinereus*	G, B, F, I	—
Northern yellow bat	*Lasiurus intermedius*	G, B, F, I	—
Seminole bat	*Lasiurus seminolus*	G, B, F, I	—
Black-tailed jackrabbit	*Lepus californicus*	G	—
Northern river otter	*Lontra canadensis*	G, B, F	—
Bobcat	*Lynx rufus*	G, F, M	O
Striped skunk	*Mephitis mephitis*	G, F	—
Long-tailed weasel	*Mustela frenata*	G, B, F	—
Cave Myotis	*Myotis velifer*	G, B, F, I	—
White-nosed coati	*Nasua narica*	B, F, M	—
Eastern woodrat	*Neotoma floridana*	G, F	—
Crawford's gray shrew	*Notiosorex crawfordi*	G	—
Evening bat	*Nycticeius humeralis*	G, B, F, I	—
Big free-tailed bat	*Nyctinomops macrotis*	G, I	—
White-tailed deer	*Odocoileus virginiana*	G, B, F, M	A
Northern grasshopper mouse	*Onychomys leucogaster*	G	—
Marsh rice rat	*Oryzomys palustris*	I	O
Collared peccary	*Pecari tajacu*	G, F	—
White-footed mouse	*Peromyscus leucopus*	G, F	O
Deer mouse	*Peromyscus maniculatus*	G, B, F, M	—

Table 2.4.1-2 (Sheet 2 of 2)
Mammals of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Eastern Perimyotis	*Pipistrellus subflavus*	G, B, F, I	—
Northern raccoon	*Procyon lotor*	B, F, I	A
Cougar	*Puma concolor*	G, F	—
Fulvous harvest mouse	*Reithrodontomys fulvescens*	G	U
Plains harvest mouse	*Reithrodontomys montanus*	G	—
Eastern mole	*Scalopus aquaticus*	G, F	—
Eastern gray squirrel	*Sciurus carolinensis*	B, F, M	O
Eastern fox squirrel	*Sciurus niger*	B, F, M	A
Hispid cotton rat	*Sigmodon hispidus*	G, I	A
Mexican ground squirrel	*Spermophilus mexicanus*	G	—
Thirteen-lined jackrabbit	*Spermophilus tridecemlineatus*	G	—
Eastern spotted skunk	*Spilogale putorius*	G, B, F	—
Feral hog	*Sus scrofa*	G, B, F, M	C
Swamp rabbit	*Sylvilagus aquaticus*	I	—
Eastern cottontail	*Sylvilagus floridanus*	G, F	C
Brazilian free-tailed bat	*Tadarida brasiliensis*	G, I	—
American badger	*Taxidea taxus*	G	—
Common gray fox	*Urocyon cinereoargenteus*	G, F	—
Red fox	*Vulpes vulpes*	G, F	—

a. According to Schmidly (2004)
b. General habitats: G = bluestem grassland, B = bottomland hardwood forest, F = live oak forest, M = live oak motte, I = depressional wetland
c. Abundance categories were intuitively based on species encounters within the project area and regional knowledge: A = abundant, C = common, U = uncommon, O = occasional, R = rare, — = not observed

Table 2.4.1-3 (Sheet 1 of 3)
Amphibians and Reptiles of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Frogs			
Blanchard's cricket frog	Acris crepitans blanchardi	B, F, M, I	C
Eastern green toad	Bufo debilis	G, I	—
Texas toad	Bufo speciosus	G, I	—
Gulf coast toad	Bufo valliceps	G, I	C
Woodhouse's toad	Bufo woodhousii woodhousii	G, I	—
Eastern narrowmouth toad	Gastrophryne carolinensis	B, F, M, I	O
Great plains narrowmouth toad	Gastrophryne olivacea	B, F, M, I	—
Cope's gray treefrog	Hyla chrysoscelis	B, F, M, I	—
Green treefrog	Hyla cinerea	B, F, M, I	C
Squirrel treefrog	Hyla squirella	B, F, M, I	O
Gray treefrog	Hyla versicolor	B, F, M, I	—
Spotted chorus frog	Pseudacris clarkii	B, F, M, I	—
Strecker's chorus frog	Pseudacris streckeri	B, F, M, I	—
Western chorus frog	Pseudacris triseriata	B, F, M, I	—
Bullfrog	Rana catesbeiana	I	C
Southern leopard frog	Rana sphenocephala	I	A
Hurter's spadefoot	Scaphiopus hurterii	G, I	—
Salamanders			
Smallmouth salamander	Ambystoma texanum	I	—
Eastern newt	Notophthalmus viridescens	I	—
Slimy salamander	Plethodon glutinosus complex	I	—
Southern redback salamander	Plethodon serratus	I	—
Western lesser siren	Siren intermedia nettingi	I	C
Crocodilians			
American alligator	Alligator mississippiensis	I	C
Lizards			
Green anole	Anolis carolinensis	B, F, M, I	—
Texas spotted whiptail	Cnemidophorus gularis	G	—
Marbled whiptail	Cnemidophorus marmoratus	G	—
Six-lined racerunner	Cnemidophorus sexlineatus sexlineatus	G	—
Five-lined skink	Eumeces fasciatus	B, F, M	C
Broadhead skink	Eumeces laticeps	B, F, M	—
Mediterranean gecko	Hemidactlus turcicus turcicus	B, F	—

Table 2.4.1-3 (Sheet 2 of 3)
Amphibians and Reptiles of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Keeled Earless lizard	Holbrookia propinqua propinqua	G	—
Western slender glass lizard	Ophisaurus attenuatus	G	—
Texas horned lizard	Phrynosoma cornutum	G	—
Texas spiny lizard	Sceloporus olivaceus	G, F	—
Southern prairie skink	Sceloporus septentrionalis obtusirostris	G, F	—
Northern fence/Prairie lizard	Sceloporus undulatus hyacinthinus	G, F	—
Ground skink	Scincella lateralis	B, F, M	C
Snakes			
Broad-banded copperhead	Agkistrodon contortrix laticinctus	B, F, M	—
Western cottonmouth	Agkistrodon piscivorus leucostoma	I	U
Texas glossy snake	Arizona elegans arenicola	G	—
Eastern yellow-bellied racer	Coluber constrictor flaviventris	G	—
Western diamondback rattlesnake	Crotalus atrox	G, F	—
Canebrake rattlesnake	Crotalus horridus atricaudatus	B, F, M	—
Great plains rat snake	Elaphe emoryi	G, F	—
Southwestern rat snake	Elaphe guttata meahllmorum	G, F	—
Texas rat snake	Elaphe obsoleta lindheimeri	G, F	C
Mud snake	Farancia abacura	I	—
Eastern hognose snake	Heterodon platirhinos	G	—
Texas night snake	Hypsiglena torquata jani	G	—
Prairie king snake	Lampropeltis calligaster calligaster	G	O
Speckled king snake	Lampropeltis getula splendida	G	O
Louisiana milk snake	Lampropeltis triangulum amaura	B, F, M	—
Texas blind snake	Leptotyphlops dulcis	B, F, M	—
Eastern coachwhip	Masticophis flagellum flagellum	G	C
Texas coral snake	Micrurus fulvius tenere	B, F, M	—
Blotched water snake	Nerodia erythrogaster transversa	I	—
Broad-banded water snake	Nerodia fasciata confluens	I	C
Diamondback water snake	Nerodia rhombifer rhombifer	I	A
Rough green snake	Opheodrys aestivus	B, F, M	—

Table 2.4.1-3 (Sheet 3 of 3)
Amphibians and Reptiles of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Bull snake	Pituophis catenifer sayi	G	—
Graham's crayfish snake	Regina grahamii	I	—
Western massasauga	Sistrurus catenatus tergeminus	G, F	—
Western pygmy rattlesnake	Sistrurus miliarius streckeri	G, F	—
Marsh brown snake	Storeria dekayi limnetes	B, F, M, I	—
Flathead snake	Tantilla gracilis	B, F, M	—
Plains black-headed snake	Tantilla nigriceps nigriceps	B, F, M	—
Checkered garter snake	Thamnophis marcianus marcianus	G, I	—
Gulf coast ribbon snake	Thamnophis proximus orarius	G, I	—
Eastern garter snake	Thamnophis sirtalis sirtalis	G, I	—
Texas lined snake	Tropidoclonion lineatum texanum	G, I	—
Ground snake	Virginia striatula	B, F, M, I	U
Rough earth snake	Virginia striatula	B, F, M	—
Turtles			
Spiny softshell	Apalone spinifera	I	U
Common snapping turtle	Chelydra serpentina	I	U
Texas tortoise	Gopherus berlandieri	G	—
Cagle's map turtle	Graptemys caglei	I	—
Yellow mud turtle	Kinosternon flavescens	I	—
Mississippi mud turtle	Kinosternon subrubrum hoppocrepis	I	—
Texas river cooter	Pseudemys texana	I	—
Common mush turtle	Sternotherus odoratus	I	—
Eastern box turtle	Terrapene carolina	G, F	—
Ornate box turtle	Terrapene ornata	G	—
Red-eared slider	Trachemys scripta	I	C

a. According to Tennant (1984, 1985, 2006), and Dixon (2000).
b. General habitats: G = bluestem grassland, B = bottomland hardwood forest, F = live oak forest, M = live oak motte, I = depressional wetland.
c. Abundance categories were intuitively based on species encounters within the project area and regional knowledge: A = abundant, C = common, U = uncommon, O = occasional, R = rare, — = not observed.

Table 2.4.1-4 (Sheet 1 of 2)
Protected Species In Counties Associated with the VCS Site

Common Name	Scientific Name	Federal Status[a]	State Status[a]	Counties[b]
Amphibians				
Sheep Frog	*Hypopachus variolosus*	—	T	Cal, Gol
Black-spotted newt	*Notopthalmus meridionalis*	—	T	Cal, Gol, Vic
Birds				
Texas Botteri's sparrow	*Aimophila botteri texana*	—	T	Nue
White-tailed hawk	*Buteo albicaudatus*	—	T	All
Piping plover	*Charadrius melodus*	LT	T	Cal, Mat
Reddish egret	*Egretta rufescens*	—	T	Cal, Jac, Mat, Vic
Peregrine falcon	*Falco peregrinus anatum*	DL	T	All
Arctic peregrine falcon	*Falco peregrinus tundrius*	DL	T	All
Whooping crane	*Grus Americana*	LE	E	All
Bald eagle	*Haliaeetus leucocephalus*	DL	T	Cal, DeW, Gol, Jac, Mat, Vic, Wha
Wood stork	*Mycteria Americana*	—	T	All
Eskimo curlew	*Numenius borealis*	LE	E	Cal, Mat
Brown pelican	*Pelecanus occidentalis*	LE-PDL	E	Jac, Mat, Vic
White-faced ibis	*Plegadis chihi*	—	T	All
Interior least tern	*Sterna antillarum athalassos*	LE	E	Gol, Jac, Vic, Wha
Sooty tern	*Sterna fuscata*	—	T	Cal, Jac, Mat
Attwater's prairie chicken	*Tympanuchus cupido attwateri*	LE	E	Vic, Wha
Fishes				
Oppossum pipefish	*Microphis brachyurus*	—	T	Cal
Mammals				
Red wolf	*Canis rufus*	LE	L	All
Jaguarundi	*Herpailurus yaguarondi*	LE	E	Cal
Ocelot	*Leopardus pardalis*	LE	E	Cal, Gol, Mat
White-nosed coati	*Nasua narica*	—	T	Vic
West Indian manatee	*Trichechus manatus*	LE	E	Cal, Mat
Black bear	*Ursus americana*	T/SA	T	Cal
Louisiana black bear	*Ursus americanus luteolus*	LT	T	Jac, Mat, Vic, Wha
Slender rushpea	*Hoffmanseggia tenella*	LE	E	Nue
Reptiles				
Loggerhead sea turtle	*Caretta caretta*	LT	T	Cal, Jac, Mat

Table 2.4.1-4 (Sheet 2 of 2)
Protected Species In Counties Associated with the VCS Site

Common Name	Scientific Name	Federal Status[a]	State Status[a]	Counties[b]
Texas scarlet snake	*Cemophora coccinea lineri*	—	T	Cal, Jac, Mat
Green sea turtle	*Chelonia mydas*	LT	T	Cal, Mat
Timber/canebrake rattlesnake	*Crotalus horridus*	—	T	Cal, DeW, Gol, Jac, Mat, Vic, Wha
Leatherback sea turtle	*Dermochelys coriacea*	LE	E	Cal, Mat
Indigo snake	*Drymarchon corais*	—	T	Gol
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	LE	E	Cal, Mat
Texas tortoise	*Gopherus berlandieri*	—	T	Cal, DeW, Jac, Gol, Mat, Vic
Cagle's map turtle	*Graptemys caglei*	—	T	DeW, Vic
Kemp's ridley sea turtle	*Lepidochelys kempii*	LE	E	Cal, Mat
Smooth green snake	*Liochlorophis vernalis*	—	T	Mat
Texas horned lizard	*Phrynosoma cornutum*	—	T	Cal, DeW, Gol, Jac, Mat

a. LE/E = Endangered; LT/T = Threatened; C = Candidate; - = Not listed; DL = delisted taxon, recovered, monitored for first five years post delisting; PDL = proposed for delisting; SA = listed due to similarity of appearance with a threatened species

b. Counties containing the proposed Exelon facilities, intake corridor and transmission lines where protected species are listed [All = listed for all counties: Cal = Calhoun, DeW = DeWitt, Gol = Goliad, Jac = Jackson, Mat = Matagorda, Vic = Victoria, & Wha = Wharton]. The main facility site is in Victoria County and the intake corridor originates in Calhoun County. New and existing transmission corridors to be upgraded will occur in all seven counties.

Sources: TPWD 2008, USFWS 2008a

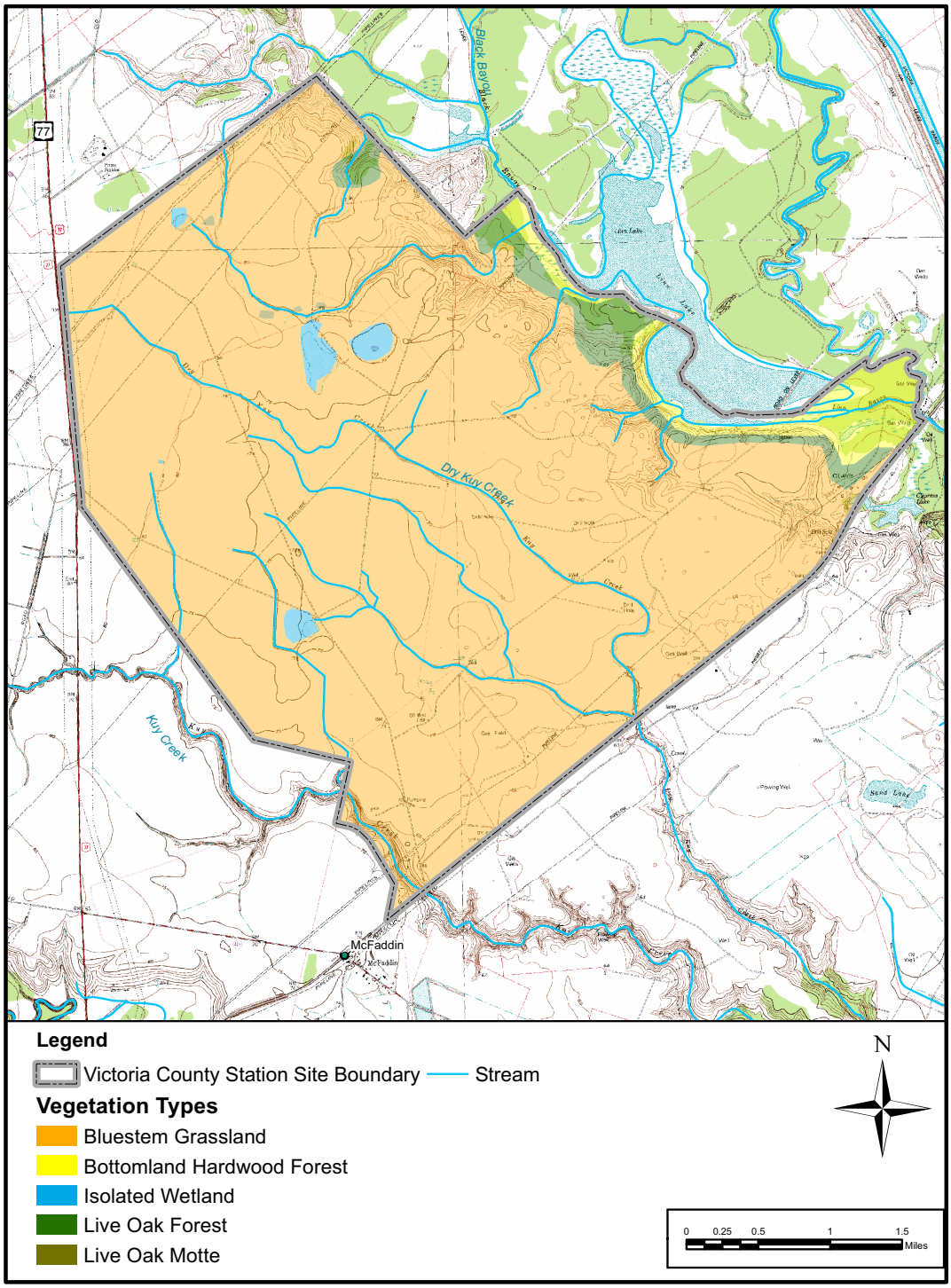

Figure 2.4.1-1 Habitat Types on the VCS Site

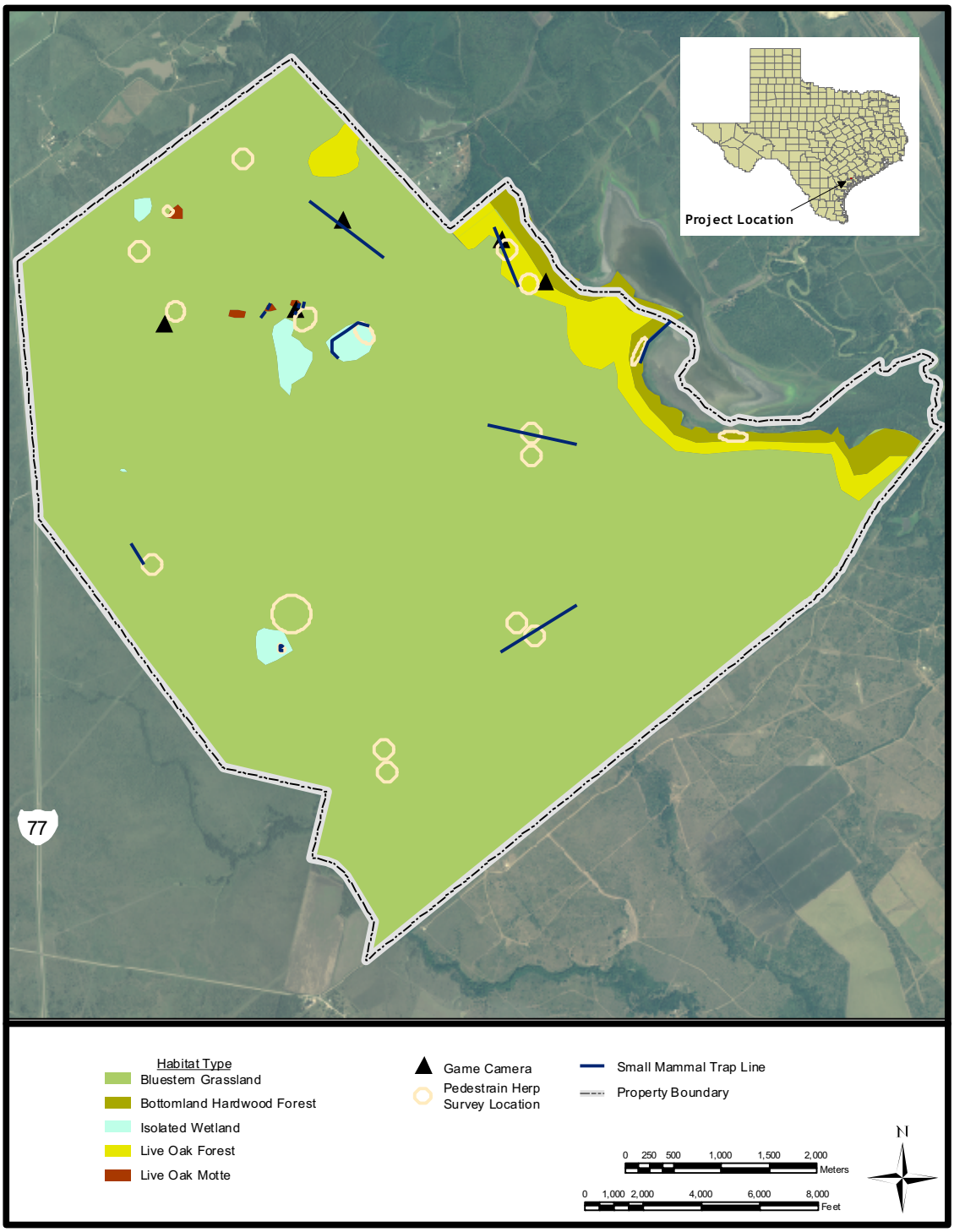

Figure 2.4.1-2 Locations of Herpetological and Mammal Surveys on the VCS Site

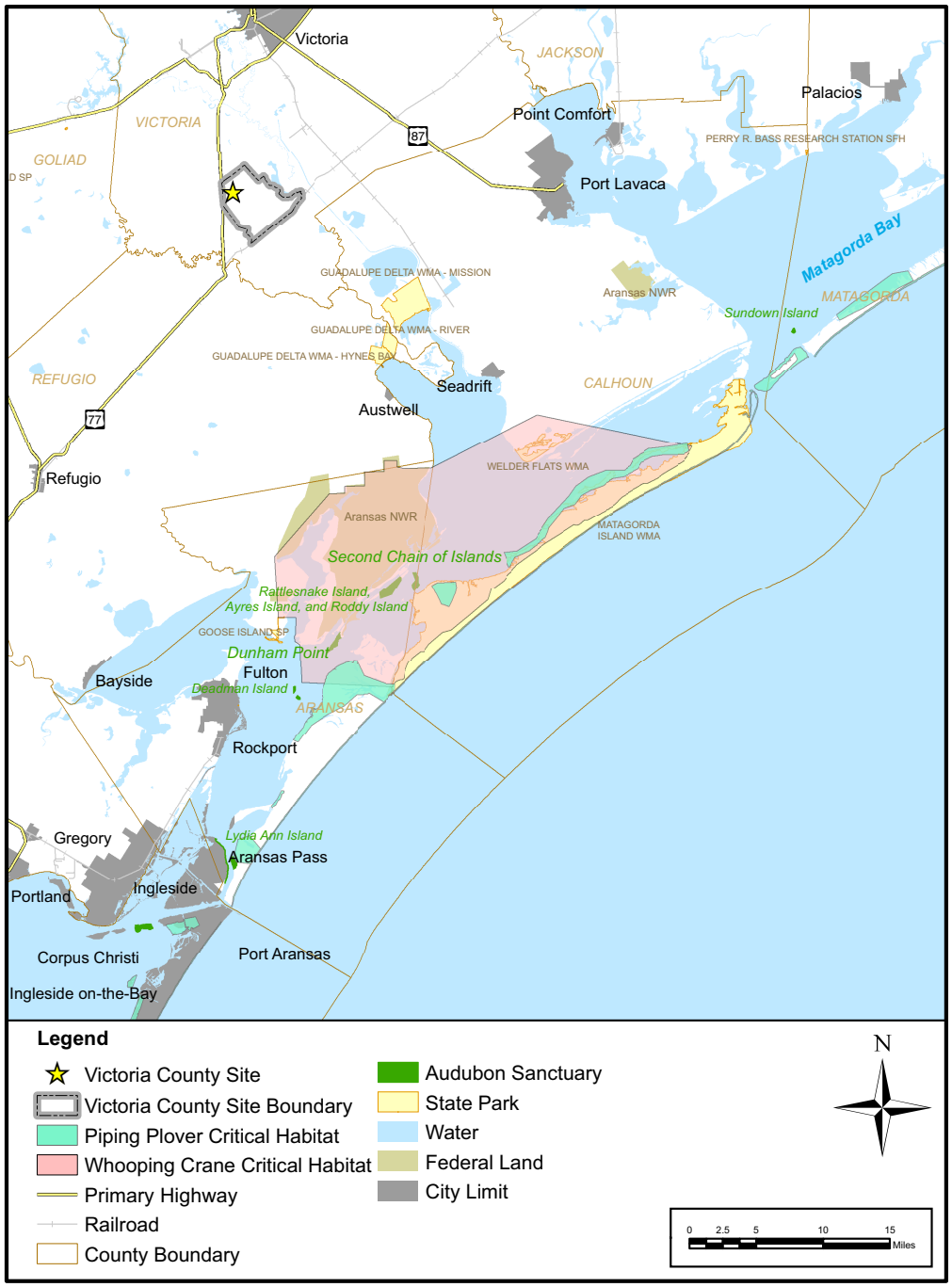

Figure 2.4.1-3 Critical Habitats, Parks, and Refuges Near the VCS Site

2.4.2 Aquatic Ecology

The surface water bodies of interest, those that could potentially be affected by construction and operation of new units at VCS Units 1 and 2 site, are:

- Onsite and near-site streams, wetlands, and ponds (including Linn Lake)
- Guadalupe River
- Guadalupe-Blanco River Authority (GBRA) Calhoun Canal

Exelon implemented a pre-application monitoring program in January 2008 to characterize the aquatic communities of these water bodies. This monitoring program is intended to support the descriptions of aquatic communities in Subsection 2.4.2 of the ER and serve as the basis for the assessment of potential impacts from construction and operation of the proposed facility.

Exelon's pre-application monitoring program encompasses fish and benthic macroinvertebrate surveys of onsite and "near-site" water bodies including several wetlands, a stock pond, permanent and intermittent streams draining the site, and two natural lakes; juvenile and adult fish sampling along approximately 18 miles of the Guadalupe River; ichthyoplankton sampling at the point where water is diverted from the Guadalupe River to the GBRA canal system; juvenile and adult fish sampling at Goff Bayou, which flows into the GBRA canal system; juvenile and adult fish sampling at a station in the GBRA Main Canal; and ichthyoplankton sampling at a station in the GBRA Main Canal. Subsection 2.4.2 summarizes the results of these surveys.

Survey results for the first 6 months of 2008 are summarized in the subsections that follow. They form the basis for the discussion of distribution and abundance of important aquatic species and assemblages on which the construction and operation of VCS could have an impact. When results for the last 6 months of 2008 are available, they will be provided to the NRC.

2.4.2.1 Aquatic Communities

2.4.2.1.1 Onsite and Near-Site Streams, Wetlands, and Ponds

The approximately 11,500-acre VCS site is located on a "bench" or terrace west of the Guadalupe River in southern Victoria County, Texas. The terrain is relatively flat on the western side of the site, sloping gently down toward the eastern side of the site. The northeastern site boundary slopes sharply downward to the Guadalupe River floodplain, more specifically Black Bayou (shown on some maps as McDonald Bayou) and Linn Lake—an oxbow lake into which Black Bayou flows (see Figure 2.4.1-1).

The site is drained by three streams: Black Bayou and its tributaries drain the northern and eastern portion of the site; Dry Kuy Creek and its tributaries drain the central and southeastern portions of the site; Kuy Creek and its tributaries drain the southwestern portion of the site (see Figure 2.4.1-1). Black Bayou is a perennial stream, while Kuy Creek and Dry Kuy Creek are intermittent/ephemeral streams. Dry Kuy Creek and several other small tributary streams held standing water in only their lower-lying sections in fall 2007 and summer 2008 and are presumed to be mostly dry during extended periods of low rainfall.

In addition to these drainages, the site contains stock ponds and ephemeral depressional wetlands of varying hydroperiods. Some of the wetland depressions appear to have been created when site roads were constructed many years ago and natural drainages were blocked or dammed. The centers of some of these wetlands have been deepened to provide additional water storage for livestock, creating open water habitats (ponds). Several additional livestock ponds have been created on the site, with most augmented by windmill-driven wells.

Linn Lake, which lies to the east of the site, is an approximately 905-acre oxbow lake. The lake is generally shallow with a muddy bottom. Although access to Linn Lake is limited, some fishermen seek panfish, bass, and catfish in its waters. The Linn Lake fishery is influenced by cycles of drought and flood in the Guadalupe River, with fish populations in the lake periodically replenished when flood waters transport fish into the basin.

The VCS site is currently used primarily for raising livestock (mostly cattle, with a few horses). No crops are cultivated. Thus, there is no regular use of agricultural chemicals. Cattle are typically restricted to small parcels of the property at any given time, while remaining areas are left ungrazed. Many of the dryer portions of the site appear to be in a 2- to 5-year-old successional stage, containing "old field/disturbed area" plants. All portions of the site show signs of livestock use.

Exelon conducted quarterly surveys of the aquatic resources of the VCS site in 2008. Onsite and near-site streams, wetlands, and stock ponds were surveyed in spring (April) and summer (July) 2008, and will be resurveyed in fall and winter 2008. Twelve sampling stations were established based on a field reconnaissance in 2007 and an examination of topographic maps and aerial photographs. Each of these sampling stations is described in detail in the section that follows. Fall and winter surveys will be provided to the NRC as they become available. Barring major flooding in the Guadalupe River, the species assemblages associated with the various onsite and near-site waterbodies are not expected to change significantly, and the April 2008 collections are considered to be representative of typical conditions in these streams, wetlands, and stock ponds for all seasons.

Station Locations and Descriptions

Station MC-1

Station MC-1 is located on a small, unnamed tributary of Black Bayou that drains a small area in the northern part of the site (see Figure 2.4.2-2). Just downstream of this sampling station, on the adjacent property, this stream has been impounded to form a small fishing pond. Station MC-1 is located in the extreme upper end of this impoundment, at the point at which the stream begins to resemble a pond. In spring and summer, this pond is almost entirely covered in floating primrose willow (Ludwigia peploides). Substrate consists of firm clay with some organic deposition.

Station MC-2

Station MC-2, a small, unnamed, deeply incised intermittent stream that drains the northeastern portion of the site, flows into the Black Bayou/Linn Lake floodplain. In spring and summer (during avian

surveys) 2008 it consisted of several small isolated pools. Substrate in these pools consists mainly of sand, with small amounts of organic matter. No aquatic vegetation grows in the pools; however, floating primrose willow, swamp smartweed (*Polygonum hydropiperoides*), and a species of millet are sometimes found in moist soil areas between the pools.

Station MC-3

Station MC-3 is a small (0.1-acre) man-made pond located near the center of the site that is used to provide water for livestock. Water in the pond is relatively clear. Two species of submerged aquatic plants are present—muskgrass (*Chara spp.*) and bushy pondweed (*Najas guadalupensis*). The margins of the pond are dominated by squarestem spikerush (*Eleocharis quadrangulata*), intermixed with sedges (*Cyperus spp.*), floating primrose willow, and cattails (*Typha spp.*).

Station MC-4

Station MC-4 is a small (0.5-acre) stock pond located directly south of MC-3 in the middle of a wetland depression. Livestock activity is very evident around the margins of the pond. As a result, water clarity is low and no submerged aquatic vegetation is present. Floating primrose willow grows around the edges of the pond.

Station MC-5 (Kuy Creek)

Station MC-5 is on Kuy Creek in a riparian woodland near the southern entrance to the site. The channel of the creek is deeply cut, with a soft to moderately firm bottom. Flows and water levels in Kuy Creek vary dramatically depending on the time of year and patterns of precipitation. No submerged aquatic vegetation is present in this section of the creek. During sustained dry periods this portion of the creek is reduced to a series of stagnant puddles. Kuy Creek drains the southwestern portion of the VCS site and flows southeast, ultimately meeting the Guadalupe River approximately 10 miles down river of the VCS site (Figure 2.4.2-1).

Station MC-6 (Dry Kuy Creek)

Station MC-6 is along Dry Kuy Creek, an intermittent/ephemeral tributary of Kuy Creek that flows southeast and drains the middle of the VCS site (Figure 2.4.2-1). Dry Kuy Creek holds water after sustained or heavy rainfall, but during dry periods it becomes a series of small stagnant pools in channel depressions. Water in these pools is typically turbid due to livestock walking through them. The substrate consists of soft silt and sand, and no aquatic vegetation is present.

Station MC-7 (Black Bayou)

Station MC-7 is on Black Bayou at a pipeline crossing a short distance above its confluence with Linn Lake. Although flows are significantly reduced during dry periods, Black Bayou is considered to be a perennial stream. Water in the bayou is generally turbid. The substrate is composed of moderately firm clay with a layer of organic material and soft silt. Although some filamentous algae may be found along the banks of the bayou, no submerged aquatic vegetation is present. Woody debris in the form of logs and fallen branches lies along the edges of the bayou.

Station MC-8 (Linn Lake)

Station MC-8 is in the upper basin of Linn Lake, a large oxbow lake, near the inflow of Black Bayou. Black Bayou empties into a broad flat of Linn Lake that is extremely shallow during most of the year and may be completely exposed during dry seasons. The substrate is composed of moderately firm clay and soft silt with an abundance of organic deposition. No submerged vegetation is present.

Station MC-9 (Linn Lake)

Station MC-9 is in the lower basin of Linn Lake, southeast of and across a large peninsula from MC-8. Linn Lake is shallow in this area with an average depth of <0.5 meters (1.5 feet). This depth is relatively consistent for several hundred meters into the lake. The substrate consists of soft silt and clay; no submerged vegetation is present.

Station MC-10 (Upper Cypress Lake)

Station MC-10 is in the headwaters of Cypress Lake, just upstream of the railroad trestle that marks the site boundary. It includes an expanse of shallow water (swamp) and a creek channel with a maximum depth of approximately 1 meter (3.3 feet). The substrate is moderately firm sand with some silt in quiescent areas. Vegetation along shorelines and islands includes bald cypress, black willow, and box elder. Large bald cypress trees were also present in the swamp and stream channel. No submerged aquatic vegetation is present.

Station MC-11

Station MC-11 is a stock pond in the approximate center of the VCS site. The surface area of the pond is approximately 0.5 acre. Substrate in the pond consists of loose, silty clays and sand. Water in the pond is very turbid, and there is no evidence of submerged aquatic vegetation. Because the pond is heavily used by livestock, no aquatic vegetation grows along its banks.

Station MC-12

Station MC-12 is a large, ephemeral wetland with the appearance of a freshwater marsh during rainy seasons and a pasture during dry seasons. During the April 2008 sampling effort, one small open area occurred in the middle of the wetland that was approximately 25 meters (84 feet) by 37 meters (120 feet). Water was clear, and substrate was composed of moderately soft soil with abundant organic deposition. The isolated emergent wetland is dominated by squarestem spikerush and rattlebush. Other associated vegetation consisted of American lotus (*Nelumbo lutea*), longbarb arrowhead (*Sagittaria longiloba*), grassy arrowhead (*S. graminea*), spider lily (*Hymenocallis occidentalis*), and swollen bladderwort (*Utricularia vulgaris*). In July 2008, during avian surveys, soils at the site were completely dry, and all wetland vegetation had died.

Fish Sampling

Fish in onsite and near-site water bodies were sampled in April and July 2008, and will be sampled again in the fall and winter. Due to the variation in habitats observed at the 12 sites, a variety of

sampling methods was employed to efficiently capture resident fishes. Active sampling techniques included backpack electrofishing and seining. Passive sampling techniques included minnow traps, sunfish traps, and gill nets.

Fish were identified to species, measured, weighed, and released, unless it was necessary to retain a voucher specimen. In addition to fish data, detailed notes were taken on the conditions observed at each site. These notes included dominant substrate, aquatic and riparian vegetation, water level/depth, weather conditions, water clarity, and presence of other wildlife.

The spring onsite fish survey resulted in capture of 1654 individuals representing 14 families and 34 species (Table 2.4.2-1). The western mosquitofish (*Gambusia affinis*) was the most abundant species overall, representing 30% of all fish captured. This is expected given that habitat at some of the sites (e.g., MC-6 and MC-2) consisted of a series of small stagnant pools. Western mosquitofish are tolerant of poor water quality and are often the last species to survive in stagnant ponds and ditches that are subject to high temperatures and low dissolved oxygen concentrations. Warmouth (*Lepomis gulosus*), bluegill (*Lepomis macrochirus*), white crappie (*Pomoxis annularis*), green sunfish (*Lepomis cyanellus*) and other members of the family Centrarchidae were present at most sampling locations and comprised 52% of all fish captured in onsite and near-site water bodies.

Golden shiners (*Notemigonus crysoleucas*) were documented in large numbers at MC-3, but were not captured elsewhere. This species is sold by bait dealers in Texas and may represent the result of a "bait-bucket introduction" at this location. Other introduced or exotic species captured included the Rio Grande cichlid (*Cichlasoma cyanoguttatum*; captured at MC-8), Mexican tetra (*Astyanax mexicanus*; captured at MC-7 and MC-10), vermiculated sailfin catfish (*Pterogoplichthys disjunctivus*), and common carp (*Cyprinus carpio*; captured at MC-4, MC-9, and MC-11). Of these, common carp was the most abundant (23 individuals) and the most widespread, appearing in collections from 3 of 12 water bodies sampled.

Species richness was highest at MC-10 (Upper Cypress Lake) where 19 species were captured, and was lowest at MC-12 (an ephemeral wetland) where western mosquitofish was the only species captured. In general, stations on the eastern edge of the site, those associated with the Black Bayou-Linn Lake system and Cypress Lake, had the largest number of fish species. These areas are associated with year-round water and are assumed to be replenished (recolonized) periodically when the Guadalupe River floods. The exception to this general rule was Station MC-11, a pond in the upper reaches of the Dry Kuy Creek drainage that is a short distance from the creek. This station contained 12 fish species. It appears that this pond has been colonized by fish moving upstream during high-rainfall periods when the creek overflows and spills into the pond. The Kuy Creek and Dry Kuy Creek sampling stations, however, were both low in species richness, with five and two species, respectively. Both creeks are subject to alternating periods of flood and drought, and their fish communities are presumed to vary dramatically as a result. The presence of sport fish, including largemouth bass, white and black crappie, and redear sunfish, in several onsite ponds indicates stocking by fishermen or ranch managers in the past.

No state- or federally listed threatened or endangered species was collected during the spring or summer aquatic surveys. Given that no state- or federally listed species has been recorded in Victoria County (TPWD 2007d), the likelihood of a listed species appearing in collections from onsite and near-site streams and ponds is extremely remote.

Even though they were only captured at two stations, smallmouth buffalo (*Ictiobus bubalus*) dominated the overall biomass (Table 2.4.2-2). Other large contributors to overall biomass included alligator gar (*Atractosteus spatula*), common carp (*Cyprinus carpio*), blue catfish (*Ictalurus furcatus*), and white crappie (*Pom oxis annularis*).

An extended period of low rainfall in the Victoria County area lowered water levels (or eliminated water altogether) at all onsite sampling locations, and severely hampered the summer (July) sampling effort. Five of the 12 onsite sampling stations (MC-2, MC-6, MC-8, MC-10, and MC-12) were completely dry in July. At the other seven stations, water levels had dropped dramatically since the April sampling, rendering all but one gear type (beach seine) unusable. Relatively small numbers of fish were collected at these seven locations. Sampling results were useful only to the extent that they illustrate the severe stresses to which aquatic biota in the onsite water bodies are subjected. Two new species—striped mullet (*Mugil cephalus*) and sheepshead minnow (*Cyprinodon variegatus*)—were collected at MC-7 (Black Bayou) in July. Black Bayou was the only onsite or near-site stream that was not reduced by the drought to isolated puddles of water.

Benthic Macroinvertebrate Sampling

Benthic samples were collected in conjunction with fish sampling in April 2008. Three grabs were taken at each sampling location with an Ekman dredge, filtered through a sieve bucket to remove excess silt, and composited into one sample. In the laboratory, samples were sorted and identified to the lowest practical taxon with the aid of a digital zoom stereomicroscope.

Methods for determining Aquatic Life Use (ALU) based on macroinvertebrate samples collected from depositional habitats have not been developed by the Texas Commission on Environmental Quality (TCEQ 2007). However, metrics and scoring criteria for rapid bioassessment protocols associated with Surber samples are available (TCEQ 2007). Therefore, in an attempt to provide some means of comparison between sites, Ekman dredge data were analyzed with this protocol to determine ALU designations. Caution should be taken in interpreting these designations due to inherent differences in sampling technique.

The number of each taxon (group) collected, as well as its percent relative abundance at each sampling location is presented in Table 2.4.2-3. A total of 246 specimens representing at least 20 families and 33 genera were collected. The number of specimens identified from each station varied from none at MC-6 to 85 at MC-1. The absence of benthic organisms at MC-6 is consistent with the fact that this station was reduced to a pair of muddy puddles in April. Flies and midges (Order Diptera) dominated collections at 11 of 12 sampling stations, and accounted for approximately 71% of all specimens collected. Two families of Dipteran midge larvae (Chaoboridae and Chironomidae) were particularly

abundant. Midge larvae are considered indicators of poor water quality and tolerant of pollution (EPA 2007). Excluding dipterans, the most numerous taxa were molluscs and mayflies.

The aquatic life use classifications calculated for each station are presented below (INT: intermediate, LIM: limited). Most sites were rated for "intermediate" aquatic life use (see below). Only one site, MC-3, was scored as "high" aquatic life use. This shallow pond had extensive aquatic vegetation and woody debris around the edges. As a result, littoral areas contained large amounts of organic matter (i.e., decayed and decaying plant material) important for benthic organisms. Sites with limited designations (MC-2, MC-6, and MC-11) contained no aquatic vegetation, and thus had little available organic matter in littoral areas.

Aquatic life use designations based on benthic invertebrates from 12 locations at the Exelon Victoria County Site are presented below:

	MC-1	MC-2	MC-3	MC-4	MC-5	MC-6	MC-7	MC-8	MC-9	MC-10	MC-11	MC-12
Source	25	19	32	29	25	0	27	23	23	27	19	23
ALU	INT	LIM	HIGH	INT	INT	LIM	INT	INT	INT	INT	LIM	INT

The relative scarcity of benthic macroinvertebrates and prevalence of pollution-tolerant forms appears to be substrate-related rather than water quality-related. Rankings appeared to be independent of dissolved oxygen levels, for example. One of the sampling stations ranked as "limited" had the highest dissolved oxygen concentration measured. Substrates tended to be clay or sand and largely devoid of organic material. The aquatic vegetation, leaf litter, and woody material that would allow a more diverse benthic community to develop were almost never present. Only one station, MC-3, contained more than a few pollution-intolerant species, and as noted previously, this station contained a lush growth of aquatic vegetation as well as substantial amounts of woody debris.

As noted previously, in the description of fish sampling, low water levels hampered sampling of aquatic biota in July. Five of 12 sampling locations could not be sampled at all. Water bodies that were sampled for benthic macroinvertebrates were stagnant with low dissolved oxygen levels. Benthos sampling results reflected these poor water quality conditions.

2.4.2.1.2 Guadalupe River

The Guadalupe River rises in western Kerr County in south-central Texas. It flows southeast for approximately 250 miles before it empties into Guadalupe Bay (the northernmost arm of San Antonio Bay) near Seadrift, Texas (TPWD 2007a). The upper Guadalupe River, which flows across the Edwards Plateau, offers steep limestone bluffs, rapids, and stream banks lined with large cypress, oak, and elm trees. It crosses the Balcones Fault Line near New Braunfels (TSHA 2008), at which point it becomes a twisting, turning, slow-moving, coastal river with none of the limestone bluffs and rapids that characterize the upper river (TPWD 2007a). The Texas Parks and Wildlife Department (TPWD) has designated the portion of the Guadalupe River from Farm-to-Market Road 447 in northwest Victoria County to its mouth on Guadalupe Bay as "ecologically significant" because it supports extensive

freshwater and estuarine wetlands including the Guadalupe Delta Wildlife Management Area, one of the largest wetland reserves in the United States (TPWD 2007b).

The Guadalupe River's two most important tributaries are the Comal and San Marcos rivers. Its drainage area is approximately 6070 square miles (TSHA 2008). One major reservoir, 8300-acre Canyon Reservoir, and many smaller reservoirs have been built on its mainstem. Coleto Creek Reservoir (3100 acres) lies approximately 11 air miles northwest of the VCS site and approximately 20 miles upstream of the proposed VCS discharge on the Guadalupe River. Coleto Creek Power Plant, a 632 MW coal-fired unit, was built on Coleto Creek, a tributary of the Guadalupe River, and went into service in 1980. The power plant uses Coleto Creek Reservoir as its cooling water source. The San Antonio River, another major tributary, merges with the Guadalupe River approximately 11 miles downstream of the Union Pacific railroad trestle}, which is a short distance (0.25 miles) from the eastern boundary of the VCS site.

The Guadalupe River, in the vicinity of the VCS site, is characterized by a deeply incised channel and a broad (2- to 4-mile wide) floodplain. Substrates are typically mud and silt and contain a large amount of woody debris. Channel widths range from 34-54 meters, and mid-channel depths range from 2.3-6.0 meters. Logjams, created when dead and uprooted trees are carried downstream during floods and deposited when flood waters recede, are common. The GBRA periodically removes these logjams, which interfere with normal river flows and impede boat traffic.

Sampling Locations and Descriptions

Exelon is conducting an assessment of the aquatic resources of the Guadalupe River over a 12-month period in 2008. Surveys of fish and benthic macroinvertebrates were conducted monthly at five sampling stations, designated GR-01 through GR-05, along an 18-mile reach of river (Figure 2.4.2-1). The upstream-most station, GR-01, is in the area of the proposed discharge structure, and is approximately 1 mile southwest of the Invista Victoria Plant. This section of the river also receives effluent from the Invista Victoria Plant. Station GR-02 is immediately downstream of the point at which Linn Bayou empties into the Guadalupe River. Station GR-03 represents a "typical" river reach with no shoreline development and no industrial activity, and is in the approximate center of the 18-mile-long study area. Station GR-04 lies just downstream of the Kuy Creek-Guadalupe River confluence and approximately 0.5 mile upstream of the confluence of the San Antonio River and the Guadalupe River. Station GR-05 is adjacent to the diversion structure/gates of the GBRA Diversion Canal, the point at which water is diverted from the Guadalupe River into the GBRA's Calhoun Canal System. Station GR-05 is also a short distance upstream of the GBRA's Salt Water Barrier, which is used to prevent salt water intrusion from Guadalupe Bay/San Antonio Bay during periods of drought and low flow in the Guadalupe River. In addition to collecting fish and benthic samples, biologists gathered information on physical characteristics of the river and river bed and took field measurements of water quality in order to characterize habitat quality. Habitats at the five Guadalupe River sites are similar, and are all characterized by a deeply incised channel, a mud and silt substrate, and large amounts of woody debris (sticks, branches, logs), both floating and submerged. The river is normally very turbid, preventing the

establishment of submerged aquatic vegetation. Floating aquatic plants, such as water lettuce and water hyacinth, are present but are relatively uncommon in the river.

Fish Sampling

Biologists used boat-mounted electrofishing gear to collect baseline data on study area fish from January 2008 through June 2008 at the five Guadalupe River sampling sites, (each associated with an approximately 650-meter long transect). (Sampling will continue through December 2008.) Electrofishing was employed because it is the least selective sampling method available and efficiently collects fish from most riverine habitats (i.e., runs, shallows, shoals, undercut banks, and backwaters). Barbour et al. (1999) noted that all fish sampling gear is selective to some degree, but "electrofishing has proven to be the most comprehensive and effective single method for collecting stream fishes."

In total, 4680 fish representing 39 species were collected from the five Guadalupe River sites (Table 2.4.2-4). Overall, red shiner (*Cyprinella lutrensis*, 34.6% of total), gizzard shad (*Dorosoma cepedianum*, 9.4%), striped mullet (*Mugil cephalus*, 8.2%), spotted gar (*Lepisosteus oculatus*, 8.1%) and Mexican tetra (*Astyanax mexicanus*, 5.7%), were the most abundant species, comprising more than 66% of all fish collected. Bluegill (Lepomis macrochirus), Western mosquitofish (*Gambusia affinis*), and threadfin shad (*Dorosoma petenense*) were also relatively common, each representing more than 3% of all fish collected.

As indicated in Table 2.4.2-4, 18 fish species were collected at all five sampling sites, suggesting widespread distribution in the lower river, although some of these species, like the Rio Grande cichlid (*Cichlasoma cyanoguttatus*), the channel catfish (*Ictalurus punctatus*) and the freshwater drum (*Aplodinotus grunniens*), were collected in fairly low numbers. Other species had a more limited distribution. For example, the ribbon shiner (*Lythrurus fumeus*) and burrhead chub (*Macrhybopsis marconis*) were collected at only one station, GR-01, and only one specimen of each species was captured. Alligator gar (*Atractosteus spatula*) were collected only at station GR-04, and in very small numbers (3 individuals over the 6-month sampling period). Three species were collected only at station GR-05, the downstream-most sampling location: grass carp (*Ctenopharyngodon idella*), golden topminnow (*Fundulus chrysotus*), and sheepshead minnow (*Cyprinodon variegatus*).

In summary, 39 species of fish representing 17 families were collected from the Guadalupe River study area over the January-June sampling period. The family Centrarchidae contributed the most species (11), followed by Cyprinidae (7), Ictaluridae (3), and Lepisosteidae (3). As noted previously, the species most commonly collected were red shiner, gizzard shad, striped mullet, spotted gar, and Mexican tetra. These species, which are all well adapted to life in turbid, low-gradient, coastal plain streams like the Guadalupe River, are common residents of streams and bayous along the Texas coast (Lee et al. 1980, Mettee et al. 1996, Chilton 1997, Hassan-Williams and Bonner 2007, TPWD 2007c).

Although red shiners, gizzard shad, and striped mullet were numerically dominant in Guadalupe River samples, they constituted a comparatively small proportion of the fish biomass. Four species generally regarded as "rough fish" accounted for 66%, by weight, of the fish collected: spotted gar (29.7%),

smallmouth buffalo (14.4%), common carp (11.3%), and longnose gar (10.7%) (Table 2.4.2-5). By contrast, five popular gamefish (largemouth bass, spotted bass, white crappie, black crappie, and bluegill) collectively made up only 2.2% of fish collected, by weight.

Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate samples were collected monthly at the five Guadalupe River stations beginning in April 2008. Sampling was conducted with a standard, manually operated Petite Ponar Dredge. Three sediment grabs were taken at each site, one along each bank and one in mid-river, and then composited into one sample. In the laboratory, samples were sorted and identified to the lowest practical taxon with the aid of a digital zoom stereomicroscope.

Methods for determining aquatic life use based on Ponar dredge samples have not been developed by the TCEQ (TCEQ 2007). However, metrics and scoring criteria for rapid bioassessment protocols associated with Surber samples do exist (TCEQ 2007) and were used as surrogates. Therefore, in an attempt to provide some means of comparison between sites, Ponar dredge data were analyzed with this protocol to determine ALU designations. Caution should be taken in interpreting these designations due to inherent differences in sampling technique.

The number of taxa collected, as well as their percent relative abundance at each site is presented in Table 2.4.2-6. The most abundant invertebrate taxon overall was a gastropod mollusc (*Hydrobiidae*), which was collected in extremely high numbers at several sites. An invasive bivalve mollusc, the Asiatic clam (*Corbiculidae*), was relatively common at all five river sites. Corbiculidae exhibited their highest abundance at GR-03 and GR-04. Other common species included several varieties of midges (*Chironomidae*), riffle beetles (*Elmidae*), and burrowing mayflies (*Ephemeridae*). When applying the benthic metrics and scoring criteria described above, all five river sites received "intermediate" aquatic life use designations.

Two insect species are shown on the Texas Parks and Wildlife Department's (TPWD) Rare, Threatened, and Endangered Species of Texas database as potentially occurring in Victoria and Calhoun Counties: a mayfly (*Tortopus circumfluus*) and the Texas asaphomyian tabanid fly (*Asaphomyia texensis*) (TPWD 2007d). These species have no official status or legal protection in Texas; however, they are rare and considered species of concern in the broadest sense, meaning that TPWD biologists are concerned about their conservation and these concerns are factored into the agency's reviews of proposed projects. One of these, the Tortopus mayfly, was collected at station GR-01. This mayfly is only known from a small region in and around Victoria County.

2.4.2.1.3 GBRA Calhoun Canal System

The GBRA operates and maintains a water delivery system in the lower Guadalupe River drainage that conveys fresh water to municipal, industrial, and agricultural customers in the region. The GBRA Calhoun Canal System includes the Lower Guadalupe Diversion Dam and Salt Water Barrier, two smaller salt water barriers on Hog and Goff Bayous, a pump station operated jointly by Dow Chemical and the GBRA, a separate GBRA-operated pump station for area refineries, and approximately 80

miles of delivery canals and 8 miles of water supply pipeline. The Canal System provides water to rice, pasture and row crop producers, aquaculture ventures, BP Chemicals Company, Seadrift Coke, Dow Chemical, the GBRA Port Lavaca Water Treatment Plant, and Calhoun County Rural Water Supply System, as well as the Aransas National Wildlife Refuge's Whitmire Unit. The Guadalupe River immediately upstream of the GBRA Salt Water Barrier is the source of the fresh water that is distributed to GBRA's agricultural, industrial, and municipal users via the canal system.

Goff Bayou

Goff Bayou fish are being sampled by electrofishing at a transect immediately upstream of the GBRA's Inverted Siphon (Figure 2.4.2-1). The Goff Bayou site is considerably shallower than the Guadalupe River sites with a maximum depth of approximately 9.2 feet (2.8 meters). The invasive water hyacinth (*Eichhornia crassipes*) is abundant at the Goff Bayou site. As indicated in Table 2.4.2-4, electrofishing collections at this site over the January-June sampling period were numerically dominated by gizzard shad (26.3% of total), striped mullet (18.6%), and spotted gar (9.9%). These three species accounted for 55% of all fish collected at this site. Bluegill (4.9%), common carp (4.6%), smallmouth buffalo (4.4%), and inland silverside (4.3%) were also relatively common. A total of 796 fish representing 31 species were collected over the 6-month sampling period. The total weight of fish captured at this site over the 6-month sampling period was 219.3 kilograms, the highest of the sites surveyed (Table 2.4.2-5). This was nearly double the average weight captured at the five Guadalupe River sites (118.5 kilograms) and 17 times the weight of fish collected from the GBRA Main Canal (13 kilograms). The comparatively high biomass of fish collected at Goff Bayou reflects the presence of substantial numbers of large-bodied "rough" fish (e.g., smallmouth buffalo, spotted gar, and common carp), and the high density of striped mullet. The amount of fish biomass at this site is presumed to be related to a habitat factor or factors, such as the lush growth of aquatic weeds that promote growth and survival of the heavier-bodied species and striped mullet. Goff Bayou offers an abundance of forage (small prey species) for the spotted gar and other top-of-the-food-chain predators, dense aquatic vegetation that provides cover and food for a variety of fish species, and a rich, organic bottom substrate with decaying vegetation and invertebrates that provides food for the bottom-feeding species (e.g., smallmouth buffalo, common carp, and striped mullet).

One species collected from the Goff Bayou site has never before been documented from Texas. Two specimens of bluefin killifish (*Lucania goodei*) were captured from Goff Bayou during the February 2008 electrofishing survey, and a third specimen was captured during March 2008 ichthyoplankton tows. Digital photographs of one specimen were sent to an ichthyologist at the Florida Museum of Natural History, who confirmed the identification made by Exelon biologists. This species is native to Atlantic Coast drainages in Georgia and in peninsular Florida west to the Choctawhatchee River drainage in the Florida panhandle (Mettee et al. 1996). Given the great distance from the nearest recorded population and the fact that this species has never been documented in Texas, its presence is likely the result of an introduction. The bright blue and orange fin coloration exhibited by this species make it popular with

aquarium hobbyists. Future sampling should determine whether these individuals are survivors of a single introduction (fish released by a hobbyist) or if a breeding population has become established.

GBRA Main Canal

The GBRA Main Canal is sampled by electrofishing at a single transect near the Relift No. 1 Pump Station (Figure 2.4.2-2). The GBRA Main Canal has a maximum depth of 5.6 feet (1.7 meters) and much less woody debris than the Guadalupe River and Goff Bayou sampling locations. Cover in the canal is limited to vegetation along the edges, consisting mainly of water hyacinth. Collections from the Main Canal were dominated by sunfish (*Centrarchids*) and small-bodied schooling species. Longear sunfish (*Lepomis megalotis*) and warmouth (*Lepomis gulosus*) were the most abundant sunfish, making up 27.5% and 11.6%, respectively, of all fish collected from this site (Table 2.4.2-4). Minnows (*Cyprinidae*) and minnow-like species, such as the inland silverside (*Menidia beryllina*), were also abundant at this site. There were noticeably fewer large-bodied species such as gar and catfish at this location. The total weight of fish captured at this site over the 6-month period was only 13 kilograms, as opposed to 219.3 kilograms at the Goff Bayou site and 118.5 kilograms (on average) at the five Guadalupe River sampling stations (Table 2.4.2-5).

Although the Guadalupe River and GBRA Calhoun Canal sites were similar in terms of species richness and densities (if not biomass) of fish present, there were obvious differences in the types of fish present. The Guadalupe River fish assemblage was dominated by freshwater species commonly found in freshwater streams across south Texas. Several marine-estuarine species were present, but, with the exception of the striped mullet, they tended to be uncommon in collections. The GBRA Calhoun Canal sites had relatively more marine-estuarine species and had five marine-estuarine species not collected from the Guadalupe River sites: ladyfish, bay anchovy, Gulf menhaden, pinfish, and Gulf pipefish. The two Calhoun Canal sites typically had higher conductivities during the sampling period than the Guadalupe River sites (station GR-05 was the exception), reflecting their proximity to the high-conductivity (brackish) waters of Guadalupe Bay and San Antonio Bay, and offered water quality conditions slightly more conducive to marine and estuarine fish species. Salinities at all the study sites were low, however, on the order of 0.3 parts per thousand (stations GR-01, -02, -03, and -04) to 0.4 parts per thousand (station GR-05, Goff Bayou, GBRA Main Canal).

2.4.2.2 Important Aquatic Resources

2.4.2.2.1 Important Aquatic Species

"Important species," including rare species and commercially or recreationally valuable species, have also been considered. Rare species include species listed by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) as threatened or endangered, species proposed for listing by these agencies, species that are candidates for listing by these agencies, and species that are listed as threatened or endangered by the state in which the proposed facilities are located. Although diadromous (migratory) fish are not one of the groups designated as "important," migratory fish have also been considered in the impact assessment.

Rare/Sensitive Species

Construction and operation of proposed new units at the VCS site could potentially impact aquatic populations, including sensitive species, located in onsite and near-site streams, wetlands, and ponds (Victoria County); the lower Guadalupe River (Victoria and Calhoun Counties), and the GBRA Calhoun Canal System (Calhoun County). Consequently, TPWD county lists were reviewed to identify sensitive aquatic species in these three counties. Sensitive species in this context are (1) state- or federal-listed species, (2) species that are candidates for federal listing, and (3) species proposed for listing by the USFWS.

Only one protected aquatic species, the opossum pipefish (*Microphis brachyurus*), is known to occur in these counties. The opossum pipefish, listed as "threatened" by the state of Texas and designated a "species of concern" by the NMFS, occurs in coastal portions of Calhoun County, but has not been recorded in Victoria County (TPWD 2005; TPWD 2007d). Breeding adult opossum pipefish are found in low-salinity portions of estuaries along the Atlantic Coast of Florida and from the Gulf Coast of Florida to Mexico (NMFS 2007). Larvae are carried by coastal rivers into higher-salinity (brackish) estuarine waters, where they develop into late-stage larvae and juveniles. Juveniles are normally found in coastal marine and oceanic environments. There, they continue to develop and then migrate as adults back to freshwater tributary streams, generally within 30 miles of the coast (NMFS 2007). This species is dependent on freshwater streams and marshes along the Gulf Coast habitats that have been replaced by development and degraded by water quality changes and alterations of historic flow regimes. The American eel (*Anguilla rostrata*), although not listed as threatened or endangered by TPWD or the USFWS, is documented as rare within the state. This species occurs in most coastal counties in Texas, including Calhoun and Victoria Counties.

TPWD county lists have also been reviewed to identify sensitive aquatic species in counties that would be crossed by the proposed RWMU system intake pipeline and transmission line corridors. Seven counties would be affected: Calhoun, Dewitt, Goliad, Jackson, Matagorda, Victoria, and Wharton. Only one protected aquatic species, the opossum pipefish, is known to occur in these counties. The opossum pipefish has been recorded in coastal portions of Calhoun County (TPWD 2007d). As described in the previous paragraph, this species spawns in fresh and low-salinity estuarine waters along the coast of Texas and could be present in lower reaches of rivers and streams flowing into Matagorda and San Antonio bays (TPWD 2005). The American eel is believed to occur in seven of the eight counties, with DeWitt the only exception. As noted in the previous subsection, the possibility exists that other unrecorded or recently discovered rare species might occur in the aforementioned counties. Exelon has written the TPWD, the USFWS, and the NMFS seeking information on any state- or federal-listed species that might be affected by construction and operation of VCS.

As described previously, Exelon commissioned baseline aquatic surveys of: (1) the VCS site, (2) an 18-mile-reach of the Guadalupe River, and (3) selected portions of the GBRA's Calhoun Canal system. The goal of the surveys was to establish baseline conditions in these water bodies for purposes of impact assessment and to identify any special status aquatic species that might be present. To date, no

state-listed or federally listed species has been collected. A single American eel was observed, but not captured, by biologists electrofishing at Guadalupe River station GR-05 in April. American eels have been documented in the upper Guadalupe River drainage and, therefore, this species' presence in the study area was not unexpected.

Three possible range extensions have been documented as a result of fish community sampling. Bantam sunfish (*Lepomis symmetricus*) have been collected from the Guadalupe River and the GBRA Main Canal, but have not been collected from Goff Bayou. The southwestern boundary of this species' range was previously reported as being the Colorado River in Texas (Hubbs et al. 1991, Thomas et al. 2007). Also, one ribbon shiner (*Lythrurus fumeus*) was collected at GR-01 in January 2008. The southwestern boundary of this species' range was thought to be the Lavaca River drainage. However, given that only one specimen has been collected, this may simply represent a migrant from populations in the nearby Lavaca River and does not necessarily indicate a persistent (breeding) population. One species new to Texas, the bluefin killifish (*Lucania goodei*), has been collected in Goff Bayou and the GRBA Main Canal, but has not been collected from the Guadalupe River. The bluefin killifish, a brightly colored topminnow (*Fundulid*), is native to southeast Georgia, Florida, and Alabama, and has been introduced into North and South Carolina. This species has no special status in the state of Texas; however, the specimens collected were almost certainly fish released (intentionally or inadvertently) by home aquarists or were descendants of fish released by aquarists.

Commercially or Recreationally Important Species

Based on anecdotal reports and casual interviews of local residents, no commercial fishermen are currently working the Guadalupe River in the vicinity of the VCS site. The lower Guadalupe River offers typical Texas coastal plain recreational fishing opportunities, with a variety of centrarchid (e.g., bluegill, warmouth, largemouth bass, spotted bass) and ictalurid (e.g., blue catfish, channel catfish, flathead catfish) species present in good numbers. Other common species, including the smallmouth buffalo and freshwater drum, are regarded as "rough fish" by most sport fishermen, but are prized as food fish by some. Species such as spotted gar and longnose gar, collected frequently during the study from the project area, are occasionally sought by bow fishermen. The TPWD has not conducted creel surveys in the project area to quantify angler effort, harvest, or success. Anecdotal information suggests that blue, flathead, and channel catfish are the most sought-after species, followed by centrarchids such as largemouth bass and panfish (Lepomids, including bluegill, warmouth, and longear sunfish). Limited public access and logjams in this reach of the Guadalupe appear to reduce fishing pressure. The GBRA Diversion Canal and associated creeks and bayous are also used by local fishermen who launch boats at a public boat ramp on Hog Bayou and fish for catfish, bass, and panfish.

In the lowest reaches of the river, especially the Guadalupe Delta area, trotlining for blue, channel, and flathead catfish is a popular activity. Commercial fishing and crabbing are also important in the Guadalupe Delta region. There is also some commercial crabbing in the Guadalupe River from its mouth (point at which it empties into Guadalupe Bay) north to State Highway 35, the state-designated

freshwater-saltwater boundary and the legal boundary for commercial crabbing. A portion of Goff Bayou lies north of Highway 35 and is used by at least one commercial crabber.

Diadromous Species

Based on a literature review and the ongoing surveys, no anadromous fish species ascend the Guadalupe River to spawn upstream or downstream of the VCS site. There are relatively few true anadromous species (e.g., Gulf sturgeon [*Acipenser oxyrinchus desotoi*], Alabama shad [*Alosa alabamae*], and striped bass [*Morone saxatilis*]) in the Gulf of Mexico, and these species spawn in rivers flowing into the Gulf of Mexico further east, in Louisiana, Mississippi, Alabama, and Florida (USFWS undated). One migratory fish species, the American eel, does ascend Gulf Coast streams in Texas, including the Guadalupe River.

The American eel occurs in rivers and streams along the east coast of the United States from Maine to Florida, and along the Gulf Coast from Florida to Texas (Facey and Van Den Avyle 1987). The American eel is catadromous, growing to sexual maturity in fresh water and migrating hundreds of miles into the Atlantic Ocean (the Sargasso Sea) to spawn. Eggs spawned in the Sargasso Sea drift westward and northward with ocean currents and develop into larvae, then nektonic glass eels. The eels swim west across the Continental Shelf and enter Atlantic Coast and Gulf Coast estuaries, where they mature into adults. Small numbers of eel larvae are carried by winds and currents from the Atlantic Ocean into the Gulf of Mexico, almost certainly via the Yucatan Strait. From the Gulf of Mexico, young eels "wander" into Gulf Coast and Central American estuaries and rivers (Nedeau 2005). American eels are uncommon in Texas. In 30 years of sampling coastal waters, the Coastal Fisheries Division of the TPWD encountered only seven eels, in Matagorda Bay, San Antonio Bay, and Corpus Christi Bay (three in 1984, one in 1986, one in 1988, and two in 2001). The Inland Fisheries Division of the TPWD encountered only 15 eels in 20 years of sampling in freshwater reservoirs and streams, two in the 1980s, ten in 1990, and three in 2003 to 2004, (NatureServe 2008).

In response to a petition received in November 2004, the USFWS announced (on July 6, 2005) in a 90-day finding that it was initiating a status review to determine if listing the American eel was warranted (70 FR 38849). The discussion of population status indicated that population declines have been most dramatic in Canada and New England, and that populations may be stable in the southeastern United States. On February 2, 2007, the USFWS published its findings on a Petition to List the American eel (72 FR 4967), summarized as follows: "After a thorough review of all available scientific information, we find that listing the American eel as either threatened or endangered is not warranted at this time."

As noted previously in this section, a single American eel was observed by Exelon’s biologists at station GR-05 on the Guadalupe River in April 2008, but they were not able to capture it or photograph it. This species has no official status or legal protection in Texas; however, it is rare and considered a species of concern in the broadest sense, meaning that TPWD biologists are concerned about its conservation and these concerns are factored into the agency's reviews of proposed projects.

2.4.2.2.2 Important Aquatic Habitats

Many marine and estuarine fishes that are managed by the Gulf of Mexico Fishery Management Council (GMFMC) rely on coastal bays and tidal rivers during part of their lives. The tidally influenced sections of the Guadalupe River and its tributaries, as well as Guadalupe and San Antonio Bays, have been designated essential fish habitat (EFH), which is defined as those waters and substrate necessary to fish or shellfish for spawning, breeding, feeding, or growth to maturity (GMFMC Oct 1998). Virtually every estuary in Texas has been similarly designated. Discussion of EFH is in §600.10 of the regulations implementing the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297). The GMFMC and NMFS are responsible for designating EFH for each life stage of federally managed marine fish species.

The generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC (GMFMC Oct 1998) prescribes EFH for federally managed species, including shrimp, red drum, reef fish, and coastal migratory pelagic species. Riverine systems, such as the Guadalupe River, are considered important to EFH because the quantity, quality and timing of the stream discharge into estuaries affects the supply of nutrients, maintains the salinity gradients, flushes pollutants, and provides other functional value. The boundaries of estuarine EFH follow those identified in the Cooperative Gulf of Mexico Estuarine Inventory conducted in each state. The landward boundary of estuarine EFH is the limit of permanent freshwater bottom; seaward limits are the coastal barrier islands. Thus, in the San Antonio Bay, EFH is all waters and substrates (mud, sand, shell, rock and associated biological communities) within the estuarine boundaries, up to the permanent freshwater bottom of the Guadalupe River (GMFMC Oct 1998).

Habitats in the lower Guadalupe River and San Antonio Bay near the VCS site include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, and seagrasses. Managed species that are considered important with respect to this ER include shrimp and red drum (GSMFC 2005). EFH has been designated for all life stages (egg, larvae, post-larvae, juvenile, and adult) of these species. The NOAA has prepared maps showing EFH for the various species and life stages (NOAA undated).

Categories of EFH in the lower Guadalupe River and San Antonio Bay that could be impacted by the project include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, and seagrasses. Detailed information on EFH is provided in the 1998 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC. In addition to providing EFH for the federally managed species listed above, the San Antonio Bay estuary provides nursery and rearing habitat for other important estuarine species as well as for non-harvested forage species that support the harvested species.

2.4.2.3 Nuisance Species

The Asiatic clam, *Corbicula fluminea*, is a problematic invasive mollusk from southeastern Asia. It is a small bivalve that is typically found at high densities and has a relatively high growth rate (GSFMC 2005). Because of its tolerance of a wide variety of aquatic conditions and its high reproductive rate, it has developed into a pest that clogs ditches and interferes with pipes and heat exchangers of power plants. The first reported collection of *Corbicula* in Texas occurred in the Neches River in 1958 (Karatayev et al. Aug 2005). *Corbicula* were next discovered near El Paso in 1964, suggesting that the species was invading Texas from both east and west. From 1970 through 1979, Corbicula spread throughout much of Texas and during this period was first discovered in the Guadalupe and Blanco River systems (Karatayev et al. Aug 2005). By 2005, *Corbicula* had been reported from 162 lotic and 174 lentic waterbodies in Texas. Based on the surveys conducted to date (Subsection 2.4.2.1.2), *Corbicula* appear to be a major component of the benthos in the reach of the Guadalupe River that adjoins the VCS site. They are less evident in the GBRA canal system, perhaps because the canals are more steep sided than the river and lack the river's sandbars and sandbanks. Although present in low densities in the GBRA Calhoun Canal system, *Corbicula* have never created any operational problems, such as clogging pipes or damaging pumps, for the GBRA.

The water hyacinth (*Eichoria crassipes*), a free-floating perennial plant, was introduced into the United States (Florida) from South America in the 1880s and has since spread throughout the southeastern and southwestern United States and into parts of the mid-Atlantic and Pacific Northwest (FDEP undated, CAIP 2001). A serious problem for water system managers in the southern United States, water hyacinth grows rapidly and can take over a waterway in a matter of days when conditions are favorable for its growth. This plant is found throughout the GBRA canal and diversion system, including Goff Bayou, and clumps of water hyacinth are occasionally seen floating in the Guadalupe River. The GBRA uses herbicides, chiefly Rodeo® (a glyphosphate-based product) to control floating-leaved nuisance plants (e.g., water hyacinth and water lettuce) in the Calhoun Canal system. The GBRA also employs mechanical methods when practicable, using a track-hoe (track-excavator) fitted with a long boom and dredge bucket to remove large masses of floating aquatic weeds from its canals and waterways.

Water lettuce (*Pistia stratiotes*), a species regarded as nonnative by some botanical authorities (who believe it was introduced from the Caribbean during the Colonial era) and indigenous to the United States by others (it was recorded by pioneer naturalists in Florida in the 18th century), is a floating perennial plant that under certain conditions forms "vast mats that disrupt submersed plant and animal communities and interfere with water movement and navigation" (Langeland and Burks 2006). This species is also found throughout the GBRA canal and diversion system, including Goff Bayou, and is presumed to occur in backwaters of the Guadalupe River. It is generally less abundant than water hyacinth, and to date it has not presented any operational problems for the GBRA.

Hydrilla (*Hydrilla verticillata*), a nonnative plant from Asia, has been found in 100 water bodies in Texas (LCRA 2003). It is a fast-growing, nuisance species that quickly establishes itself and produces dense

mats of vegetation that can clog pipes and ditches and otherwise restrict water flow. It was first recorded in Texas in 1969 and has since spread through much of the state, from north-central to eastern Texas and south to the Rio Grande (LCRA 2003; Jacono and Richerson 2005). Although present in the upper and middle reaches of the Guadalupe River, and a problem in several GBRA reservoirs, it is present in limited backwater areas of the lower river and the GBRA canal system, if at all. The GBRA applies herbicide to control Hydrilla and several other aquatic plants in upstream reservoirs, but to date this species has not been a significant problem in the Calhoun Canal system.

2.4.2.4 Preexisting Environmental Stresses

Environmental or man-induced stresses include thermal and chemical pollutants (discharges), which are regulated by the TCEQ under the Texas Pollutant Discharge Elimination System (TPDES) program. The TCEQ is required, under Section 303(d) of the Clean Water Act, to identify water bodies for which effluent limitations are not stringent enough to satisfy water quality standards (TCEQ 2008). In every even-numbered year, the TCEQ publishes a "Texas Water Quality Inventory and 303(d) List" that identifies freshwater streams, impoundments, tidal streams, and coastal bays that are impaired for one or more pollutants and therefore do not meet one or more water quality standards. Stream segments in the vicinity of the VCS site that could potentially be affected by construction or operation of the new units are listed in Table 2.3.3-3 of Subsection 2.3.3 and shown in Figure 2.3.3-2.

Segment 1803 of the Guadalupe River, which lies adjacent to the VCS site and would receive effluent from the proposed new units, did not appear on 2004, 2006, or (draft) 2008 TCEQ lists of impaired waters. Segment 1802, the short segment of the Guadalupe River between its confluence with the San Antonio River and the Salt Water Barrier, likewise did not appear on 2004, 2006, or (draft) 2008 lists. Segment 1801, the tidal portion of the Guadalupe River (from the GBRA Salt Water Barrier to Guadalupe Bay), appeared on the 2004 list as impaired for low dissolved oxygen but met state water quality standards in the last two assessments. (TCEQ 2004, 2006, 2008)

Bay Segment 2462, Guadalupe/Hynes/San Antonio Bay, was listed as impaired for bacteria (oyster waters) in 2004, 2006, and 2008 (TCEQ 2004, 2006, 2008). Fecal coliform is the indicator bacterium used by the TCEQ to determine if bay and gulf waters are suitable for shellfish harvesting. Assessment of oyster waters is coordinated with the Seafood Safety Division of the Texas Department of State Health Services, which is responsible for monitoring and classifying shellfish waters into four categories for harvesting: approved, conditionally approved, restricted, and prohibited. Bay segments are classified and mapped, with maps available for viewing on the Texas Department of State Health Services Web site. The map currently displayed on the Web site, dated November 1, 2007, shows Guadalupe Bay as a Restricted Area, Hynes Bay as a Conditionally Approved Area, and San Antonio Bay as an Approved Area for shellfish harvesting (TDSHS 2007).

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Table 2.4.2-1 (Sheet 1 of 2)
Number collected (#) and percent relative abundance (%) of fish captured at 12 locations on the Exelon Victoria County Site in April 2008

Family	Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lepisosteidae																												
	Alligator gar	*Atractosteus spatula*															5	7.5									5	0.3
	Spotted gar	*Lepisosteus oculatus*							2	1.6							1	1.5					4	5.3			7	0.4
Clupeidae																												
	Gizzard shad	*Dorosoma cepedianum*													1	0.5	3	4.5			2	1.0	2	2.6			8	0.5
	Threadfin shad	*Dorosoma petenense*													11	5.5			9	69.2	2	1.0					22	1.3
Cyprinidae																												
	Golden shiner	*Notemigonus crysoleucas*[a]					65	18.2																			65	3.9
	Red shiner	*Cyprinella lutrensis*																			6	3.0					6	0.4
	Common carp	*Cyprinus carpio*[a]							18	14.2									2	15.4			3	3.9			23	1.4
	Pugnose minnow	*Opsopoeodus emiliae*																			1	0.5					1	0.1
	Bullhead minnow	*Pimephales vigilax*															1	1.5			12	5.9					13	0.8
Catostomidae																												
	Smallmouth buffalo	*Ictiobus bubalus*															1	1.5					4	5.3			5	0.3
Characidae																												
	Mexican tetra	*Astyanax mexicanus*[a]													10	5.0					1	0.5					11	0.7
Ictaluridae																												
	Black bullhead	*Ameiurus melas*			3	1.5	1	0.3															1	1.3			5	0.3
	Yellow bullhead	*Ameiurus natalis*							15	11.8	7	9.0											1	1.3			23	1.4
	Blue catfish	*Ictalurus furcatus*															5	7.5	1	7.7	1	0.5					7	0.4
	Channel catfish	*Ictalurus punctatus*																			18	8.9					18	1.1
	Flathead catfish	*Pylodictis olivaris*																			1	0.5					1	0.1
Loricariidae																												
	Vermiculated sailfin catfish	*Pterygoplichthys disjunctivus*[a]													1	0.5											1	0.1
Atherinopsidae																												
	Inland silverside	*Menidia beryllina*													4	2.0	2	3.0			4	2.0					10	0.6

Table 2.4.2-1 (Sheet 2 of 2)
Number collected (#) and percent relative abundance (%) of fish captured at 12 locations on the Exelon Victoria County Site in April 2008

Family	Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Fundulidae																												
	Golden topminnow	*Fundulus chrysotus*	2	1.5																							2	0.1
Poeciliidae																												
	Western mosquitofish	*Gambusia affinis*	1	0.8	185	90.7	32	9.0	11	8.7	63	80.8	31	68.9	2	1.0	2	3.0			6	3.0	4	5.3	155	100.0	492	29.7
	Sailfin molly	*Poecilia latipinna*					30	8.4							10	5.0	22	32.8			9	4.5					71	4.3
Moronidae																												
	White bass	*Morone chrysops*															1	1.5									1	0.1
Centrarchidae																												
	Green sunfish	*Lepomis cyanellus*			7	3.4	128	35.9	15	11.8	1	1.3															151	9.1
	Warmouth	*Lepomis gulosus*	32	24.6	9	4.4	101	28.3	44	34.6	4	5.1			25	12.5					21	10.4	2	2.6			238	14.4
	Orangespotted sunfish	*Lepomis humilis*																			2	1.0	12	15.8			14	0.8
	Bluegill	*Lepomis macrochirus*							16	12.6	3	3.8			106	53.0	23	34.3			67	33.2	17	22.4			232	14.0
	Longear sunfish	*Lepomis megalotis*													2	1.0					11	5.4					13	0.8
	Redear sunfish	*Lepomis microlophus*	2	1.5											8	4.0					2	1.0					12	0.7
	Bantam sunfish	*Lepomis symmetricus*	13	10.0											10	5.0					1	0.5					24	1.5
	Largemouth bass	*Micropterus salmoides*	3	2.3					1	0.8													2	2.6			6	0.4
	White crappie	*Pomoxis annularis*	77	59.2					5	3.9			14	31.1	9	4.5	1	1.5			35	17.3	24	31.6			165	10.0
	Black crappie	*Pomoxis nigromaculatus*													1	0.5											1	0.1
Sciaenidae																												
	Freshwater drum	*Aplodinotus grunniens*																	1	7.7							1	0.1
Cichlidae																												
	Rio Grande cichlid	*Cichlasoma cyanoguttatum*[a]															1	1.5									1	0.1
Total			130		204		357		127		78		45		200		67		13		202		76		155		1654	

a. Exotic or introduced species

Table 2.4.2-2 (Sheet 1 of 3)
Combined weight (g) and percent of total weight (%) for fish collected at 12 locations on the Exelon Victoria County Site in April 2008

Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
		(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%
Alligator gar	*Atractosteus spatula*															7470	47.1									7470	16.0
Spotted gar	*Lepisosteus oculatus*							230	3.6													1320	7.7			1550	3.3
Gizzard shad	*Dorosoma cepedianum*													30	1.3					20	1.8	550	3.2			600	1.3
Threadfin shad	*Dorosoma petenense*																										
Golden Shiner	*Notemigonus crysoleucas*[a]					730	22.4																			730	1.6
Red shiner	*Cyprinella lutrensis*																										
Common carp	*Cyprinus carpio*[a]							2450	38.6													2870	16.8			5320	11.4
Pugnose minnow	*Opsopoeodus emiliae*																										
Bullhead minnow	*Pimephales vigilax*																										
Smallmouth buffalo	*Ictiobus bubalus*															2500	15.8					8100	47.5			10600	22.7
Mexican tetra	*Astyanax mexicanus*[a]																										
Black bullhead Catfish	*Ameiurus melas*					1030	31.6															330	1.9			1360	2.9
Yellow bullhead catfish	*Ameiurus natalis*							420	6.6													280	1.6			700	1.5
Blue catfish	*Ictalurus furcatus*															4890	30.8									4890	10.5
Channel catfish	*Ictalurus punctatus*																			20	1.8					20	0.0

Table 2.4.2-2 (Sheet 2 of 3)
Combined weight (g) and percent of total weight (%) for fish collected at 12 locations on the Exelon Victoria County Site in April 2008

Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
		(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%
Flathead catfish	*Pylodictis olivaris*																			20	1.8					20	0.0
Vermiculated sailfin catfish	*Pterygoplichthys disjunctivus*[a]													340	14.9											340	0.7
Inland silverside	*Menidia beryllina*																										
Golden topminnow	*Fundulus chrysotus*																										
Western mosquitofish	*Gambusia affinis*																										
Sailfin molly	*Poecilia latipinna*					40	1.2																			40	0.1
White bass	*Morone chrysops*															900	5.7									900	1.9
Green sunfish	*Lepomis cyanellus*					370	11.3	590	9.3																	960	2.1
Warmouth	*Lepomis gulosus*					1090	33.4	1490	23.5					100	4.4					50	4.4					2730	5.8
Orangespotted sunfish	*Lepomis humilis*																										
Bluegill	*Lepomis macrochirus*							430	6.8	3	100.0			140	6.1					20	1.8					593	1.3
Longear sunfish	*Lepomis megalotis*																			50	4.4					50	0.1
Redear sunfish	*Lepomis microlophus*	10	1.2											40	1.8											50	0.1
Bantam sunfish	*Lepomis symmetricus*																										
Largemouth bass	*Micropterus salmoides*	20	2.4					300	4.7													2680	15.7			3000	6.4

Table 2.4.2-2 (Sheet 3 of 3)
Combined weight (g) and percent of total weight (%) for fish collected at 12 locations on the Exelon Victoria County Site in April 2008

Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
		(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%	(g)	%
White crappie	*Pomoxis annularis*	796	96.4					430	6.8					1590	69.7	110	0.7			950	84.1	920	5.4			4796	10.3
Black crappie	*Pomoxis nigromaculatus*													40	1.8											40	0.1
Freshwater drum	*Aplodinotus grunniens*																										
Rio Grande cichlid	*Cichlasoma cyanoguttatum*[a]																										
Total		826		0		3260		6340		3		0		2280		15870		0		1130		17050		0		46759	

a. P = Exotic or introduced species

Table 2.4.2-3 (Sheet 1 of 2)
Macroinvertebrates in benthic samples from 12 locations on the Exelon Victoria County Site in April 2008

Common Name	Family	Genus	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Mayflies	Caenidae	*Caenis*					8	28	3	30					1	5.6			1	33.3							13	5.3
Dragonflies	Libellulidae	*Perithemis*					1	3.4																			1	0.4
	Gomphidae	*Aphylla*	2	2.4																							2	0.8
Water boatmen	Corixidae	*Trichocorixa*																					1	14.3	1	6.3	2	0.8
Caddisflies	Hydroptilidae	*Orthotrichia pupa*					1	3.4																			1	0.4
		Berosus															1	25.0									1	0.4
Beetles	Elmidae	*Dubiraphia*																			1	16.7					1	0.4
	Haliplidae	*Haliplus*					4	13.8																			4	1.6
		Peltodytes					1	3.4																			1	0.4
	Curculionidae						1	3.4																			1	0.4
Flies and midges	Tabanidae	*Chrysops*					3	10.3																	1	6.3	4	1.6
	Ceratopogonidae	*Ceratopogon*	2	2.4					3	30.0	2	20.0			3	16.7	2	50.0	1	33.3	1	16.7					14	5.7
		Culicoides	1	1.2							1	10.0									2	33.3					4	1.6
		Probezzia	2	2.4											1	5.6											3	1.2
		Serromyia	1	1.2																							1	0.4
		Sphaeromias	1	1.2					1	10.0					2	11.1									2	12.5	6	2.4
	Chaoboridae	*Chaoborus*			42	72.4																					42	17.1
	Chironomidae	*Procladius*	25	29.4	10	17.2					2	20.0			4	22.2							1	14.3	2	12.5	44	17.9
		Clinotanypus	16	18.8							1	10.0															17	6.9
		Tanypus													2	11.1					1	16.7					3	1.2
		Rheotanytarsus	16	18.8					1	10.0							1	25.0									18	7.3
		Cryptochironomus	1	1.2											1	5.6							2	28.6			4	1.6
		Dicrotendipes																	1	33.3							1	0.4
		Parachironomus	8	9.4					1	10.0																	9	3.7
		Polypedilum	4	4.7																							4	1.6
		Chironomus																					1	14.3	1	6.3	2	0.8
Molluscs	Physidae		4	4.7	1	1.7	2	6.9	1	10.0															3	18.8	11	4.5
	Planorbidae						2	6.9																			2	0.8
	Ancylidae																								2	12.5	2	0.8
	Sphaeriidae		2	2.4			6	20.7			4	40.0			4	22.2					1	16.7					17	6.9
	Unionidae	*Toxolasma texasiensis*																					1	14.3			1	0.4

Table 2.4.2-3 (Sheet 2 of 2)
Macroinvertebrates in benthic samples from 12 locations on the Exelon Victoria County Site in April 2008

Common Name	Family	Genus	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Crustaceans	Palaemonidae	*Palaemonetes*																					1	14.3	4	25.0	5	2.0
	Cambaridae				5	8.6																					5	2.0
Segmented worms	Phylum Annelida				P						P				P		P				P		P				P	
Totals			85		58		29		10		10		0		18		4		3		6		7		16		246	

(P Worms were observed in the samples but could not be counted because of their segmented nature

Table 2.4.2-4 (Sheet 1 of 2)
Number collected (#) and percent relative abundance (%) of fish collected from the lower Guadalupe River, Goff Bayou, and the GBRA Main Canal, January–June 2008

Common Name	Scientific Name	GR-01		GR-02		GR-03		GR-04		GR-05		GR-all stations		Goff		Canal	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Alligator gar	*Atractosteus spatula*							3	0.3			3	0.1				
Spotted gar	*Lepisosteus oculatus*	85	4.3	43	7.1	34	8.4	145	16.3	73	9.2	380	8.1	79	9.9	12	1.5
Longnose gar	*Lepisosteus osseus*	26	1.3	19	3.2	29	7.2	33	3.7	28	3.5	135	2.9	2	0.3		
Ladyfish	*Elops saurus*													1	0.1		
American eel	*Anguilla rostrata*[a]									1	0.1	1					
Bay anchovy	*Anchoa mitchilli*													20	2.5	1	0.1
Gulf menhaden	*Brevoortia patronus*													3	0.4		
Gizzard shad	*Dorosoma cepedianum*	190	9.6	119	19.7	36	8.9	43	4.8	54	6.8	442	9.4	209	26.3	18	2.2
Threadfin shad	*Dorosoma petenense*	112	5.6	2	0.3	2	0.5	18	2.0	13	1.6	147	3.1	36	4.5	4	0.5
Grass carp	*Ctenopharyngodon idella*[b]									1	0.1	1					
Red shiner	*Cyprinella lutrensis*	974	49.0	213	35.3	143	35.4	167	18.7	124	15.7	1621	34.6	17	2.1	36	4.4
Common carp	*Cyprinus carpio*[b]	3	0.2	1	0.2	2	0.5	19	2.1	14	1.8	39	0.8	37	4.6	4	0.5
Ribbon shiner	*Lythrurus fumeus*	1	0.1									1					
Burrhead chub	*Macrhybopsis marconis*	1	0.1									1					
Pugnose minnow	*Opsopoeodus emiliae*	2	0.1	8	1.3			47	5.3	15	1.9	72	1.5	5	0.6	64	7.8
Bullhead minnow	*Pimephales vigilax*	44	2.2	22	3.6	8	2.0	25	2.8	21	2.7	120	2.6	13	1.6	52	6.3
Smallmouth buffalo	*Ictiobus bubalus*	6	0.3	6	1.0	15	3.7	7	0.8	9	1.1	43	0.9	35	4.4	10	1.2
Gray redhorse	*Moxostoma congestum*															1	0.1
Mexican tetra	*Astyanax mexicanus*[b]	122	6.1	33	5.5	22	5.4	61	6.8	27	3.4	265	5.7	14	1.8	3	0.4
Blue catfish	*Ictalurus furcatus*	8	0.4	9	1.5	5	1.2	6	0.7	12	1.5	40	0.9	13	1.6		
Channel catfish	*Ictalurus punctatus*	1	0.1	4	0.7	4	1.0	7	0.8	8	1.0	24	0.5	3	0.4		
Tadpole madtom	*Noturus gyrinus*															4	0.5
Flathead catfish	*Pylodictis olivaris*			3	0.5	3	0.7			3	0.4	9	0.2	3	0.4		
Vermiculated sailfin catfish	*Pterygoplichthys disjunctivus*[b]							2	0.2	2	0.3	4	0.1	1	0.1	1	0.1
Striped mullet	*Mugil cephalus*	163	8.2	6	1.0	6	1.5	20	2.2	189	23.9	384	8.2	148	18.6		
Inland silverside	*Menidia beryllina*	138	6.9					44	4.9	33	4.2	215	4.6	34	4.3	89	10.8
Golden topminnow	*Fundulus chrysotus*									1	0.1	1					
Bluefin killifish	*Lucania goodei*[b]											0		2	0.3	1	0.1
Sheepshead minnow	*Cyprinodon variegatus*									1	0.1	1					
Gulf pipefish	*Syngnathus scovelli*															2	0.2
Western mosquitofish	*Gambusia affinis*	16	0.8	12	2.0	2	0.5	69	7.7	50	6.3	149	3.2	28	3.5	73	8.8
Sailfin molly	*Poecilia latipinna*	1	0.1					39	4.4	9	1.1	49	1.0	4	0.5	14	1.7
White bass	*Morone chrysops*	1	0.1							1	0.1	2		2	0.3		

Table 2.4.2-4 (Sheet 2 of 2)
Number collected (#) and percent relative abundance (%) of fish collected from the lower Guadalupe River, Goff Bayou, and the GBRA Main Canal, January–June 2008

Common Name	Scientific Name	GR-01		GR-02		GR-03		GR-04		GR-05		GR-all stations		Goff		Canal	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Green sunfish	*Lepomis cyanellus*			1	0.2	2	0.5					3	0.1				
Warmouth	*Lepomis gulosus*	9	0.5	12	2.0	5	1.2	35	3.9	25	3.2	86	1.8	6	0.8	96	11.6
Orangespotted sunfish	*Lepomis humilis*	7	0.4			2	0.5					9	0.2			1	0.1
Bluegill	*Lepomis macrochirus*	25	1.3	35	5.8	32	7.9	38	4.3	29	3.7	159	3.4	39	4.9	61	7.4
Longear sunfish	*Lepomis megalotis*	33	1.7	27	4.5	24	5.9	13	1.5	11	1.4	108	2.3	21	2.6	227	27.5
Redear sunfish	*Lepomis microlophus*					1	0.2					1	0.0				
Bantam sunfish	*Lepomis symmetricus*							1	0.1	2	0.3	3	0.1			3	0.4
Spotted bass	*Micropterus punctulatus*	6	0.3	13	2.2	18	4.5	22	2.5	4	0.5	63	1.3			2	0.2
Largemouth bass	*Micropterus salmoides*	2	0.1					1	0.1	1	0.1	4	0.1	10	1.3	1	0.1
White crappie	*Pomoxis annularis*	1	0.1	3	0.5			8	0.9	7	0.9	19	0.4	1	0.1	3	0.4
Black crappie	*Pomoxis nigromaculatus*	4	0.2	4	0.7			10	1.1	14	1.8	32	0.7	7	0.9	1	0.1
Pinfish	*Lagodon rhomboides*															1	0.1
Freshwater drum	*Aplodinotus grunniens*	5	0.3	5	0.8	2	0.5	5	0.6	8	1.0	25	0.5	2	0.3		
Rio Grande cichlid	*Cichlasoma cyanoguttatum*[b]	3	0.2	3	0.5	7	1.7	4	0.4	2	0.3	19	0.4	1	0.1	40	4.8
		1989		603		404		892		792		4680		796		825	

a. Observed but not collected
b. Exotic or introduced species

Table 2.4.2-5
Combined weight (g) and percent of total weight (%) of fish collected (2,059 individuals) from the Guadalupe River, Goff Bayou, and the GBRA Main Canal, January–June 2008

Scientific Name	GR-01		GR-02		GR-03		GR-04		GR-05		GR-All		Goff		Canal	
	Weight	%	Weight	%	Weight	%	Weight	%	Weight	%	Weight	%	Weight	%	Weight	%
Atractosteus spatula							8320	4.4			1664	1.4				
Lepisosteus oculatus	42055	31.3	12251	25.9	10825	13.0	75455	39.8	35427	25.7	35203	29.7	36135	16.5	5830	44.9
Lepisosteus osseus	13380	9.9	4940	10.4	22900	27.5	9310	4.9	13125	9.5	12731	10.7	180	0.1		
Elops saurus											0	0.0	10	0.0		
Dorosoma cepedianum	15614	11.6	15205	32.1	6610	7.9	4235	2.2	4370	3.2	9207	7.8	8650	3.9		
Dorosoma petenense	40	0.0	20	0.0							12	0.0				
Ctenopharyngodon idella[a]									10480	7.6	2096	1.8				
Cyprinella lutrensis	85	0.1					482	0.3			113	0.1				
Cyprinus carpio[a]	1590	1.2	420	0.9	2400	2.9	44570	23.5	17705	12.9	13337	11.3	24530	11.2	2480	19.1
Ictiobus bubalus	7530	5.6	660	1.4	28995	34.8	26020	13.7	22000	16.0	17041	14.4	68405	31.2	2770	21.3
Moxostoma congestum											0	0.0			110	0.8
Astyanax mexicanus[a]	155	0.1	10	0.0	5	0.0					34	0.0				
Ictalurus furcatus	9010	6.7	6225	13.1	4425	5.3	4735	2.5	5085	3.7	5896	5.0	10660	4.9		
Ictalurus punctatus	450	0.3	735	1.6	330	0.4	1195	0.6	1525	1.1	847	0.7	2680	1.2		
Pylodictis olivaris			2210	4.7	1480	1.8			2375	1.7	1213	1.0	10195	4.6		
Pterygoplichthys disjunctivus[a]							120	0.1	280	0.2	80	0.1	410	0.2		
Mugil cephalus	40595	30.2	1265	2.7	3710	4.4	7520	4.0	17710	12.9	14160	11.9	51245	23.4		
Morone chrysops	370	0.3							210	0.2	116	0.1	660	0.3		
Lepomis gulosus	10	0.0	80	0.2	30	0.0	920	0.5	425	0.3	293	0.2	80	0.0	575	4.4
Lepomis macrochirus	315	0.2	460	1.0	145	0.2	465	0.2	645	0.5	406	0.3	585	0.3	170	1.3
Lepomis megalotis	225	0.2	180	0.4	35	0.0	175	0.1	40	0.0	131	0.1	50	0.0	130	1.0
Micropterus punctulatus	290	0.2	910	1.9	400	0.5	3055	1.6	440	0.3	1019	0.9			160	1.2
Micropterus salmoides	580	0.4					210	0.1	160	0.1	190	0.2	4140	1.9	550	4.2
Pomoxis annularis	10	0.0	85	0.2			550	0.3	365	0.3	202	0.2	70	0.0	25	0.2
Pomoxis nigromaculatus	660	0.5	570	1.2			880	0.5	1635	1.2	749	0.6	435	0.2	100	0.8
Aplodinotus grunniens	1540	1.1	1160	2.4	760	0.9	1400	0.7	3620	2.6	1696	1.4	160	0.1		
Cichlasoma cyanoguttatum[a]	40	0.0			335	0.4					75	0.1			80	0.6
	134544		47386		83385		189617		137622		118511		219280		12980	

a. Exotic or introduced species

Table 2.4.2-6 (Sheet 1 of 2)
Benthic macroinvertebrates collected at five stations on the lower Guadalupe River, April–June 2008

Common Name	Family	Genus	GR-1		GR-2		GR-3		GR-4		GR-5		Total	
			#	%	#	%	#	%	#	%	#	%	#	%
Mayflies	Ephemeridae	*Hexagenia*	1	3.7	3	1.6	4	1.8					8	1.4
	Polymitarcyidae	*Tortopus*	4	14.8									4	0.7
	Caenidae	*Cercobrachys*	2	7.4			1	0.4					3	0.5
	Palingeniidae	*Pentagenia vittegera*	1	3.7									1	0.2
	Baetidae	*Apobaetis*	1	3.7									1	0.2
Caddisflies	Leptoceridae	*Oecetis*							1	0.9			1	0.2
	Polycentropodidae	*Neureclipsis*					1	0.4					1	0.2
	Hydroptilidae	*Hydroptila pupa*									1	4.0	1	0.2
Dragonflies	Gomphidae	*Gomphus*					2	0.9					2	0.3
Beetles	Scarabaeidae								1	0.9			1	0.2
	Elmidae	*Stenelmis*			2	1.1	3	1.3	1	0.9			6	1.0
		Heterelmis	1	3.7									1	0.2
		Hexacylloepus									1	4.0	1	0.2
	Chrysomelidae				1	0.5							1	0.2
Flies and midges	Ceratopogonidae	*Probezzia*	3	11.1			2	0.9					5	0.9
	Chironomidae	*Procladius*					1	0.4					1	0.2
		Ablabesmyia					3	1.3					3	0.5
		Microspectra	7	25.9									7	1.2
		Cryptochironomus	5	18.5			6	2.7					11	1.9
		Dicrotendipes			2	1.1							2	0.3
		Paracladopelma	1	3.7			1	0.4					2	0.3
		Polypedilum					6	2.7	1	0.9			7	1.2
		Chironomus			19	10.2	2	0.9					21	3.7
		Microchironomus			2	1.1	1	0.4					3	0.5
		Axarus							1	0.9	2	8.0	3	0.5
		Eukiefferiella			1	0.5							1	0.2
Molluscs	Corbiculidae		1	3.7	4	2.2	7	3.1	7	6.3	3	12.0	22	3.8
	Hydrobiidae				151	81.2	180	80.0	96	85.7	18	72.0	445	77.4
	Physidae								1	0.9			1	0.2
	Sphaeriidae						1	0.4	1	0.9			2	0.3
	Mysidae	*Mysis*			1	0.5			1	0.9			2	0.3
	Gammaridae	*Gammarus*					3	1.3					3	0.5
	Marine Gastropod								1	0.9			1	0.2

Table 2.4.2-6 (Sheet 2 of 2)
Benthic macroinvertebrates collected at five stations on the lower Guadalupe River, April–June 2008

Common Name	Family	Genus	GR-1		GR-2		GR-3		GR-4		GR-5		Total	
			#	%	#	%	#	%	#	%	#	%	#	%
Crustaceans	Class: Branchiura						1	0.4					1	0.2
Segmented worms	Annelids		P		P		P		P		P		P	
Totals			27		186		225		112		25		575	

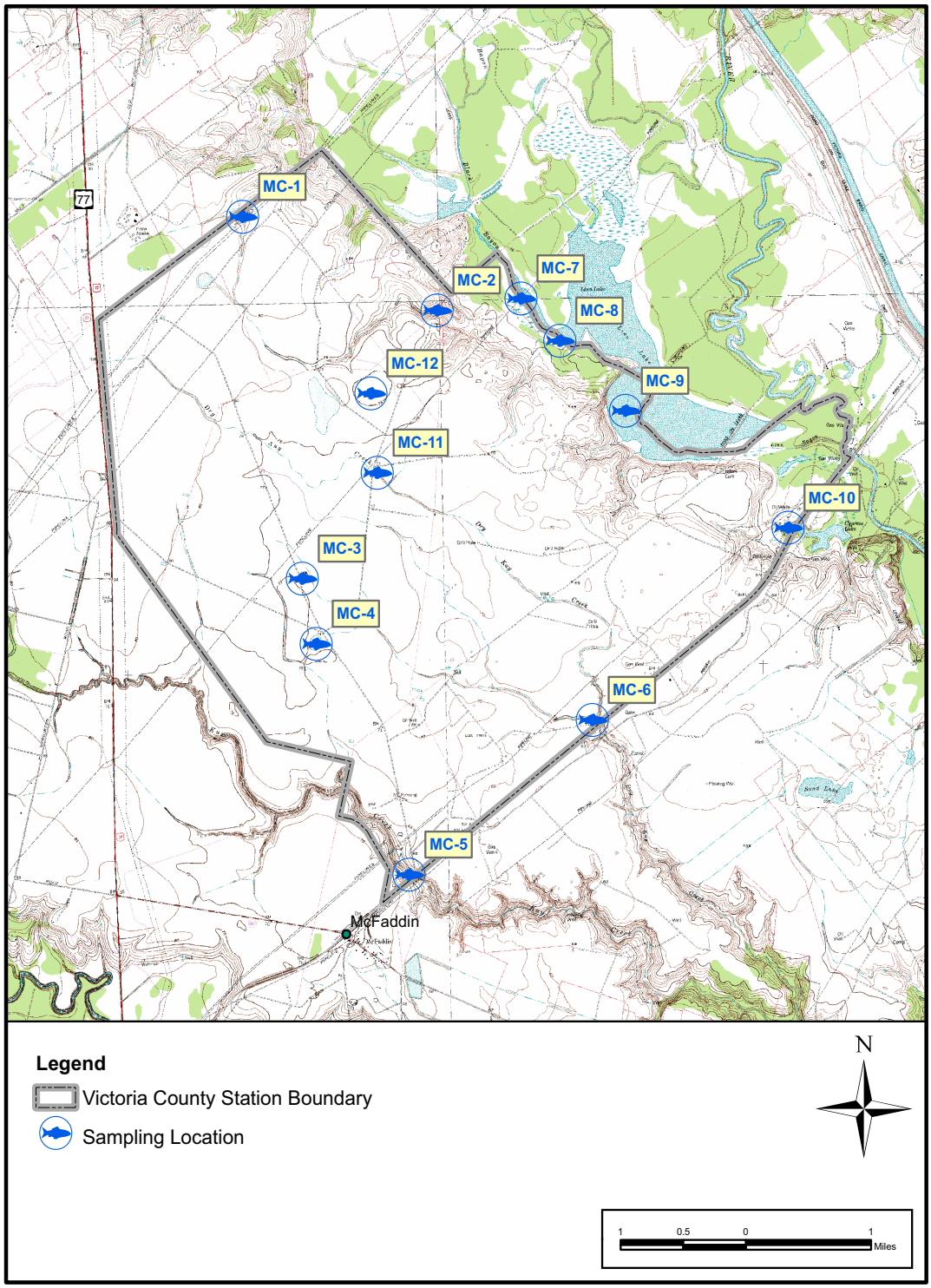

Figure 2.4.2-1 Onsite/Near-Site Fish Sampling Locations

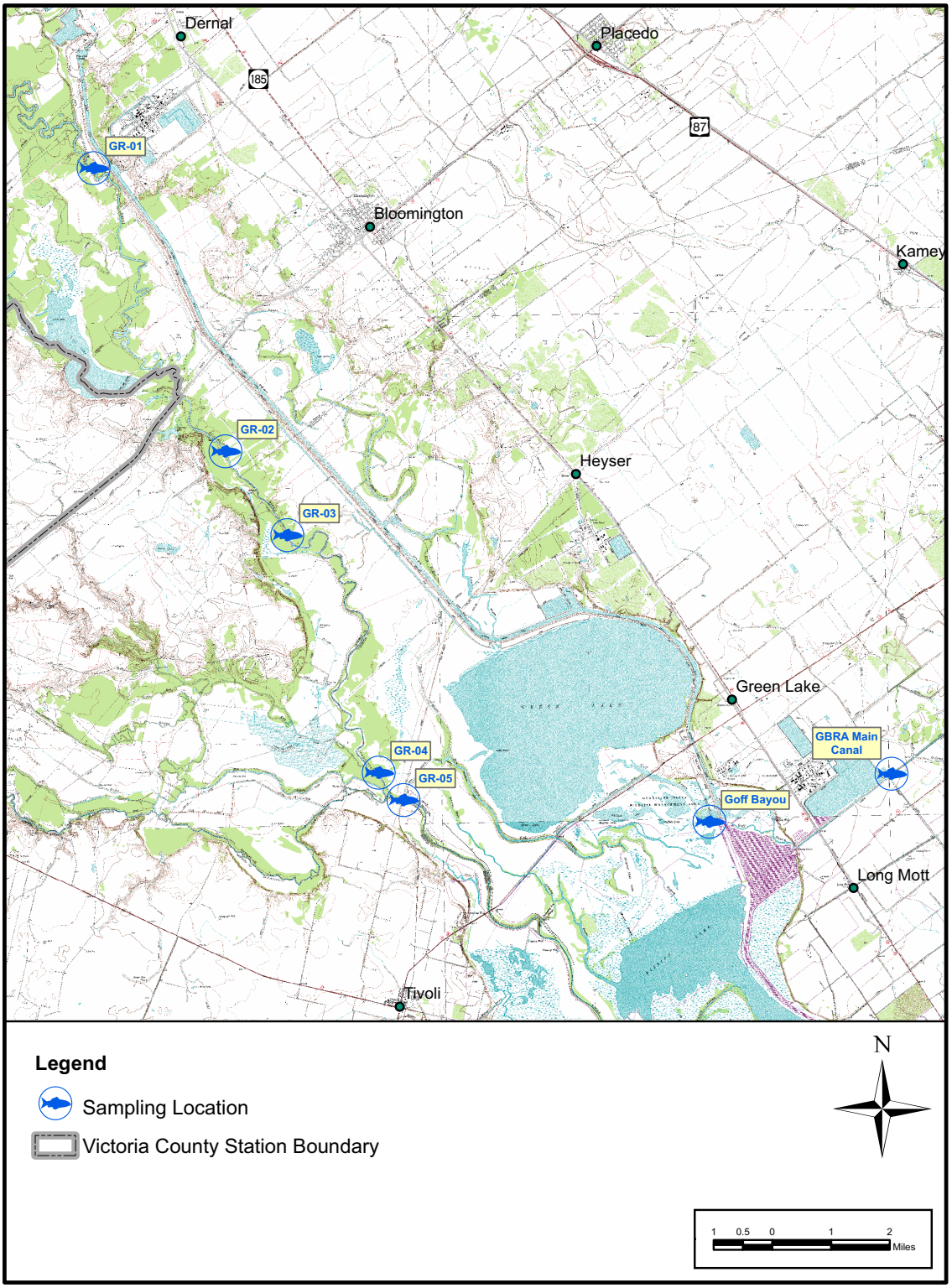

Figure 2.4.2-2 Guadalupe River Sampling Locations

2.5 Socioeconomics

This section describes the socioeconomic resources that have the potential to be impacted by the construction and operation of two ESBWR units at the VCS Units 1 and 2 site and is divided into four subsections: demographics, community characteristics, historic properties, and environmental justice. These subsections include descriptions of spatial and temporal considerations, where appropriate.

For purposes of socioeconomic analysis, Exelon has collected and analyzed regional socioeconomic data, including the transit of workers between Victoria County and its neighboring counties, to determine the appropriate socioeconomic region of influence. Based on this analysis, Exelon determined that the socioeconomic region of influence for this project includes Victoria County and the following counties bordering it: Calhoun, DeWitt, Goliad, Jackson, and Refugio. Because the socioeconomic effects would be most evident in these counties, their socioeconomic characteristics are analyzed.

2.5.1 Demography

This subsection describes the following demographic characteristics: population data by sector, population data by political jurisdiction, and transient populations. Migrant populations are characterized in Subsection 2.5.4, Environmental Justice.

2.5.1.1 Population Data by Sector

The population surrounding the proposed site, up to 50 miles, was estimated based on the 2000 U.S. Census Bureau (USCB) decennial census data. The population distribution was estimated in 16 directional sectors, each direction consisting of 22.5°, and in 10 concentric bands, measured from the midpoint between the two new units: 0 to 1 mile, 1 to 2 miles, 2 to 3 miles, 3 to 4 miles, 4 to 5 miles, 5 to 10 miles, 10 to 20 miles, 20 to 30 miles, 30 to 40 miles, and 40 to 50 miles. The projected commercial startup dates for the proposed units are 2015 and 2017, respectively. Population estimates were projected using an exponential growth rate calculated from state population projections in 10-year increments from 2010 to 2080. This period covers the period of construction through 40 years of operations (conservatively assumed to begin in 2020) plus 20 years of license renewal for both units. The use of 2020 would tend to over-predict the population in the vicinity of VCS.

The population distribution within 50 miles of the proposed site was computed by overlaying the 2000 census block point data (the smallest unit of census data) on the grids shown in Figures 2.5.1-9 and 2.5.1-10.

SECPOP2000, a code developed for the NRC by Sandia National Laboratories to calculate population by emergency planning zone sectors, was used to determine the 2000 resident population by sector[1].

1. The latest decennial census (2000) data was used as the basis for population projections by radius and sector . While more recent population estimates are available from the U.S. Census Bureau, these estimates are either too general (by county), or are not spatially complete (by city or town). In order to get appropriate projections, SECPOP 2000 uses USCB census block data to distribute the 2000 population by sector and radius. Populations for future years are then projected from the 2000 base data. State data is not used because it is based on the U.S. Census Bureau data and has the same formats.

The transient population for 0 to 10 miles was added to the 2000 resident population for use in the projections, and is reflected in Table 2.5.1-1. The population projections for radii of more than 10 miles include only residents.

Once the 2000 population (resident and transient, as appropriate) was determined for each sector, projections were made for the 10-year increments from 2010 to 2080.

Growth rates were calculated for each county based on projections obtained from the Texas State Data Center. Projections provided by the Texas State Data Center include four scenarios: Zero Migration Scenario, 1990–2000 Migration Scenario, One-Half 1990–2000 Migration Scenario, and 2000–2004 Migration Scenario. These scenarios assume the same set of mortality and fertility assumptions, but differ in their net migration assumptions. The Texas State Data Center suggests using the One-Half 1990–2000 Migration Scenario for most counties for long-term planning because migration is expected, but the 1990–2000 rate is not expected to be maintained over the coming years[2]. The 2000–2004 Migration Scenario was based on post-2000 population trends (estimates) and represents too few years on which to base a meaningful long-term trend. Therefore, Exelon used the One-Half 1990–2000 migration scenario for this analysis. Once county growth rates were determined, geographic information system software (ArcGIS® 9.2) was used to determine the total land area within a sector and the percentage of the land area in each sector occupied by a particular county. The population in a sector was assumed to be evenly distributed. In any sector spanning more than one county, the percentage of land area attributed to each county was multiplied by the sector population to determine each county's portion of the sector population. Then, each county's growth rate was applied to its respective

2. The State Demographer's Office reported, "(f)rom our analyses of these projection scenarios, we believe that the 0.5 scenario is the most appropriate scenario for most counties for use in long-term planning. This recommendation is suggested for several reasons. First, the 1990-2000 period was a period of expansive growth in the Texas economy. There has been a general slowdown in the U.S. and Texas economies since 2000 that is likely to slow population growth. Although a recovery is occurring, it is uncertain at this time when it will be complete. At the same time, we believe that the substantial changes shown for 2000-2004 for many areas are unlikely to prevail over the long run in most areas, thus its use for long term projections such as those produced here seems ill advised. The 0.5 scenario produces a statewide annual rate of growth of approximately 1.5, percent slower than 1990-2000 but still substantial growth, given the 2000 population base. It thus represents a rate of growth more moderate than the rapid growth of the 1990s but one that produces substantial population growth in the State. . . Second, the 2000 Census count showed a substantially larger U.S. and Texas population than was anticipated. Although the Census Bureau has not fully determined the reasons for this, it is likely that the 2000 count included persons who were missed in 1990. Since residual migration measures classify such persons as 1990-2000 migrants and three of the scenarios are based on 1990-2000 migration patterns, it is possible that the migration rates for some groups, for some periods, for some counties are too high suggesting the use of a more moderate rate of growth scenario. Third, although the scenarios use trends in births and deaths, they assume constant levels of migration. Such an assumption is used because of the lack of historical data of sufficient specificity to trend these rates over time. Our analyses of such rates suggest that it is unlikely that such trends (especially in some key groups) will continue at the level of the 1990s. At the same time, the overall direction of trends and differences among racial/ethnic groups seem likely to continue suggesting the need for the use of a scenario that is based on 1990-2000 trends in migration but shows slower growth--the 0.5 scenario. Finally, higher than expected birth rates and elderly survival rates from 2000 to 2004 resulted in an alteration of projected fertility and mortality rates so that larger populations are projected under the 0.0, 0.5 and 1.0 scenarios. Because all four projection scenarios use the same fertility and mortality projections, the projected values for the three scenarios used in the previous (2004) projections are higher in this (2006) set of projections than in the previous projections. As a result, the rates of growth shown for the 1.0 scenario have become even higher and even more difficult to sustain over the projection period. This serves as an additional factor further recommending the use of the 0.5 scenario for long-term planning purposes. . . As noted above, we recommend the 0.5 scenario for the long-term planning purposes for which these projections are produced. However, for those who intend to use the projections for relatively short-term (i.e., 3-10 year) planning purposes or who believe the 2000-2004 period is indicative of long-term trends, the 2000-2004 scenario may be preferable." (TOSD 2006)

population number to determine the projected population of that portion of the sector population. The projected populations of all portions in a sector were summed to determine the total projected population of that sector. Table 2.5.1-1 presents the population projections to 2080 by sector.

Regional population density and use characteristics of the site environs, including the exclusion area, low population zone, and population center distance are presented in Subsection 2.1.3 of the Final Safety Analysis Report in Part 2 of this application.

2.5.1.2 Population Data by Political Jurisdiction

Exelon has also included population data by political jurisdiction to facilitate analyses in the socioeconomic sections of this Environmental Report. The area defined by a 50-mile radius from the midpoint between the proposed units (Figure 2.5.1-9) includes all or part of 16 counties in Texas (Table 2.5.1-2 and Figure 2.5.1-9).

The proposed VCS site is located approximately 13.3 miles south of Victoria, Texas, 4.3 miles northwest of McFaddin, and adjacent to Linn Lake (Figure 2.5.1-10). The site is not located within a township. The closest population center with more than 25,000 residents is the city of Victoria (Figure 2.5.1-10). The city of Victoria had a 2000 population of 60,603 and a 2006 population estimate of 62,169 (USCB 2000a; USCB 2007a). The larger municipalities in the 50-mile radius (those with populations of 5000 or greater), their 2000 populations and 2006 estimates, and locations relative to the proposed site are presented in Table 2.5.1-3.

The 50-mile vicinity includes: the Victoria, Texas metropolitan statistical area (MSA) in its entirety; portions of the Corpus Christi, Texas, MSA; and portions of the Bay City, El Campo, and Beeville micropolitan statistical areas (MiSAs) (USCB 2003a).

- The Victoria, Texas MSA had a 2000 population of 111,663 (USCB 2003a). It was the 305th largest MSA in the United States (out of 362). From 1990 to 2000, it grew 12.3% (USCB 2003a). The 2006 population estimate was 114,088 (USCB 2007b).
- The Corpus Christi, Texas MSA had a 2000 population of 403,280 (USCB 2003a). It was the 111th largest MSA in the United States (out of 362). From 1990 to 2000, it grew 9.7% (USCB 2003a). The 2006 population estimate was 415,810 (USCB 2007b).
- The Bay City, Texas MiSA is characterized as primarily rural, with a 2000 population of 37,957 (USCB 2003a). It was the 352nd largest MiSA in the United States (out of 560). From 1990 to 2000, it grew 2.8% (USCB 2003a). The 2006 population estimate was 37,824 (USCB 2007b).
- The El Campo, Texas MiSA had a 2000 population of 41,188 (USCB 2003a). It was the 303rd largest MiSA in the United States (out of 560). From 1990 to 2000, it grew 3.1% (USCB 2003a). The 2006 population estimate was 41,475 (USCB 2007b).
- The Beeville, Texas MiSA had a 2000 population of 32,359 (USCB 2003a). It was the 428th largest MiSA in the United States (out of 560). From 1990 to 2000, it grew 28.7% (USCB 2003a). The 2006 population estimate was 33,176 (USCB 2007b).

Table 2.5.1-4 presents historical and projected population and growth rate data for the counties in the region of influence and for the region of influence as a whole. For the purpose of comparison, population data for the state of Texas is included in this table. From 1990 to 2000, the populations of the six counties grew at average annual growth rates ranging from –0.2% in Refugio County to 1.5% in Goliad County. The region of influence population grew at an average annual rate of 1.0%. For the same period, the state of Texas population grew at an average annual rate of 2.1%. The 2006 population estimates for the counties in the region of influence are as follows: Calhoun County, 20,705; DeWitt County, 20,167; Goliad County, 7192; Jackson County, 14,249; Refugio County, 7596; and Victoria County, 86,191 (USCB 2007a).

Population projections are provided by the Texas State Population Estimates and Projections Program. The program's projections of the population of Texas and of each county in Texas were prepared by the Office of the State Demographer and the Texas State Data Center in the Institute for Demographic and Socioeconomic Research at the University of Texas at San Antonio (TOSD 2006).

The population projections were completed using a cohort-component projection technique. Figure 2.5.1-11 provides a brief explanation of the technique, as provided by the Office of the State Demographer. Between 2010 and 2040 (the latest year for which data is provided), the average annual growth rates of all six counties and the state of Texas are projected to slow. By 2040, both Goliad and Refugio Counties are projected to begin decreasing in population. The average annual growth rate for the region of influence is projected to slow to 0.4%.

Table 2.5.1-5 lists the age distributions of the populations in each of the six counties, and the region of influence as a whole, in 2000 and compares them to the age distribution of the population in the state of Texas.

2.5.1.3 Transient Populations

NRC RG 4.7, General Site Suitability Criteria for Nuclear Power Stations, Section C.4 defines transient populations as people (other than those just passing through the area) who work, reside part-time, or engage in recreational activities in a given area, but are not permanent residents of the area (U.S. NRC Apr 1998)[3]. Under this definition, transients include people in:

- Workplaces
- Places where people reside part-time, such as hotels and motels and seasonal housing
- Recreational areas or at special events

Transient information is presented in two formats: quantitatively within the 0- to 10-mile radius and qualitatively within the 10- to 50-mile radius. The transient population within 10 miles was estimated to be 1270, based on major employers, overnight accommodations (including hotels, motels, and

3. People living in institutional settings, such as correctional institutions and nursing homes, and non-institutional settings, such as college dormitories and military quarters, are considered, by the USCB, as permanent residents and are included in the decennial census.

seasonal housing), and major recreation areas. These transient populations are included in Table 2.5.1-1. Transients within the 10- to 50-mile radius are not included in Table 2.5.1-1 but are described qualitatively in this subsection and throughout Section 2.5. Because most transient data is available by political boundaries and not by radii, the transient discussion encompasses Aransas, Bee, Calhoun, DeWitt, Jackson, Goliad, Refugio, and Victoria Counties because they are the counties whose boundaries are primarily within the 50-mile radius. For the transient description, they will be called the "eight-county region," not to be confused with the six-county socioeconomic region of influence.

A method for measuring the number of transient workers entering an area is to use worker flows in and out of counties. The USCB tracks this data, and Table 2.5.1-6 identifies the number of workers that traveled into the eight-county region for work in 2000. Workers traveling from one county to another in the eight-county region are not counted as transients. According to the data, about 7850 workers traveled into the eight-county region for work in 2000. Migrant populations are described in Subsection 2.5.4.2.

Table 2.5.1-7 presents hotel and motel data for the eight-county region. Within all eight counties, in the first quarter of 2007, there were 72 hotels or motels with 313,500 room nights available and an occupancy rate of 51.7%. Table 2.5.1-8 quantifies seasonal housing in the eight counties. In 2000, there were 5806 vacant housing units that were designated for seasonal, recreational, or occasional use. Most seasonal housing is located along the coast, so seasonal population fluctuations are more apparent in places such as Port O'Connor, Seadrift, Olivia, Port Alto, and Port Lavaca. In the "resort-style" towns, the population drops in the "off season" and swells to several times the "off season" size in the "high season." Visitors to the area come to rent homes near the beach, go fishing and boating, and engage in wildlife observation activities.

Recreational facilities and major special events in the 50-mile region are described in Section 2.5.2.5.

2.5.1 References

TOG 2007. Texas Office of the Governor, *Regional Hotel Reports*, available at http://www.travel.state.tx.us/HotelReports.aspx, accessed December 13, 2007.

TOSD 2006. Texas Office of the State Demographer, *Projections of the Population of Texas and Counties in Texas by Age, Sex, and Race/Ethnicity for 2000-2004*, available at http://txsdc.utsa.edu/tpepp/2006projections/, accessed December 10, 2007.

USCB 2000a. U.S. Census Bureau, *P1. Total Population [1] — Universe: Total population. Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data*, available at http://www.factfinder.census.gov, accessed January 9, 2008.

USCB 2000b. U.S. Census Bureau, *DP-1. Profile of General Demographic Characteristics: 2000. Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data*, available at http://www.factfinder.census.gov, accessed December 6 and 13, 2007.

USCB 2003a. U.S. Census Bureau, *Table 3b. Population in Metropolitan and Micropolitan Statistical Areas Ranked Separately by 2000 Population for the United States and Puerto Rico: 1990 and 2000*, available at http://www.census.gov, accessed December 6, 2007.

USCB 2003b. U.S. Census Bureau, *County-To-County Worker Flow Files*, available at http://www.census.gov, accessed January 21, 2008.

USCB 2007a. U.S. Census Bureau. *Subcounty Population Datasets,* available at http://www.census.gov, accessed March 24, 2008

USCB 2007b. U.S. Census Bureau. *Metropolitan and Micropolitan Statistical Area Estimates,* available at http://www.census.gov, accessed March 24, 2008.

U.S. NRC Apr 1998. U.S. Nuclear Regulatory Commission, *Regulatory Guide 4.7 — General Site Suitability Criteria for Nuclear Power Stations*, DG-4004, April 1998.

Table 2.5.1-1 (Sheet 1 of 6)
Current Populations and Projections, by Sector, to 2080

Radii/Distance (miles)

Sectors	Year	0–1	1–2	2–3	3–4	4–5	5–10	0–10	10–20	20–30	30–40	40–50	0–50
N	2000	0	1	0	9	0	141	151	37,290	1792	681	8007	47,921
	2010	0	1	0	10	0	154	165	40,646	1946	695	8030	51,482
	2020	0	1	0	11	0	168	180	44,375	2119	714	8064	55,452
	2030	0	1	0	12	0	183	196	48,477	2307	730	8086	59,796
	2040	0	1	0	13	0	200	214	52,952	2513	753	8189	64,621
	2050	0	2	0	14	0	219	235	57,799	2735	770	8212	69,751
	2060	0	2	0	15	0	238	255	63,020	2975	792	8246	75,288
	2070	0	2	0	17	0	259	278	68,614	3232	814	8280	81,218
	2080	0	2	0	18	0	283	303	74,953	3523	839	8314	87,932
NNE	2000	0	0	0	35	0	503	538	28,296	1151	694	327	31,006
	2010	0	0	0	38	0	548	586	30,843	1249	725	335	33,738
	2020	0	0	0	42	0	599	641	33,672	1358	761	344	36,776
	2030	0	0	0	45	0	654	699	36,785	1477	798	354	40,113
	2040	0	0	0	50	0	714	764	40,180	1606	836	365	43,751
	2050	0	0	0	54	0	780	834	43,859	1747	879	376	47,695
	2060	0	0	0	59	0	850	909	47,820	1898	922	388	51,937
	2070	0	0	0	64	0	926	990	52,065	2059	965	399	56,478
	2080	0	0	0	70	0	1011	1081	56,875	2241	1015	411	61,623
NE	2000	0	0	0	0	0	1312	1312	1263	1203	7433	3217	14,428
	2010	0	0	0	0	0	1430	1430	1377	1286	7805	3378	15,276
	2020	0	0	0	0	0	1561	1561	1503	1380	8251	3571	16,266
	2030	0	0	0	0	0	1706	1706	1642	1480	8697	3764	17,289
	2040	0	0	0	0	0	1863	1863	1793	1586	9143	3964	18,349
	2050	0	0	0	0	0	2034	2034	1958	1704	9663	4189	19,548
	2060	0	0	0	0	0	2217	2217	2134	1827	10,183	4414	20,775
	2070	0	0	0	0	0	2414	2414	2324	1956	10,704	4639	22,037
	2080	0	0	0	0	0	2637	2637	2539	2102	11,298	4897	23,473

Table 2.5.1-1 (Sheet 2 of 6)
Current Populations and Projections, by Sector, to 2080

Radii/Distance (miles)

Sectors	Year	0–1	1–2	2–3	3–4	4–5	5–10	0–10	10–20	20–30	30–40	40–50	0–50
ENE	2000	0	0	0	0	0	2881	2881	1222	800	1549	655	7107
	2010	0	0	0	0	0	3140	3140	1331	851	1627	690	7639
	2020	0	0	0	0	0	3428	3428	1453	909	1720	731	8241
	2030	0	0	0	0	0	3745	3745	1586	970	1814	773	8888
	2040	0	0	0	0	0	4091	4091	1732	1034	1907	816	9580
	2050	0	0	0	0	0	4466	4466	1889	1105	2016	864	10,340
	2060	0	0	0	0	0	4869	4869	2059	1179	2125	914	11,146
	2070	0	0	0	0	0	5301	5301	2241	1256	2234	964	11,996
	2080	0	0	0	0	0	5791	5791	2447	1343	2359	1021	12,961
E	2000	0	0	0	0	0	58	58	262	262	262	262	1106
	2010	0	0	0	0	0	63	63	281	281	281	281	1187
	2020	0	0	0	0	0	68	68	297	297	297	297	1256
	2030	0	0	0	0	0	74	74	318	318	318	318	1346
	2040	0	0	0	0	0	80	80	339	339	339	339	1436
	2050	0	0	0	0	0	87	87	360	360	360	360	1527
	2060	0	0	0	0	0	94	94	384	384	384	384	1630
	2070	0	0	0	0	0	101	101	409	409	409	409	1737
	2080	0	0	0	0	0	110	110	438	438	438	438	1862
ESE	2000	0	0	0	0	0	0	0	360	626	1108	0	2094
	2010	0	0	0	0	0	0	0	385	670	1186	0	2241
	2020	0	0	0	0	0	0	0	407	707	1252	0	2366
	2030	0	0	0	0	0	0	0	436	757	1341	0	2534
	2040	0	0	0	0	0	0	0	464	808	1429	0	2701
	2050	0	0	0	0	0	0	0	493	858	1518	0	2869
	2060	0	0	0	0	0	0	0	526	914	1618	0	3058
	2070	0	0	0	0	0	0	0	558	970	1717	0	3245
	2080	0	0	0	0	0	0	0	598	1039	1839	0	3476

Table 2.5.1-1 (Sheet 3 of 6)
Current Populations and Projections, by Sector, to 2080

Radii/Distance (miles)

Sectors	Year	0–1	1–2	2–3	3–4	4–5	5–10	0–10	10–20	20–30	30–40	40–50	0–50
SE	2000	0	0	0	0	0	12	12	1007	1607	2	0	2628
	2010	0	0	0	0	0	13	13	1053	1695	2	0	2763
	2020	0	0	0	0	0	14	14	1096	1774	2	0	2886
	2030	0	0	0	0	0	16	16	1146	1872	2	0	3036
	2040	0	0	0	0	0	17	17	1197	1970	3	0	3187
	2050	0	0	0	0	0	19	19	1248	2069	3	0	3339
	2060	0	0	0	0	0	20	20	1310	2183	3	0	3516
	2070	0	0	0	0	0	22	22	1365	2292	3	0	3682
	2080	0	0	0	0	0	24	24	1434	2426	3	0	3887
SSE	2000	0	0	0	0	55	104	159	43	17	0	0	219
	2010	0	0	0	0	60	111	171	44	18	0	0	233
	2020	0	0	0	0	65	118	183	46	19	0	0	248
	2030	0	0	0	0	72	126	198	47	19	0	0	264
	2040	0	0	0	0	78	134	212	48	20	0	0	280
	2050	0	0	0	0	85	143	228	49	21	0	0	298
	2060	0	0	0	0	93	153	246	51	22	0	0	319
	2070	0	0	0	0	101	164	265	52	23	0	0	340
	2080	0	0	0	0	111	176	287	54	24	0	0	365
S	2000	0	0	0	0	0	33	33	13	122	10,397	18,948	29,513
	2010	0	0	0	0	0	34	34	13	127	10,878	20,268	31,320
	2020	0	0	0	0	0	35	35	14	132	11,359	21,650	33,190
	2030	0	0	0	0	0	37	37	14	138	11,924	23,314	35,427
	2040	0	0	0	0	0	38	38	15	144	12,489	25,103	37,789
	2050	0	0	0	0	0	39	39	15	149	13,055	27,016	40,274
	2060	0	0	0	0	0	41	41	15	156	13,639	29,083	42,934
	2070	0	0	0	0	0	43	43	16	162	14,289	31,527	46,037
	2080	0	0	0	0	0	44	44	16	169	14,958	34,157	49,344

Table 2.5.1-1 (Sheet 4 of 6)
Current Populations and Projections, by Sector, to 2080

Radii/Distance (miles)

Sectors	Year	0–1	1–2	2–3	3–4	4–5	5–10	0–10	10–20	20–30	30–40	40–50	0–50
SSW	2000	0	0	0	0	0	34	34	17	232	1100	6491	7874
	2010	0	0	0	0	0	35	35	18	239	1147	7530	8969
	2020	0	0	0	0	0	36	36	18	246	1196	8688	10,184
	2030	0	0	0	0	0	38	38	19	253	1248	10,089	11,647
	2040	0	0	0	0	0	39	39	19	260	1305	11,729	13,352
	2050	0	0	0	0	0	40	40	20	267	1365	13,606	15,298
	2060	0	0	0	0	0	42	42	20	276	1440	15,782	17,560
	2070	0	0	0	0	0	43	43	21	283	1512	18,380	20,239
	2080	0	0	0	0	0	45	45	21	293	1600	21,336	23,295
SW	2000	0	0	3	0	0	18	21	21	3697	1825	7802	13,366
	2010	0	0	3	0	0	19	22	22	3815	1894	8577	14,330
	2020	0	0	4	0	0	20	24	22	3935	1964	9417	15,362
	2030	0	0	4	0	0	21	25	23	4056	2033	10,390	16,527
	2040	0	0	4	0	0	22	26	24	4177	2109	11,534	17,870
	2050	0	0	5	0	0	23	28	24	4298	2179	12,772	19,301
	2060	0	0	5	0	0	24	29	25	4456	2273	14,259	21,042
	2070	0	0	6	0	0	25	31	26	4580	2350	15,933	22,920
	2080	0	0	6	0	0	26	32	27	4741	2445	17,850	25,095
WSW	2000	0	0	0	0	31	58	89	14	161	108	27,560	27,932
	2010	0	0	0	0	34	62	96	14	166	113	28,938	29,327
	2020	0	0	0	0	37	67	104	15	173	118	30,316	30,726
	2030	0	0	0	0	40	72	112	16	179	124	31,694	32,125
	2040	0	0	0	0	44	77	121	16	184	130	33,348	33,799
	2050	0	0	0	0	48	82	130	17	191	135	34,726	35,199
	2060	0	0	0	0	52	88	140	17	197	142	36,655	37,151
	2070	0	0	0	0	57	95	152	18	204	148	38,308	38,830
	2080	0	0	0	0	62	102	164	18	212	155	40,238	40,787

Table 2.5.1-1 (Sheet 5 of 6)
Current Populations and Projections, by Sector, to 2080

Radii/Distance (miles)

Sectors	Year	0–1	1–2	2–3	3–4	4–5	5–10	0–10	10–20	20–30	30–40	40–50	0–50
W	2000	0	0	0	33	0	13	46	241	2609	493	1649	5038
	2010	0	0	0	36	0	14	50	248	2687	508	1717	5210
	2020	0	0	0	39	0	15	54	258	2792	528	1789	5421
	2030	0	0	0	43	0	16	59	268	2896	548	1860	5631
	2040	0	0	0	47	0	18	65	275	2974	563	1942	5819
	2050	0	0	0	51	0	19	70	284	3079	583	2013	6029
	2060	0	0	0	56	0	21	77	294	3183	603	2107	6264
	2070	0	0	0	61	0	22	83	304	3287	623	2188	6485
	2080	0	0	0	66	0	24	90	316	3418	648	2285	6757
WNW	2000	0	4	0	0	2	52	58	643	1147	475	2287	4610
	2010	0	4	0	0	2	56	62	662	1181	488	2350	4743
	2020	0	5	0	0	2	61	68	688	1227	505	2418	4906
	2030	0	5	0	0	3	67	75	714	1273	520	2481	5063
	2040	0	6	0	0	3	72	81	733	1308	535	2566	5223
	2050	0	6	0	0	3	79	88	759	1353	551	2629	5380
	2060	0	7	0	0	3	85	95	785	1399	568	2715	5562
	2070	0	7	0	0	4	92	103	811	1445	585	2783	5727
	2080	0	8	0	0	4	101	113	843	1503	605	2869	5933
NW	2000	0	0	6	16	4	814	840	1867	916	3525	765	7913
	2010	0	0	7	17	4	887	915	1945	947	3598	783	8188
	2020	0	0	7	19	5	969	1000	2042	988	3706	808	8544
	2030	0	0	8	21	5	1058	1092	2143	1026	3782	827	8870
	2040	0	0	9	23	6	1156	1194	2233	1064	3887	853	9231
	2050	0	0	9	25	6	1262	1302	2341	1105	3963	872	9583
	2060	0	0	10	27	7	1376	1420	2453	1150	4071	899	9993
	2070	0	0	11	29	7	1498	1545	2569	1197	4179	926	10,416
	2080	0	0	12	32	8	1636	1688	2707	1250	4290	953	10,888

Table 2.5.1-1 (Sheet 6 of 6)
Current Populations and Projections, by Sector, to 2080

Radii/Distance (miles)

Sectors	Year	0–1	1–2	2–3	3–4	4–5	5–10	0–10	10–20	20–30	30–40	40–50	0–50
NNW	2000	0	0	4	0	0	192	196	4680	1616	9705	1206	17,403
	2010	0	0	4	0	0	209	213	5100	1703	9899	1231	18,146
	2020	0	0	5	0	0	228	233	5567	1807	10,190	1268	19,065
	2030	0	0	5	0	0	250	255	6081	1910	10,384	1293	19,923
	2040	0	0	6	0	0	273	279	6641	2029	10,675	1329	20,953
	2050	0	0	6	0	0	298	304	7247	2148	10,870	1355	21,924
	2060	0	0	7	0	0	324	331	7901	2283	11,161	1392	23,068
	2070	0	0	7	0	0	353	360	8601	2425	11,452	1429	24,267
	2080	0	0	8	0	0	386	394	9394	2584	11,743	1466	25,581
TOTAL	2000	0	5	13	93	92	6225	6428	77,239	33,257	39,870	82,417	239,211
	2010	0	5	14	101	100	6775	6995	83,982	35,230	41,393	87,537	255,137
	2020	0	6	16	111	109	7387	7629	91,473	37,150	43,140	93,004	272,396
	2030	0	6	17	121	120	8063	8327	99,715	39,442	44,880	99,107	291,471
	2040	0	7	19	133	131	8794	9084	108,661	41,751	46,760	106,182	312,438
	2050	0	8	20	144	142	9590	9904	118,362	44,148	48,607	113,346	334,367
	2060	0	9	22	157	155	10,442	10,785	128,814	46,817	50,666	121,867	358,949
	2070	0	9	24	171	169	11,358	11,731	139,994	49,491	52,769	131,066	385,051
	2080	0	10	26	186	185	12,396	12,803	152,680	52,699	55,075	141,445	414,702

Table 2.5.1-2
Counties Completely or Partially within the 50-Mile Region

Aransas	Karnes*
Bee	Lavaca*
Calhoun	Matagorda*
Colorado*	Nueces*
DeWitt	Refugio
Goliad	San Patricio*
Gonzales*	Victoria
Jackson	Wharton*

SOURCE:Figure 2.5.1-9
*Less than approximately 50% of this county falls within the 50-mile radius

Table 2.5.1-3
Larger* Municipalities in the 50-Mile Region

Municipality	County	2006 Population	2000 Population	Distance from Proposed Site (air-miles)	Direction
Victoria	Victoria	62,169	60,603	13.3	N
Port Lavaca	Calhoun	11,696	12,035	24.5	E
Cuero	DeWitt	6632	6571	36.6	NNW
Edna	Jackson	5867	5899	34.4	NE
Yoakum	DeWitt	5677	5731	47.2	N

Sources: USCB 2000a; USCB 2007a; and Figures 2.5.1-9 and 2.5.1-10
*Municipalities with populations greater than 5000

Table 2.5.1-4
Population Data, 1970 to 2040

	Calhoun		DeWitt		Goliad		Jackson	
Year	Population	Average Annual Percent Growth	Population	Average Annual Percent Growth	Population	Average Annual Percent Growth	Population	Average Annual Percent Growth
1970	17,831	N/A	18,660	N/A	4869	N/A	12,975	N/A
1980	19,574	0.9%	18,903	0.1%	5193	0.6%	13,352	0.3%
1990	19,053	–0.3%	18,840	0.0%	5980	1.4%	13,039	–0.2%
2000	20,647	0.8%	20,013	0.6%	6928	1.5%	14,391	1.0%
2010	22,684	0.9%	20,832	0.4%	7416	0.7%	15,571	0.8%
2020	24,427	0.7%	21,538	0.3%	7798	0.5%	16,745	0.7%
2030	25,732	0.5%	21,902	0.2%	7963	0.2%	17,432	0.4%
2040	26,571	0.3%	21,987	0.0%	7921	–0.1%	17,759	0.2%

	Refugio		Victoria		Region of Influence		Texas	
Year	Population	Average Annual Percent Growth	Population	Average Annual Percent Growth	Population	Average Annual Percent Growth	Population	Average Annual Percent Growth
1970	9494	N/A	53,766	N/A	117,595	N/A	11,196,730	N/A
1980	9289	–0.2%	68,807	2.5%	135,118	1.4%	14,229,191	2.4%
1990	7976	–1.5%	74,361	0.8%	139,249	0.3%	16,986,510	1.8%
2000	7828	–0.2%	84,088	1.2%	153,895	1.0%	20,851,820	2.1%
2010	8365	0.7%	94,143	1.1%	169,011	0.9%	24,330,612	1.6%
2020	8660	0.3%	104,236	1.0%	183,404	0.8%	28,005,788	1.4%
2030	8793	0.2%	112,380	0.8%	194,202	0.6%	31,830,589	1.3%
2040	8783	0.0%	119,276	0.6%	202,297	0.4%	35,761,201	1.2%

Sources: USCB 1995; USCB 2000b; TOSD 2006
N/A – Not applicable, base year.

Table 2.5.1-5
Age Distribution, 2000

Age Group	Calhoun		DeWitt		Goliad		Jackson	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Under 5 years	1,616	7.8	1,093	5.5	399	5.8	1,022	7.1
5 to 9 years	1,714	8.3	1,263	6.3	481	6.9	1,001	7
10 to 14 years	1,621	7.9	1,453	7.3	530	7.7	1,125	7.8
15 to 19 years	1,524	7.4	1,424	7.1	555	8	1,227	8.5
20 to 24 years	1,197	5.8	924	4.6	276	4	752	5.2
25 to 34 years	2,556	12.4	2,188	10.9	690	10	1,631	11.3
35 to 44 years	3,077	14.9	3,229	16.1	1,043	15.1	2,123	14.8
45 to 54 years	2,598	12.6	2,727	13.6	996	14.4	1,927	13.4
55 to 59 years	1,096	5.6	1,036	5.2	397	5.7	676	4.7
60 to 64 years	909	4.4	895	4.5	353	5.1	612	4.3
65 to 74 years	1,705	8.3	1,887	9.4	659	9.5	1,194	8.3
75 to 84 years	804	3.9	1,319	6.6	400	5.8	780	5.4
85 years and over	230	1.1	575	2.9	152	2.2	321	2.2
TOTAL	20,647	100	20,013	100	6,928	100	14,391	100
Median age (years)	35.3		40.1		40.2		37.3	

Age Group	Refugio		Victoria		Region of Influence		Texas	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Under 5 years	466	6	6,431	7.6	11,027	7.2	1,624,628	7.8
5 to 9 years	566	7.2	6,682	7.9	11,707	7.6	1,654,184	7.9
10 to 14 years	626	8	7,051	8.4	12,406	8.1	1,631,192	7.8
15 to 19 years	616	7.9	6,925	8.2	12,271	8.0	1,636,232	7.8
20 to 24 years	346	4.4	5,167	6.1	8,662	5.6	1,536,404	7.4
25 to 34 years	875	11.2	10,745	12.8	18,685	12.1	3,162,083	15.2
35 to 44 years	1,155	14.8	12,911	15.4	23,538	15.3	3,322,238	15.9
45 to 54 years	1,029	13.1	11,109	13.2	20,386	12.2	2,611,137	12.5
55 to 59 years	423	5.4	3,884	4.6	7,509	4.9	896,521	4.3
60 to 64 years	425	5.4	3,124	3.7	6,318	4.1	107,669	3.4
65 to 74 years	689	8.8	5,557	6.6	11,691	7.6	1,142,608	5.5
75 to 84 years	438	5.6	3,346	4	7,087	4.6	691,984	3.3
85 years and over	174	22	1,156	1.4	2,608	1.7	237,940	1.1
TOTAL	7,828	100	84,088	100	153,895	100	20,851,820	100
Median age (years)	38.6		34.2		N/A		32.3	

Source: USCB 2000b
Note: Age stratification data at this level of detail is not available in 2006 estimates. Therefore, the 2000 data is the most current.

Table 2.5.1-6
Worker Flows into the Eight-County Region, 2000

Number of workers residing outside of the 8-county region but traveling into the 8-county region for work	Workplace County
1248	Aransas
1216	Bee
1503	Calhoun
1369	DeWitt
109	Goliad
502	Jackson
261	Refugio
1644	Victoria
7852	8-County In-Migrating Worker Total

Source: USCB 2003b

Table 2.5.1-7
Hotel/Motel Data, 2007, First Quarter, 8-County Region[a]

City/Town/Place	Rate (Dollars)	Number of Hotels	Room Nights Available (in thousands)[b]	Percent Occupancy
Aransas Pass	0–39.99	1	4.1	27.1
Beeville	0–39.99	2	5.9	53.3
	40–49.99	1	4.9	43.6
	50–59.99	1	5.4	79.6
	80–89.99	1	5.5	80.3
Cuero	0–39.99	2	5.4	39.0
	70–79.99	1	2.8	78.4
Edna	40–49.99	2	5.7	49.1
Fulton	60–69.99	2	7.0	50.2
	70–79.99	1	6.6	48.0
	80–89.99	1	4.0	54.8
Goliad	0–39.99	2	5.3	55.4
Port Aransas	110–120	1	4.1	76.4
Port Lavaca	0–39.99	2	7.5	39.2
	40–49.99	1	4.8	46.9
	50–59.99	2	13.6	48.8
	80–89.99	1	4.5	73.2
Port O'Connor	40–49.99	1	3.2	19.0
	60–69.99	2	4.7	48.2
	80–89.99	1	0.7	29.2
	90–99.99	1	4.5	10.2
Refugio	0–39.99	1	1.5	36.3
	40–49.99	1	4.0	38.9
	70–79.99	1	1.4	38.3
Rockport	0–39.99	3	7.7	32.8
	40–49.99	1	5.4	45.4
	50–59.99	3	9.9	33.7
	60–69.99	2	4.2	42.5
	70–79.99	3	20.1	41.5
	80–89.99	1	4.5	55.7
	100–110	2	8.1	38.0
	120–130	2	1.6	31.0
	130+	1	7.0	46.7
Seadrift	40–49.99	2	4.3	42.2
	60–69.99	1	1.1	27.5
	80–89.99	1	1.1	55.6
Victoria	0–39.99	7	41	51.5
	40–49.99	1	7.2	76.1
	50–59.99	1	9.0	51.3
	60–69.99	5	45.1	61.1
	80–89.99	1	5.8	76.3
	90–99.99	2	11.0	79.8
Yoakum	60–69.99	1	2.3	69.5
8-County Total		72	313.5	51.7

a. Only properties with revenues exceeding $18,000 in the current quarter.
b. Room Nights Available — the number of rooms in a hotel multiplied by the number of nights in the current quarter.

Source: TOG 2007

Table 2.5.1-8
Seasonal Housing Data 2000, 8-County Region

County	Vacant Housing for Seasonal, Recreational, or Occasional Use
Aransas	2461
Bee	215
Calhoun	1751
DeWitt	318
Goliad	385
Jackson	228
Refugio	187
Victoria	261
8-County Total	5806

Source: USCB 2000b

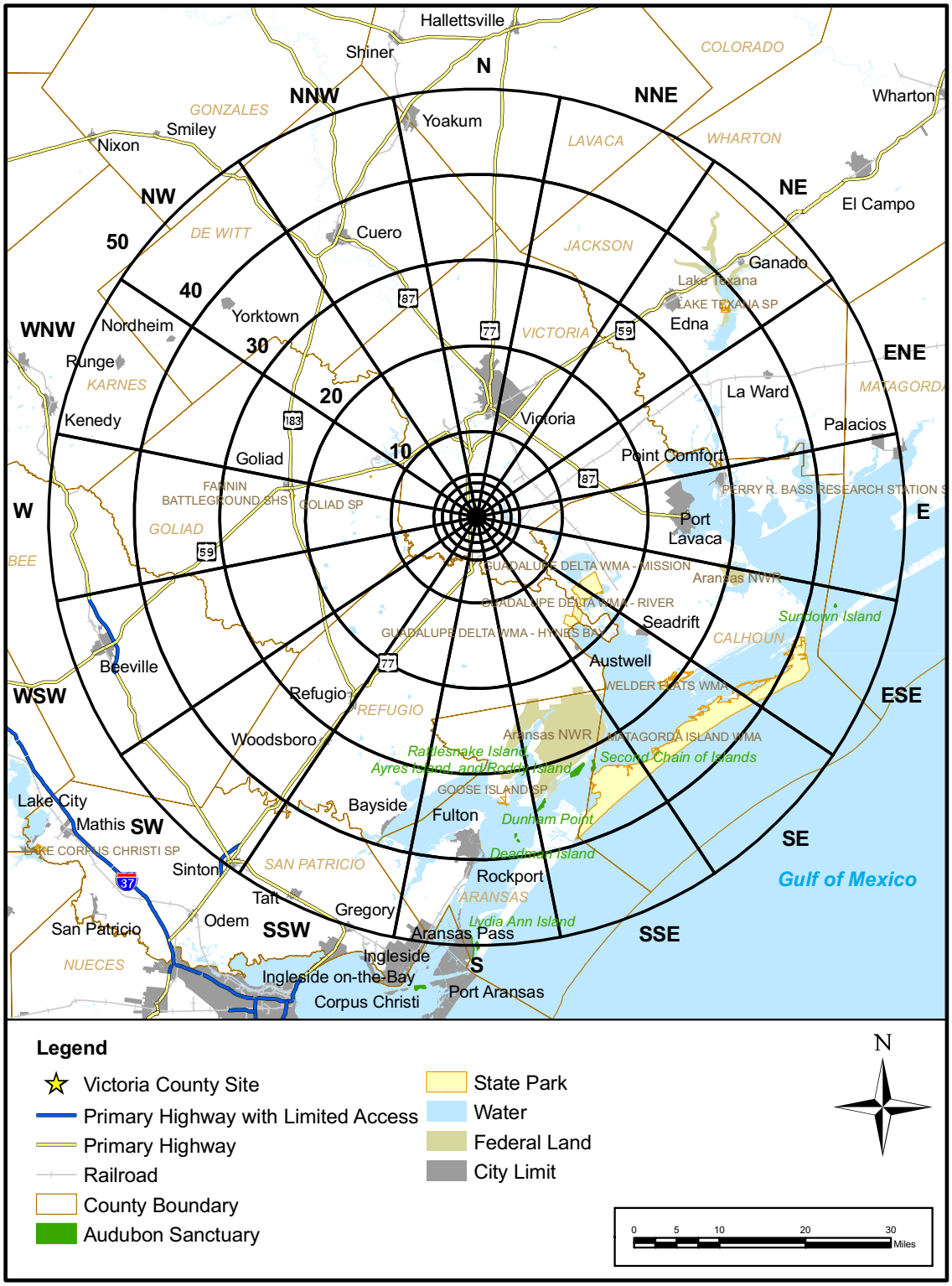

Figure 2.5.1-9 50-Mile Vicinity with Direction Sectors

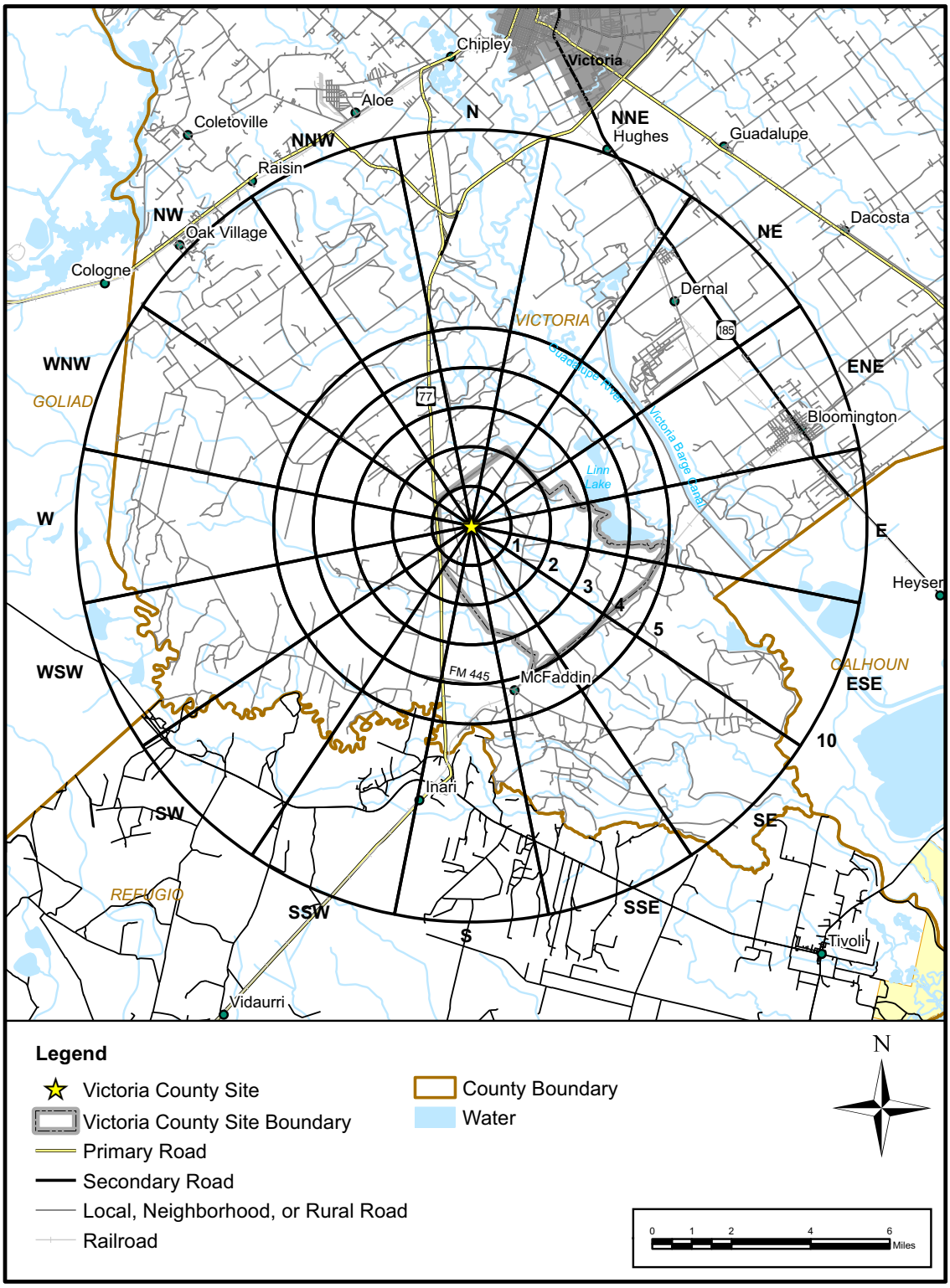

Figure 2.5.1-10 10-Mile Vicinity with Direction Sectors

The basic characteristics of this technique are the use of separate cohorts — persons with one or more common characteristics — and the separate projection of each of the major components of population change — fertility, mortality, and migration — for each of the cohorts. These projections of components for each cohort are then combined in a demographic equation as follows:

$P_{t2} = P_{t1} + B_{t1-t2} - D_{t1-t2} + M_{t1-t2}$

Where :

P_{t1} = the population projected at some future data $t_1 - t_2$
P_{t1} = the population at the base year t_1
B_{t1-t2} = the number of births that occur during the interval $t_1 - t_2$
D_{t1-t2} = the number of deaths that occur during the interval $t_1 - t_2$
M_{t1-t2} = the number of net migration that takes place during the interval $t_1 - t_2$

When several cohorts are used, P_{t2} may be seen as:

$$P_{t2} = \sum_{i=1}^{n} P_{ci,\,t2}$$

Where:

Pt2 is as in the equation above
Pci,t2 = population of a given cohort at time t2 and
$P_{ci,t2} = P_{ci,\,t1} + B_{ci,\,t1-t2} - D_{ci,\,t1} + M_{ci,\,t1}$

Where :

all terms are as noted above but are specific to given cohorts ci
In this, as in any other use of the cohort-component technique at least four major steps must be completed:

1. The selection of a baseline set of cohorts for the projections area or areas of interest for the baseline time period (usually the last census and for other dates for which detailed base data are available);
2. The determination of appropriate baseline migration, mortality, and fertility measures for each cohort for the baseline time period;
3. The determine of a method for projecting trends in fertility, mortality and migration rates over the projection period;
4. The selection of a computational procedure for applying the rates to the baseline cohorts to project the population for the projection period.

Source: TOSD 2006
Note: In performing their projection analyses, the State Demographer's Office provided projections based on four different scenarios, which produce four alternative sets of population values. These scenarios assume the same set of mortality and fertility assumptions in each scenario but differ in their assumptions relative to net migration. The net migration assumptions made for three scenarios are derived from 1990-2000 patterns which have been altered relative to expected future population trends. This is done by systematically and uniformly altering the adjusted (as noted above) 1990-2000 net migration rates by age, sex and race/ethnicity. The scenarios so produced are referred to as the zero migration (0.0) scenario, the one-half 1990-2000 (0.5) scenario, and the 1990-2000 (1.0) scenario. The fourth scenario uses 2000 to 2004 estimates of net migration with 2004 population values being taken from the Texas State Data Center age, sex, and race/ethnicity estimates.

Exelon selected the one-half 1990-2000 (0.5) scenario because it is the scenario recommended by the State Demographer's Office for long term planning. This scenario was prepared as an approximate average of the zero (0.0) and 1990-2000 (1.0) scenarios. It assumes rates of net migration one-half of those of the 1990s. The reason for including this scenario is that many counties in the State are unlikely to continue to experience the over all levels of relative extensive growth of the 1990s. This scenario suggests slower than 1990-2000, but steady growth.

Figure 2.5.1-11 Population Projection Methodology

2.5.2 Community Characteristics

The VCS site is a greenfield site; therefore, Exelon can not use the residential distributions of an existing nuclear plant workforce at that location as a surrogate for the residential distributions of the new plant workforce, as utilities have done when proposing new reactors on existing sites. Instead, to establish the most likely counties that would be affected by the new workforce, Exelon reviewed data from several governmental agencies, including the U.S. Census Bureau (USCB), the U.S. Department of Commerce, the Bureau of Economic Analysis (BEA), the U.S. Department of Labor, and the Bureau of Labor Statistics (BLS), to develop a model and then arrive at a determination of which counties within 50 miles of the proposed site have strong economic linkages to the proposed project's host county, Victoria. Exelon analyzed regional socioeconomic data including, but not limited to, county populations, the location of population centers, location and sizes of overall and construction labor forces, and worker commuting patterns among counties surrounding the VCS site. Generally, counties are linked economically and share economic benefits if (1) there is a relationship between one county's labor force (size, availability, skill mix) and the use of that labor force in another county and (2) there are commuting routes of relative ease between the counties (particularly between the population centers). These factors were used to objectively determine the region of influence (ROI) analyzed in this document. Based on this analysis, Exelon has concluded that the proposed action has the potential to impact socioeconomic variables (employment, population, income, housing, infrastructure, and community services) in six counties (Calhoun, DeWitt, Goliad, Jackson, Refugio, and Victoria).

This subsection addresses the following community characteristics for the ROI: economy, taxes, transportation, land use, housing, community infrastructure and public services, and education. Subsection 2.5.2.5, Aesthetics and Recreation, contains data for the entire 50-mile radius around the site because most of the potential socioeconomic impacts to these resources should be experienced in that area. Subsection 2.5.2.8, Schools, contains data for colleges and universities within a 50-mile region for the same reason.

Throughout socioeconomics, data is presented for the most current year available. Depending on the source of the data, the most current year may vary.

2.5.2.1 Economy

The proposed VCS site is in Victoria County, near the central Texas Gulf Coast. In the ROI, Victoria, Goliad, and Calhoun Counties comprise the Victoria, Texas Metropolitan Statistical Area (MSA) (OMB Dec 2006). In addition, five of the six ROI counties (excluding Refugio County), along with Gonzales and Lavaca Counties to the north and east, comprise the seven-county Golden Crescent Regional Planning Commission (GCRPC) (GCRPC Undated) and the Texas Workforce Commission's Golden Crescent Local Workforce Development Region (TWC 2007).

The ROI's principal economic centers include the six county seats: Port Lavaca (Calhoun County); Cuero (DeWitt County); Goliad (Goliad County); Edna (Jackson County); Refugio (Refugio County); and Victoria (Victoria County) (TWC 2007). Victoria is by far the largest city in the ROI; as of the 2000

Census, its population of 60,603 was more than double the combined population of the other five county seats (USCB 2000a).

The area within 10 miles of the proposed VCS site is generally rural farmland, primarily pastureland used for livestock ranching with some crop production. The ROI as a whole is also predominantly rural, with an economy based primarily on cattle ranching, crop production (rice, cotton, sorghum, and corn), oil and natural gas production, oil refining, petrochemical production, and commercial fishing (TSHA Jun 2001a; TSHA Jun 2001b; TSHA Jun 2001c; TSHA Jan 2006a; TSHA Jan 2006b; TSHA Jan 2008a; TWC 2007).

Table 2.5.2-1 details labor force, employment, and unemployment trends in the ROI, as reported by the BLS. In 2006, the ROI labor force totaled 78,157 persons, representing less than 1.0% of the total Texas labor force (BLS 2007a). The ROI labor force increased at an average annual rate of 0.4% between 1996 and 2006, while the state's labor force grew at an average annual rate of 1.7% over the same period (BLS 2007a). As shown in Figure 2.5.2-1, the ROI labor force is concentrated in Victoria County, with 59% of the ROI total, followed by Calhoun and DeWitt Counties with 12% each (BLS 2007a). In 2006, 3391 persons in the ROI were unemployed, a decline of 1.3% since 1996. The 2006 annual unemployment rate in the ROI was 4.3%, and the unemployment rate in its individual counties ranged from 4.1% to 4.9%, compared to 4.9% for Texas and 4.6% for the United States (BLS 2007a).

The BEA reports employment data by industrial sector (as defined by the North American Industrial Classification System [NAICS]) and other subcategories. The Service sector (which includes Information; Professional and Technical Services; Management of Companies and Enterprises; Administrative and Waste Services; Educational Services; Health Care and Social Assistance; Arts, Entertainment and Recreation; Accommodation and Food Services; and other services except Public Administration) is the largest source of employment in the ROI, accounting for 28.4% of jobs, compared to 39.6% for Texas. Local government provides 12.2% of jobs in the ROI, while the retail sector provides 11.4%. Manufacturing and construction each provide approximately 8%, and the finance, insurance, and real estate sectors together account for 6.5%. The rural nature of the ROI is reflected in the number of jobs in farm employment, 7.4% for the ROI compared to 2.2% for Texas (BEA 2008). Table 2.5.2-2 summarizes regional employment by industrial category and shows detailed industry sector employment by county, for the ROI, and for Texas. Figure 2.5.2-2 illustrates employment by industrial sector in the ROI as a whole.

Table 2.5.2-3 lists the ROI's major employers. The largest employers are concentrated in Victoria and Calhoun Counties, with one large plastics company located in Jackson County. The largest public employers tend to be the independent school districts (ISDs) (e.g., Victoria ISD has more than 2100 employees) and county governments. The largest private employers are in the chemical/plastics industry and the health care sector (CCEDC Undated; CDC Jul 2006; Victoria Undated b, Yoakum Undated a, TWC 2007, JCCC Oct 2007, VEDC 2007a). {According to the Texas Workforce Commission, as of 2004, the ROI contained 1264 establishments with 10 or more employees. Less than

1% of these firms had more than 1000 employees, and 84% had fewer than 50 employees} (TWC 2007).

In its Quarterly Census of Employment and Wages, the BLS collects employment and wage data by NAICS industrial sectors. Table 2.5.2-4 presents data for 2001 through 2006 for workers in all industry sectors and in NAICS Sector 23, Construction; Sector 237, Heavy and Civil Engineering Construction; Sector 22, Utilities; and Sector 221113, Nuclear Electric Power Generation. As the table shows, the 2006 average annual wages for the total of all sectors and subsectors vary widely among the ROI counties, ranging from $26,506 in DeWitt County to $49,933 in Calhoun County. Generally, wages tend to rise as industry specialization increases. Average ROI wages in 2006 for Sector 23, Construction, ranged from $26,207 in DeWitt County to $51,233 in Goliad County. Wages for Sector 237, Heavy and Civil Engineering Construction, ranged from $33,150 in DeWitt County to $51,390 in Calhoun County, compared to $48,466 for Texas and $52,617 for the United States (BLS 2007b). Average annual wages in 2006 were not disclosed for Sector 237 in Goliad and Refugio Counties[1]. In the ROI, wages in this sector grew between 2001 and 2006 (not adjusted for inflation) and the growth rates also varied widely, ranging from 0.2% in DeWitt County to 6.8% in Victoria County, compared to 4.9% for Texas and 4.1% nationally (BLS 2007b; BLS 2007c). Figure 2.5.2-3 illustrates wage growth for Sector 237 in the ROI counties. Construction wages are discussed more fully in Subsection 4.4.2

Table 2.5.2-4 also presents average annual wages in Sector 22, Utilities, for the three ROI counties where wages were disclosed, along with Texas and the United States. In 2006 in this sector, Goliad County had the highest annual wages among the ROI counties, at $70,386, followed by Victoria County with $62,337. The table shows only U.S. wages for Section 221113, Nuclear Electric Power Generation; wages for Texas were not disclosed, and this sector is currently not present in the ROI. Operations wages are discussed in more detail in Subsection 5.8.2.

BLS also collects occupational employment data by state and by selected MSAs. Occupational categories are determined by a worker's skills and job duties, regardless of the industrial sector in which the worker is employed. Table 2.5.2-5 shows 2006 employment in the Department of Labor category of Construction and Extraction Occupations was 5390 jobs for the Victoria MSA, representing 1% of Texas employment (513,910) for that category. In the Victoria MSA, employment in the Construction and Extraction Occupation category accounts for 11.2% of total employment in the MSA, while these occupations provide only 5.3% of total employment in Texas as a whole (BLS May 2006).

Texas is a "right-to-work" state; workers are not required to join labor unions as a condition of employment. Approximately 5% of the Texas workforce is unionized, with the greatest concentration of unionized workers in the governmental (public) sector (BLS Jan 2008).

Per capita personal income (PCI) provides a useful means of comparing income among regions. The BEA calculates PCI by dividing the total personal income in an area by the area population. The ROI

1. County or other small area data may not be disclosed when data do not meet BLS or state agency disclosure standards regarding confidentiality or data quality (BLS Dec 2006). For example, if there are few firms in an area, data users could determine or approximate a firm's total payroll, hours worked, and other information that a firm may not want known to its competitors.

counties have lower PCI values than those for Texas and the United States. In 2005, the ROI's PCI was $27,983, representing 81% of the national PCI ($34,471) and 86% of the Texas PCI ($32,460). Victoria County's PCI of $30,667 was the highest in the ROI, while Goliad County, with $23,353, was the lowest (BEA 2008). Incomes for the ROI, Texas, and the United States are shown in Table 2.5.2-6, which also presents the percent change between 1995 and 2005, both adjusted and unadjusted for inflation[1]. During that period, the PCI in the overall ROI increased by 13.8% when adjusted for inflation, while Texas PCI increased by 20.6% and that of the United States by 16.6% (BEA 2008; BLS 2007c).

2.5.2.2 Transportation

The 50-mile region surrounding the proposed VCS site is served by a transportation network of U.S. highways and state and county roads providing access to major north-south and east-west routes, rail terminals (cargo service only), 13 public airports (including one with commercial passenger service), and three navigable waterways.

2.5.2.2.1 Roads

Roads in the region consist of U.S. highways (Hwy), state routes (SR), county roads, and county farm-to-market (FM) roads. Figure 2.5.2-4 shows the road and highway transportation system in the 50-mile region.

Most roads in Texas are owned and maintained by the counties, rather than by the state or municipalities. The state of Texas owns 79,648 miles of roadway (26.2% of the total), individual counties own 144,685 miles (47.6%), local governments own 78,848 miles (25.9%), other jurisdictional agencies own 159 miles (0.05%), and the federal government is responsible for 831 miles (0.3%) of roadways in federal parks, forests or reservations that are not part of the state and local highway systems (BTS 2005). Primary access to the proposed site would be via Hwy 77.

In the ROI, there are four U.S. highways: Hwy 59, which runs northeast-southwest connecting Jackson, Victoria, Goliad and Bee Counties; Hwy 77 which runs north-south-southwest connecting Lavaca, Victoria, and Refugio Counties; Hwy 87, which runs northwest-southeast connecting DeWitt, Victoria and Calhoun Counties; and Hwy 183, which runs north-south connecting DeWitt, Goliad and Refugio Counties. A number of state routes intersect these U.S. highways and connect to the towns in the counties, providing outlying areas access to the U.S. highway system.

Most roadways in the region are secondary roads and feed from primary highways. The proposed VCS site is located in a rural area and most of the roads in the vicinity are paved, two-lane roadways. Table 2.5.2-7 presents road characteristics and traffic statistics, including average annual daily traffic counts, for the primary road segments that would be used by the construction and operations workforces to reach the site. Figure 2.5.2-5 identifies the road segments. Vehicle volumes on the roads, as measured by average annual daily traffic counts within a 24-hour period, reflect the rural character of

1. The BLS inflation calculator (BLS 2007c) was used to adjust 1995 dollars to 2005 dollars before calculating the percent change between the two years, in order to provide the "real" increase ("real" meaning that a value has been adjusted for inflation). The adjustment factor between 1995 and 2005 was 1.28 (i.e., the 1995 dollars were multiplied by 1.28 to adjust to 2005 values).

the area. There are no Transportation Research Board Level of Service determinations for these roads (TXDOT Oct 2007).

Hwy 77 would provide the only access to and from the proposed site for commuting workers and truck deliveries. Deliveries from the Houston metro area would likely use Hwy 59 to reach Hwy 77 south to the site entrance. Workers arriving from the north would likely take Hwy 77 to the site entrance. Those arriving from the east would likely take SR 35 west to SR 239, then follow Hwy 239 west to Hwy 77 north. Workers arriving from the south would likely take Hwy 77 north, or take SR 35 to SR 239 west to Hwy 77. Workers arriving from the west would likely take Hwy 59 east to Hwy 77 south, SR 239 east to Hwy 77 north, or SR 202 east to Hwy 77 north. Potential commuting routes are shown in Figure 2.5.2-4.

Roads in Victoria County surrounding the proposed site do not traverse any parks, national forests, or other federally, state, or locally protected areas. The portion of SR 35 that connects Port Lavaca and the town of Tivoli in Calhoun County, approximately 14 miles southeast of the proposed site, serves as the northern boundary of the Guadalupe Delta Wildlife Management Area (WMA) and provides access to the WMA's headquarters. The Guadalupe Delta WMA provides important habitat for wetland-dependent wildlife, especially waterfowl.

2.5.2.2.2 Railroads

Figure 2.5.2-4 shows the railroad lines within 50 miles. These railroad lines within this radius are owned and operated by Union Pacific; however, Tex-Mex/Kansas City Southern, Burlington Northern Santa Fe, and Port Comfort & Northern have track rights allowing them to operate on the Union Pacific rail lines (VEDC 2007b).

The Union Pacific railroad system runs east-west across Matagorda, Jackson, Victoria, and Refugio Counties, and north-south across DeWitt, Victoria, and Calhoun Counties (UP Undated). There is no passenger rail service within the 50-mile region. The nearest passenger rail (Amtrak) service is from Houston to San Antonio, north of the proposed site and outside of the 50-mile region (NRPC Undated).

2.5.2.2.3 Navigable Waterways and Ports

Figure 2.5.2-5 shows the navigable waterways within 50 miles of the proposed site. These are the San Antonio River, Guadalupe River, and Victoria Barge Canal. The site is not located on a waterway, but lies west of the Guadalupe River (approximately 4.1 miles at the nearest point), west-southwest of the Victoria Barge Canal (approximately 5.2 miles at the nearest point), and west-northwest of the San Antonio River (approximately 5.5 miles at the nearest point).

The 35-mile-long Victoria Barge Canal connects Victoria and Calhoun Counties to the San Antonio Bay, the Gulf Intracoastal Waterway and nearby deepwater ports on the Gulf of Mexico. The Canal begins at its intersection with the Gulf Intracoastal Waterway near Seadrift in Calhoun County, and terminates at the Port of Victoria, south of the city of Victoria. The canal provides transportation of large equipment and products for the chemical, construction and steel fabrication, and agribusiness industries in the area. Constructed in 1968, the canal was expanded in 2002 to a width of 125 feet and a depth of 12 feet

to match the dimensions of the Gulf Intracoastal Waterway and allow access to larger cargo loads (VEDC Undated). Because of its size limitations, the canal cannot accommodate ocean going ships; it primarily serves commercial barges and small boat traffic, because the clearance at the railroad bridge is approximately 73 feet.

The U.S. Army Corps of Engineers (USACE) Navigation Data Center tracks waterways and waterborne traffic in America's inland water system. In 2005, the Corps reported an average of 100 barge trips per week along the Victoria Barge Canal. The number of trips has declined since 2002 (USACE 2001; USACE 2002; USACE 2003; USACE 2004; USACE 2005). Table 2.5.2-8 shows the number of inbound and outbound trips between 2001 and 2005. According to the Navigation Data Center, there are 11 docks along the Canal (USACE 2008a), as listed in Table 2.5.2-9.

The Port of Victoria is a shallow water port serviced by the Victoria Barge Canal, with a 400-acre turning basin area. The port serves as an intermodal point of cargo transfer to air, rail, and truck networks. The Port of Victoria Industrial Park, with varied industrial customers, surrounds the turning basin (VEDC Undated). The port's freight tonnage declined between 2000 and 2005, but rebounded in 2006, when the port was ranked 96th out of 150, among principal ports in the United States (USACE 2008a; USACE 2008b). Table 2.5.2-10 shows freight tonnage for the port between 1992 and 2006 and the port's rankings between 2002 and 2006.

2.5.2.2.4 Airports

Thirteen public airports are within or near the 50-mile region. Airport information is presented in Table 2.5.2-11, and Figure 2.5.2-6 shows the locations of the airports. Restricted or private-use airports, unused airstrips, and abandoned military runways are not included.

The only airport in the region offering commercial passenger service is Victoria Regional Airport, located in the city of Victoria. The Federal Aviation Administration (FAA) collects passenger boarding data for commercial airports. The FAA reported 9113 boardings at the Victoria Regional Airport for 2006, a decline of 41.7% since 2001. Table 2.5.2-12 presents the annual data for 2001 through 2006. According to the Victoria Regional Airport manager, the decline is due to reduced service from six commercial flights per day to two. The airport employs 20 workers. (VRA Mar 2008)

2.5.2.2.5 Evacuation Routes

The proposed site is approximately 36 miles inland from the Gulf of Mexico. Hurricane evacuation routes serving the area include Interstate 37; Hwys 59, 77, 87, 181, and 183; and SRs 35, 239, 111, and 185. These routes cross the counties within 50 miles (TEP 2007; TDPS Jun 2002).

2.5.2.3 Taxes

Several tax revenue categories would be affected by the construction and operation of VCS. These include franchise taxes on corporate profits, sales and use taxes on construction- and operations-related purchases and purchases made by project-related workers; real property taxes related to the construction and operation of the plant; and real property taxes paid by incoming workers.

The following subsections describe each type of tax and its application in the ROI counties, and discuss revenues and expenditures by category for local jurisdictions.

2.5.2.3.1 Personal Income and Corporate Franchise Taxes

Texas does not have a personal income tax (FTA JAN 2007). It does, however, have a corporate franchise tax.

According to the website for the Texas Comptroller of Public Accounts, the franchise tax is the state's primary business tax (GT Jun 2006). In 2007, the state of Texas received $3.1 billion (4.1% of its total net revenue of $77.2 billion) from franchise taxes (TCPA 2008a). The Texas franchise tax is imposed on each taxable entity that is chartered and/or organized in Texas or is "doing business in Texas" (TCPA 2008b). The Texas Legislature recently made significant revisions to the Texas franchise tax in House Bill 3 (passed during the 79th Third Called Session) and House Bill 3928 (passed during the 80th Regular Session), which extended the franchise tax to partnerships (general, limited, and limited liability), corporations, limited liability companies, business trusts, professional associations, business associations, joint ventures, and most other legal entities. The tax will be based on the taxable entity's margin (defined by the company's revenues and expenses in Texas). To determine the margin for each taxable entity, the least of three calculations will be used: (1) total revenue minus cost of goods sold, (2) total revenue minus compensation, or (3) 70% of total revenue. The tax rate is 1.0% for most taxable entities and 0.5% for entities engaged primarily in retail and wholesale trade. These revisions became effective January 1, 2008 (TCPA 2008b).

2.5.2.3.2 Sales and Use Taxes

Texas state sales and use tax is imposed on retail sales, leases and rentals of most goods, and some services. The state sales tax rate is 6.25% of the sale price of taxable goods and services (TCPA 2008c). Texas received $20.3 billion (26.3% of its revenue) from sales tax collections in 2007 (TCPA 2008a).

Regulations governing sales and use tax for Texas are found in the Texas Administrative Code, Title 34, Part 1, Chapter 3, Tax Administration: §295, taxation of natural gas and electricity; §306, taxation of mobile homes; §344, taxation of telecommunications; and §481, taxation of manufactured housing (other than mobile homes) (TAC 2007). The total sales and use tax (sales tax) imposed on most taxable goods and services consists of the state sales tax and, where applicable, a local sales tax (TCPA 2008c).

Collecting sellers remit state sales tax revenues directly to the state. While these funds are not returned directly to county or city governments for their use, the state uses sales tax and other revenues throughout the state to support a variety of services. In 2006, the state government spent a total of $71.5 billion for the 254 counties that comprise Texas. State expenditures in the ROI counties totaled approximately $470 million, accounting for less than 1.0% of the state total. Of the ROI expenditures, 38.4% was for public assistance, while intergovernmental payments accounted for 27.4% (TCPA 2007).

Table 2.5.2-13 summarizes the state's expenditures in the ROI, and Figure 2.5.2-7 illustrates the allocation of expenditures by category.

Local jurisdictions, including cities, counties, transit authorities, and some special purpose districts, may also impose a local sales tax. (A special purpose district is a voter-approved district governed by an elected board that provides infrastructure and public services such as water, health, community colleges, or economic development). According to the "Overview of Local Taxes in Texas," published by the Research Division of the Texas Legislative Council, the imposition of a local sales tax must be approved by the voters residing in the jurisdiction in which the sales tax is to be imposed. Local sales tax revenues may be used for a variety of purposes, including general funds, property tax relief, health care for the indigent, crime control, economic development, support of public libraries, emergency services, street maintenance, and support of public transit (TLC Nov 2002).

The sum of all local sales taxes may not exceed 2% anywhere in the state, and thus, the maximum allowable sales tax in Texas is 8.25%. Cities, counties, and special purpose districts each have the authority to levy a local sales tax of up to 2%, while transit authorities may levy a local sales tax of up to 1%. The state has the authority to govern taxation by local jurisdictions and to ensure that the sum of local sales taxes does not exceed the 2% cap (TLC Nov 2002).

Voters in about half of the counties in Texas have approved the levy of a county sales tax (up to 0.5% for counties with a city territory, and up to 1% for counties without a city territory) for property tax relief (TLC Nov 2002). In the ROI, Calhoun, Jackson, and Victoria Counties each levy a 0.5% sales tax (TCPA 2008d). Table 2.5.2-14 shows county and city sales tax rates in the ROI.

Cities in Texas may also impose additional sales tax, up to the maximum of 2%, for the following purposes:

- General fund (1%);
- Property tax reduction (up to 0.5%);
- Street maintenance (0.25%);
- Industrial and economic development (up to 0.5%);
- Sports and community venues (up to 0.5%) (TCPA 2008c).

As shown in Table 2.5.2-14, several cities in the ROI impose sales taxes ranging from 1% to 2%, with Cuero, Yoakum, Goliad (city), and Refugio (city) imposing the maximum tax of 2%. The city of Victoria, the largest retail center in the ROI, imposes a 1.5% sales tax. Since Victoria County also imposes a 0.5% sales tax, shoppers in the city of Victoria pay the maximum of 8.25% (TCPA 2008d).

Some items are exempt from state sales tax but may be taxed locally. For example, natural gas and electricity for residential and agricultural use are exempt from state sales tax (TAC 2007). Although local jurisdictions have the authority to levy sales tax on these items (TLC Nov 2002), none of the cities in the ROI do so (TCPA 2008e).

All telecommunications (including cellular phone services) are subject to the state sales tax. Local jurisdictions may impose taxes for intrastate services only (calls between locations in Texas). Services are billed by the caller's residence or the call's place of origin, depending on billing arrangements (TAC 2007). In the ROI, the cities of Goliad, Edna, and Victoria currently impose the 2% sales tax on telecommunications services (TCPA 2008f).

2.5.2.3.3 Other Sales and use-Related Taxes

The state of Texas currently imposes a 6% hotel occupancy tax on rooms or space in a hotel with rates of at least $15 per day. Stays of 30 consecutive days or more are exempt from the tax (TLC Nov 2002). {Texas received $341 million (0.4% of its revenue) from the hotel occupancy tax in 2007 (TCPA 2008a).

All cities, and some counties, are eligible to adopt a hotel occupancy tax on rooms with a rate of at least $2 per day. According to the "Overview of Local Taxes in Texas," hotel occupancy tax revenues must be used to directly promote tourism and the convention and hotel industry. Specifically, hotel tax revenues should be used for a convention center, tourism advertising and promotion, programs to enhance the arts, and historic preservation projects that promote tourism. These revenues may not be used for general revenue purposes or for activities not directly related to promoting tourism (TLC Nov 2002). The Texas Tax Code, §352.002, lists criteria under which a county may impose this tax. However, Provision (d) prohibits collection of the county hotel occupancy tax within municipalities (TTC 2007). The city of Victoria imposes a 7% sales tax on eligible hotel rooms in addition to the state's 6% hotel tax, for a total of 13% (VEDC 2007c).

Manufacturers of manufactured homes or industrialized housing who conduct business in Texas must apply for a permit to collect manufactured housing sales tax. This tax is imposed by the state at a current rate of 3.25% of the sales price. Additionally, manufactured homes purchased outside of Texas for use in the state are subject to a use tax imposed at the same rate of 3.25%. Manufactured homes purchased in Texas for use in another state are not subject to the tax (TAC 2007).

2.5.2.3.4 Property Taxes — Counties and Special Districts

According to the "Overview of Local Taxes in Texas," all privately owned real property in Texas is subject to property taxation by the county, city, special district(s) (such as junior college districts and groundwater districts), and school district(s) in which it is located, unless specifically exempted by the Texas constitution (TLC Nov 2002).

The "Overview of Local Taxes in Texas" notes that county appraisal districts determine the value of properties, and local taxing jurisdictions set the tax rates. Each county appraisal district sets property values and sends those values to the local taxing jurisdictions in that county. The governing body of each local jurisdiction sets its tax rates, which are applied to property values to generate the needed property tax revenues. Tax rates are stated as an amount per $100 of assessed value. The annual property tax levy in any jurisdiction is derived by multiplying the total taxable value divided by 100 in the jurisdiction by the total tax rate per $100 of value. The total tax rate may include a rate for day-to-day maintenance and operations (M&O rate) and a rate for debt service payments (often called the "I&S

rate" or Interest and Sinking Fund rate). Some special districts with other revenue sources do not levy a maintenance and operations tax (TLC Nov 2002).

Texas counties collect real property taxes (sometimes referred to in Texas law as *ad valorem* taxes (TLC Nov 2002), based on assessed valuations, from the property owners within their boundaries. These taxes are used for county operations. As stated previously, the appraised value of a property, as determined by each county's appraisal district, is used to calculate property tax assessments for all taxing jurisdictions in the county. Generally, taxpayers make consolidated payments to the county tax assessor, who distributes the funds to the other taxing jurisdictions in the county.

As provided by the Texas constitution, each county may levy as many as three individual tax rates for funds dedicated to specific purposes. Those three funds include the General Fund, a Special Road and Bridge Fund, and Farm-to-Market Roads & Flood Control. All Texas counties impose a tax for the General Fund. In 2005, that levy totaled $4.6 billion statewide. For the 2005 tax year, 118 counties reported levying the Farm-to-Market Roads & Flood Control tax, raising $134.7 million, while 71 counties reported levying the Special Road and Bridge Fund tax, resulting in $63.2 million in revenue (TCPA Dec 2006). Victoria County collects property taxes for its General Fund and Special Road and Bridge Fund (VCTX 2007).

Texas tax rates are stated in dollars per $100 of assessed value.[1] The 2006 total county property tax rates for the counties in the ROI range from 0.3986 (Victoria County) to 0.7224 (DeWitt County) dollars per $100 of assessed value, and are shown in Table 2.5.2-15 (TAOC 2007a). Between 2000 and 2006, Victoria County annual property tax levies rose steadily, from $11.3 to $16.9 million (TAOC 2007b), although the tax rate remained constant between 2003 and 2006 (TAOC 2007a). Table 2.5.2-16 shows the market value and taxable value of Victoria County property and the total property taxes collected by the county.

In addition to county property taxes, most private property owners in Texas pay property taxes to cities, local special districts such as junior college districts and groundwater districts, and school districts. Property taxes are a major source of tax revenue for counties, cities, special purpose districts, and school districts. Property owners within each district's boundaries pay taxes to the districts in addition to those taxes paid to the county, at the standard millage rates assigned by the taxing districts each year (TLC Nov 2002). Table 2.5.2-17 shows city property taxes for ROI cities, and Table 2.5.2-18 provides information on the special taxing districts in the ROI counties. The affected school districts are discussed in the following section.

The VCS site consists of nine separate parcels, listed in Table 2.5.2-19. The parcels lie within the boundaries of Victoria County, three additional special taxing districts, and two school districts (discussed in the following section). The proposed site is not within any city boundaries. Table 2.5.2-20

1. For example, a tax rate of 0.3986 on a property with a taxable assessed value of $100,000 would yield a tax levy of $398.60 [0.3986 times (100,000 divided by 100)].

shows the total 2006 and 2007 property tax payments, by taxing entity, for the nine parcels comprising the VCS site.

According to the Web site for the Victoria Economic Development Corporation, the city of Victoria and Victoria County have established guidelines for the creation of reinvestment zones and granting tax abatements, for which manufacturing and other types of businesses are eligible to apply. Economic qualifications include an increase to appraised value of the property equal to or in excess of $500,000 and creation of a minimum of 10 full-time positions. Abatements can be granted for up to eight years (VEDC Undated).

2.5.2.3.5 Property Taxes — Independent School Districts

Property taxes are the sole local source of tax revenue for school districts in Texas (TLC Nov 2002). According to the Texas Education Agency, Texas uses a wealth equalization process to determine funding for each ISD, which is generally summarized as follows. The state provides funds to ISDs according to district wealth, which is determined by the assessed valuation of property. After a county appraisal district sets a district's total assessed valuation, and it is validated by the State Property Tax Board, the district's total assessed valuation is divided by the total number of students (weighted average daily attendance) to determine its wealth per student. Each year, the Texas Legislature establishes a wealth benchmark to determine if a school district is to be designated as a "property-wealthy" or "property-poor" district, according to the guidelines of Texas Education Code Title 2 (Public Education), Chapter 41 or Chapter 42. Districts with a wealth per student value at or above the benchmark fall under Chapter 41 and are designated as "property-wealthy" school districts. Districts with a wealth per student value below the benchmark are designated as "property-poor" school districts and are governed by the provisions of Chapter 42. The state's funding formula is applied to each district. The state requires Chapter 41 (Equalized Wealth Level) school districts to send a share of their local tax monies to the state as a part of the equalization of wealth stipulated by law. Chapter 42 (Foundation School Program) school districts receive funding from the state (TEA Oct 2007).

ISDs may only tax properties within their boundaries. Although Victoria County is home to several ISDs, eight of the nine parcels comprising the proposed VCS site lie in the Refugio ISD and one of the nine parcels is in the Victoria ISD (Table 2.5.2-19).

The Refugio ISD is a relatively small district with a 2007–2008 enrollment of 735 students (RISD Apr 2008). It is headquartered in the city of Refugio, and includes non-contiguous portions in Refugio and Victoria Counties. The Victoria County portion is bordered by the Victoria, Bloomington, Calhoun County, and Austwell-Tivoli ISDs} (TEA Jul 2007) (Figure 2.5.2-16).

The Refugio ISD's property values between 2001 and 2007 are shown in Table 2.5.2-21. The substantial fluctuations during those years primarily reflect changes in oil and gas production, which makes up a large portion of the assessed value of property in the ISD (RISD Feb 2008). Figure 2.5.2-8 illustrates these fluctuations. As shown in Table 2.5.2-21, for 2007 the ISD's total assessed value of property was $480,471,469, which represented a very small decline (–0.6%) from the previous year

(RISD Feb 2008). The predominance of the oil and gas industry is shown by the ISD's major taxpayers. The top five taxpayers in the Refugio County portion of the Refugio ISD were Hilcorp Energy Co., CDM Resource Management LTD, Acock/Anaqua Operating Co. LP, Kinder Morgan Tejas Pipeline, and Primrose Operating Company. In the Victoria County portion of the Refugio ISD, the top five taxpayers were Apache Corp., Future Petroleum Co., LLC, Union Pacific Railroad, Kinder Morgan Tejas Pipeline, and C K McCan, Jr. et al. (RISD Feb 2008).

The Refugio ISD was first designated a "property-wealthy" (Chapter 41) school district in the 2007-2008 school year, and was previously a "property-poor" (Chapter 42) district (RISD Feb 2008). Consequently, the ISD must now send part of its local tax collections to the state for redistribution to "property-poor" districts. District taxpayers submit their entire payments directly to the Refugio ISD, which then distributes the required portion to the state of Texas. For the 2007-2008 school year, the ISD's total revenues were $4,846,993, with only $320,707 (6.62%) in "excess" collections remitted to the state (RISD Feb 2008). Table 2.5.2-22 shows the Refugio ISD's revenues for 2001-2002 through 2007-2008 and the state submittal for 2007-2008.

As noted previously, the proposed VCS site consists of nine parcels, eight of which are taxed by the Refugio ISD and the ninth by the Victoria ISD. Table 2.5.2-23 shows the assessed value and tax payments to each ISD for 2006 and 2007. In 2006, the current owner's payments of $12,334 to the Refugio ISD represented 0.19% of that ISD's total revenues. In 2007, the payment of $10,174 was 0.21% of the total.

2.5.2.3.6 Local Revenues and Expenditures

As noted previously, the proposed VCS would primarily affect Victoria County through county real property taxes. According to the Victoria Economic Development Corporation (VEDC 2007c), Victoria County had $1.7 million in retail sales in 2005 (compared to Calhoun County's $206,684 and Jackson County's $145,644), thus making Victoria County (especially its main population center, the city of Victoria) the predominant retail center in the ROI. Victoria County and the city of Victoria would thus be most affected by project and worker expenditures and consequent sales tax collections. For this reason, only Victoria County and the city of Victoria are discussed in this section.

Victoria County

In 2006, the Victoria County government had $28.9 million in total revenues. The county received two-thirds of its revenues from property (ad valorem) and sales taxes. Other large revenue sources were intergovernmental payments (15.3%), fees (6.5%), and fines and forfeitures (5.3%). Figure 2.5.2-9 illustrates the proportion from each revenue source. Table 2.5.2-24 provides revenue details.

The county's expenditures for 2006 totaled $26.3 million, as shown in Table 2.5.2-25. General government accounted for 54% of expenses. Public safety, accounting for 40.1%, included expenses for the fire marshal, sheriff, constables, and the Emergency Management City/County Interlocal Agreement. Culture and Recreation, which included parks and recreation, extension services, and the Victoria Public Library accounted for 4.9%. Figure 2.5.2-10 shows the expense breakout. Table 2.5.2-26

provides a recap of revenues and expenses, showing that the Victoria County government had a surplus of $2.6 million in 2006.

As noted previously, Victoria County imposes a sales tax of 0.5% on eligible goods and services. Table 2.5.2-27 shows that sales tax revenues for Victoria County increased every year between 1997 and 2007 except one (2002), with an annual average growth rate of 5.8% on non-inflation-adjusted values. To obtain an inflation-adjusted, annual, average growth rate, the revenues were converted to 2007 dollars[1], yielding an adjusted rate of 3.2%. Sales tax allocations were $7.2 million for the county in 2007 (TCPA 2008g).

City of Victoria

For fiscal year 2006-2007, the Victoria municipal government budgeted $38 million in revenues (Table 2.5.2-28). Major revenue sources were taxes (62.7%) and franchise fees (12.2%) (Victoria 2007). Other sources accounted for the remaining revenues. Figure 2.5.2-11 illustrates the revenue sources. Table 2.5.2-29 provides Victoria's budgeted revenues by category, and shows a budget surplus of $283,600.

Table 2.5.2-29 summarizes Victoria's 2006-2007 expenditures by category. Its expenditures were budgeted at $37.8 million, with more than one-half allocated to public safety (Victoria 2007). The next highest category of expenses (23.6%) was development, including planning, engineering, building and environmental inspections, code enforcement, street maintenance and operation, and traffic control. Recreation, including parks and recreation and library, accounted for 12.6% of expenditures (Victoria 2007). Figure 2.5.2-12 illustrates the expenditure proportions.

Victoria imposes a sales tax of 1.5% on eligible goods and services. Table 2.5.2-31 presents Victoria sales tax revenues from 1997 to 2007. Like the County's revenues, Victoria's revenues increased every year (except 2002), with an annual average growth rate of 5.5% when not adjusted for inflation, and an inflation-adjusted average annual rate of 2.8%. Sales tax allocations were $19.6 million for the city in 2007 (TCPA 2008g). Figure 2.5.2-13 compares sales tax revenues (adjusted for inflation) for Victoria County and the city of Victoria for the past decade.

2.5.2.4 Land Use

The proposed site is in south-central Victoria County, approximately 13.3 miles south of the city of Victoria, 17 miles northwest of San Antonio Bay, 33 miles west of Matagorda Bay, and is adjacent to Linn Lake. The site is located adjacent to Hwy 77 to the west. The Union Pacific Rail Line, used by the Burlington Northern Santa Fe railroad, is just south of the site (Figure 2.5.2-4). The site consists of 11,532 acres of land. Section 2.2, Land Use, provides tables and maps displaying land use categories and breakdowns for the proposed site vicinity and the 50-mile radius.

1. Conversions were made from nominal dollars to 2007 dollars using the Bureau of Labor Statistics Inflation Calculator (BLS 2007c).

The ROI counties except Refugio are part of the Golden Crescent Regional Planning District (along with Gonzales and Lavaca counties). The GCRPC provides planning services for the region and provides assistance to local governments in carrying out regional plans and recommendations including those related to solid waste management, water issues, land use issues, and rural transportation. (GCRPC Undated)

Calhoun County

Calhoun County is on the Gulf Coast between Houston and Corpus Christi. In 2000, the county had a land area of 512.3 square miles (327,878 acres) (USCB 2008). Calhoun County is bordered by Victoria and Jackson Counties on the north, Matagorda Island and the Gulf of Mexico on the south, Refugio County on the west, and Matagorda County on the east. Port Lavaca is its largest city and the county seat. Calhoun County is located in the Coastal Prairie and its elevation ranges from sea level to 50 feet above sea level. The county's terrain is flat. The county is drained by the Guadalupe River and Chocolate Bayou. Green Lake, one of the largest freshwater lakes in Texas at approximately 10,000 acres (TSHA Jan 2008b), is in Calhoun County.

Incorporated communities in Calhoun County include Point Comfort, Port Lavaca, and Seadrift. The county is served by the Union Pacific railroad, as well as by Hwy 87 and SR 35 and 185 (TSHA Jan 2006a).

In 2002, there were 328 farms and ranches covering 247,827 acres, of which, 59% were in pasture and 38% in crops (USDA 2002). Between 21% and 30% of the land was considered "prime farmland" (TSHA Jan 2006a). Within the boundaries of the county, land coverage and use is classified as being approximately 1% urban or built-up land, 18% agricultural land, 18% rangeland, 3% forest land, 51% water, 8% wetland, and 1% barren land. Matagorda Island State Park and Wildlife Management Area, Calhoun County's principal state park, covers 7325 acres (TSHA Jan 2006a).

The unincorporated portion of Calhoun County is not zoned but does have subdivision regulations "to protect the health, safety, and welfare of the citizens of Calhoun County" (Calhoun County Dec 2007). Calhoun County has some commercial development and concentrations of residential development, primarily in Port Lavaca.

The county's main population center, Port Lavaca, is not zoned (Port Lavaca 2008). However, it does have a subdivision ordinance to guide "sound community growth" (Port Lavaca May 2007) within the city boundaries and the extraterritorial jurisdiction adjacent to the city (Port Lavaca May 2007).

DeWitt County

DeWitt County is on the Gulf Coast Plain in southeastern Texas about 45 miles inland from Copano Bay. It is bounded by Victoria, Goliad, Karnes, Gonzales, and Lavaca Counties. Cuero, the county's largest town, serves as the county seat (TSHA Jan 2006b). In 2000, the county had a land area of 909.2 square miles (581,875 acres) (USCB 2008). Most of the land is nearly level to sloping, with the areas of greatest elevation mostly in the northwest. The elevation ranges from about 150 feet above sea level in

the east corner to more than 540 feet above sea level in the southwest. Most of the county is drained by the Guadalupe River and its tributaries. Small areas in the northern part of the county are drained by the Lavaca River, and a small area in the southern portion is drained by the San Antonio River (TSHA Jan 2006b).

In 2002, there were 1786 farms and ranches covering 576,896 acres, of which 64% was in pasture and 29% in crops (USDA 2002). More than 336,700 barrels of oil and 16,322,000 cubic feet of gas-well gas were produced in the county in 2004 (TSHA Jan 2006b). Within the boundaries of the county, land coverage and use is classified as being approximately 1% urban or built-up land, 55% agricultural land, 8% rangeland, 36% forest land, less than 1% water, less than 1% wetland, and 1% barren land. The principal towns in the county are Cuero, Yoakum, and Yorktown (TSHA Jan 2006b).

The unincorporated portion of DeWitt County is not zoned and has no county-wide land use plans. There are only small areas of commercial development and concentrations of residential development in the county.

The county's main population center, Cuero, has adopted land use regulations in Title XV of its City of Cuero, Texas Code of Ordinances (Cuero May 2005). The land use regulations include subdivision regulations (Chapter 154) and zoning (Chapter 158). The purpose of the subdivision regulations is to, "(p)romote and develop the utilization of the land in a manner to assure the best possible community environment" (Cuero May 2005).

Goliad County

Goliad County is on the Coastal Plain 25 miles inland from Copano Bay in southeast Texas. It is bounded by Bee, DeWitt, Karnes, Refugio, and Victoria Counties. Goliad is the county seat and largest town (TSHA Jun 2001a). In 2000, the county had a land area of 853.5 square miles (546,253 acres) (USCB 2008), most of which is nearly level to gently rolling. The elevation ranges from 100 to 250 feet above sea level. The northeastern half of the county is drained primarily by the San Antonio River and its tributaries. Coleto Creek Reservoir is an industrial reservoir on the Goliad-Victoria county line (TSHA Jun 2001a).

In 2002, there were 984 farms and ranches covering 506,019 acres, of which 70% was in pasture and 22% in crops (USDA 2002). Oil and gas production, and agriculture represent much of the county's land use. Within the boundaries of the county, land coverage and use is classified as being approximately 1% urban or built-up land, 26% agricultural land, 24% rangeland, 49% forest land, less than 1% water, less than 1% wetland, and less than 1% barren land. The county is served by a variety of paved farm and ranch roads and by three major highways: Hwy 59 to Houston and Laredo, Hwy 183 to Austin, and SR 239, which joins Hwy 181 to San Antonio (TSHA Jun 2001a).

Despite the increasing urbanization of surrounding counties, Goliad County has remained rural. The unincorporated portion of Goliad County is not zoned but does have subdivision regulations. The subdivision regulations were "established for the orderly growth of Goliad County" (Goliad County

May 2005). There are only small areas of commercial development and concentrations of residential development in the county.

The city of Goliad, the county's main population center, is located at the head of the navigable portion of the San Antonio River. Goliad is the only incorporated community in the county (TSHA Jun 2001a) and is zoned (Goliad 2004).

Jackson County

Jackson County is southwest of Houston on Hwy 59, in the Coastal Prairies region of the Coastal Plain. It is bordered by both Lavaca Bay and Carancahua Bay. It is bounded by Calhoun, Victoria, Lavaca, Colorado, Wharton, and Matagorda Counties. Edna, the county's largest town, is the county seat. Elevation ranges from sea level to 150 feet above sea level (TSHA Jun 2001b). In 2000, the county had a land area of 829.5 square miles (530,874 acres) (USCB 2008).

In the early 1990s, 90% of the county was used for farming and ranching (TSHA Jun 2001b). In 2002, there were 917 farms and ranches covering 470,500 acres (USDA 2002). Between 41% and 50% of Jackson County land is deemed "prime farmland" (TSHA Jun 2001b) Within the boundaries of the county, land coverage and use is classified as being approximately 3% urban or built-up land, 63% agricultural land, 9% rangeland, 23% forest land, 2% water, 2% wetland, and less than 1% barren land.

The unincorporated portion of Jackson County is not zoned. However, it is guided by subdivision regulations (Jackson County Mar 2008). There are only small areas of commercial development and concentrations of residential development in the county.

The county population center, Edna, adopted a land use management ordinance (Ordinance 2004-24), that is "in accordance with a comprehensive plan for the purpose of promoting the health, safety, morals, and general welfare of the city; …to prevent the overcrowding of land, to provide undue concentration of population" (Edna Jan 2005). *The Comprehensive Plan for the City of Edna Jackson County, Texas* is applicable to the area within the city limits and the area of extraterritorial jurisdiction, or 1 mile beyond the city limits. The Plan provides for "adequate space and efficient, convenient arrangement of all types of community land uses, which should include residential, commercial, industrial, transportation, educational, civic, and cultural uses while at the same time following a harmonious plan of preserving the open space for drainage and recreation" (Edna May 1972).

Refugio County

Refugio County is on the lower Texas Gulf Coast in the Coastal Prairies region of the Coastal Plain, bounded on the south by San Patricio County, on the west by Bee and Goliad counties, on the north by Victoria and Calhoun Counties, and on the east by Aransas County and by Hynes Bay and Copano Bay (TSHA Jun 2001c). The county had 770.2 square miles of land area in 2000 (492,934 acres) (USCB 2008). The town of Refugio, the county's seat of government and its largest population center, is 35 miles north of Corpus Christi. The county is generally flat land. Elevations range from sea level to 100 feet above sea level in the northwest section. The county is drained by the Aransas River, which

forms its southern border, and by the converging Guadalupe and San Antonio Rivers, which form its northern boundary. Refugio County is joined to the rest of Texas by Hwy 77, which runs southwesterly across the western part of the county, and by SR 35, which runs north to south across the eastern section. (TSHA Jun 2001c).

Since the early 1990s, agriculture has been the leading source of income. In 2002, there were 274 farms and ranches covering 505,954 acres, of which 75% was in pasture and 21% in crops (USDA 2002). Within the boundaries of the county, land coverage and use is classified as being approximately 5% urban or built-up land, 21% agricultural land, 45% rangeland, 19% forest land, 6% water, 5% wetland, and less than 1% barren land.

There is currently no formal land use planning or zoning at the county, city, or town level in Refugio County. There are only small areas of commercial development and concentrations of residential development in the county. Refugio County's main population center is Refugio.

Victoria County

Victoria County is in southeastern Texas on the Coastal Plain, midway on the Texas Gulf Coast. Victoria, the county's largest city, is the county seat. Victoria is approximately 120 miles from Houston, 100 miles from San Antonio, 110 miles from Austin, and 75 miles from Corpus Christi (TSHA Jan 2008a). In 2000, Victoria County was comprised of 882.5 square miles of land area (564,800 acres) (USCB 2008). The county has a nearly level to gently rolling terrain. The elevation ranges from sea level in the southeast to 300 feet above sea level near Mission Valley in the northwest. The northeastern half of the county drains into Lavaca Bay, and the southwestern area is drained by the Guadalupe and San Antonio River systems (TSHA Jan 2008a). The Guadalupe River is important because of its navigability to Kemper's Bluff and Victoria, a distance of about 78 miles from the river's mouth (TSHA Jan 2008a).

In 2002, there were 1286 farms and ranches covering 513,828 acres, of which 64% was in pasture and 32% in crops (USDA 2002). Within the boundaries of the county, land use and coverage is classified as being approximately 5% urban or built-up land, 39% agricultural land, 28% rangeland, 25% forest land, less than 1% water, 2% wetland, and 1% barren land.

The unincorporated portion of Victoria County is not zoned. The city of Victoria has a comprehensive land use plan, *Victoria 2020: Remembering the Past, Preparing for the Future* (Victoria Nov 2001). The Plan provides the basis for Victoria's subdivision regulations and other development-related regulations. The stated purpose of the Plan's development guidelines is, "to maintain and stabilize the value of property, to reduce fire hazards, improve public safety, and safeguard the public health; to decrease traffic congestion and its accompanying hazards; to prevent the concentration of population; and to create a comprehensive and stable pattern of land uses upon which to plan for transportation, water supply, sewerage, schools, parks, public utilities, and other facilities" (Victoria Nov 2001). The purpose of the subdivision and development ordinance is, "to insure the development and maintenance of a healthy, attractive and efficient community that provides for the conservation and protection of its

human and natural resources. It is the purpose of this ordinance to implement the goals, objectives and policies of the city comprehensive planning process to promote orderly growth and development" (Victoria Jul 2007). The Plan was commissioned "to help position the community for the future while maintaining Victoria's unique quality of life and environment." The Plan was designed, "permitting flexibility for new developments, allowing market forces to be the primary driving force that determines future land uses. The city of Victoria has historically taken a conservative approach to planning and land use management. It remains the second largest city in the State of Texas that does not utilize zoning laws" (Victoria Nov 2001). Constraints on the city's growth, including residential development, include the large floodplain along the Guadalupe River, railroad lines, as well as scattered oil and natural gas fields (Victoria Nov 2001). Victoria County has a well recognized commercial district, as well as a more sprawling commercial creep and concentrations of residential development.

2.5.2.5 Aesthetics and Recreation

This subsection characterizes the aesthetics and recreational facilities and opportunities in the 50-mile region.

2.5.2.5.1 Aesthetics

Victoria County is in the coastal plain ecosystem of east Texas. The county is primarily surfaced with dark clay loams and clays that support bluestems and tall grasses, oak forest, huisache, mesquite, prickly pear, and other vegetation (TSHA Jan 2008a).

The topography of the proposed site is fairly flat with the elevation ranging from 12 feet to 80 feet above MSL. The area in which the plant facilities would be constructed is currently at an elevation of approximately 80 feet. The proposed site is currently used for rangeland for cattle and horses on the surface. There is also limited oil and gas production in the subsurface of the proposed site. The major land uses within a 6-mile radius are rangeland and forest land. Within the 50-mile region, the major land uses are agricultural, forest land, rangeland, and water.

No sensitive visual resources, such as residential subdivisions or public lands, have been identified in the proposed VCS area or in the vicinity of the proposed site. Hwy 77 provides the best opportunity for the public to view the site. Since the topography surrounding the site is relatively flat and sparsely populated with trees, there is little to no screen for the proposed facilities from area roadways.

2.5.2.5.2 Recreation

There are federal, state, local, and private recreational facilities and opportunities within 50 miles of the proposed site. Table 2.5.2-32 lists locations, acreages, and other information for the WMAs, national wildlife refuges (NWRs), and state parks within the 50-mile region. Table 2.5.2-33 lists county and city parks within the 50-mile region. Figure 2.5.2-14 shows the WMAs, national wildlife refuges, state parks, and Audubon sanctuaries within 50 miles of the site.

Federal and State Facilities and Opportunities

Of the 172 million acres in Texas, 5.7% (approximately 9,872,800 acres) are public lands; approximately 2.5% of the 172 million acres are in parks, forests, and refuges, and 0.6% of the public lands are managed by the Texas Parks and Wildlife Department. In addition, 9.1% of the private land in Texas is under wildlife management (TPWD 2001). Most of these lands are available for recreational use.

The Matagorda Island WMA, an offshore barrier island and bayside marsh, is jointly owned by the Texas General Land Office and the U.S. Fish and Wildlife Service (TPWD Feb 2007a).

The Guadalupe Delta WMA, spread across Victoria, Refugio, and Calhoun Counties, approximately 14 miles southeast of the proposed site, consists of freshwater marshes in the delta of the Guadalupe River. Lands in the Guadalupe Delta WMA have traditionally provided habitat for wetland-dependent wildlife, especially migratory waterfowl. Public hunting is permitted for waterfowl and migratory shore birds, alligators, and other wetland wildlife. Other uses include birding and nature observation. (TPWD Feb 2007b)

The Welder Flats WMA is south of Seadrift in Calhoun County, approximately 29 miles from the proposed VCS site. It has 1480 acres of submerged coastal wetlands that are used to stock the San Antonio Bay with red drum and spotted sea trout. Public use is allowed with permission. (TPWD Feb 2007c)

The Aransas NWR is near Rockport in Aransas and Calhoun Counties, and its Lamar unit is approximately 22 miles from the proposed site. The Aransas NWR consists of approximately 115,000 acres and provides resting, feeding, wintering, and nesting grounds for migratory birds and native Texas wildlife. The refuge is known for hosting the largest wild flock of endangered whooping cranes each winter. (USFWS 2008)

Goliad State Park serves as a hub for visiting Mission Espiritu Santo State Historic Site (in the park), Presidio La Bahia, Ignacio Zaragoza Birthplace State Historic Site, Fannin Battleground State Historic Site, Goliad Historic District, and Mission Rosario State Historic Site (TPWD Feb 2007d). Other nearby state parks are Lake Texana State Park in Jackson County, approximately 37 miles from the proposed site, and Goose Island State Park in Aransas County, approximately 32 miles from the proposed site. Lake Texana State Park provides a swimming area, boating, fishing piers, birding, and canoeing (TPWD Jan 2008). The "Big Tree," a Coastal Live Oak (Quercus virginiana) in Goose Island State Park, is thought to be one of the largest trees in the nation. Estimated to be over 1000 years old, the "Big Tree" trunk has a circumference of 35 feet (TPWD Oct 2007).

Table 2.5.2-32 presents acreage, location, annual visitor, and capacity information about WMAs, NWRs, and state parks within 50 miles of VCS.

The Texas Independence Trail follows SR 35 from east of Palacios to west of Port Lavaca and passes within 9 miles of the VCS site. Two points of interest along the trail are in Palacios and near Port

Lavaca. A half-scale, seaworthy replica of French explorer La Salle's ship, the Belle, is being constructed at the Port of Palacios. South of Port Lavaca, in Indianola, there is a 25-foot granite statue of La Salle (THC Undated).

Birding is a major recreational activity in the region. The Coastal Birding Trail is a 500-mile trail that stretches along the Texas Gulf Coast from north of Beaumont to the Rio Grande Valley. The trail establishes viewing areas at feeding, roosting, and nesting points for both migrating and endemic bird species. Established in October 1994, the Central Texas Coast section of the trail encompasses 95 of the 308 distinct wildlife viewing sites. Approximately 40 wildlife viewing sites are located within 50 miles of the proposed site (TPWD Feb 2007e).

Recreational fishing, sailing, and boating opportunities are available on area bays and rivers, such as the Matagorda and San Antonio Bays and the Guadalupe and San Antonio Rivers. These bodies of water offer fishing for redfish, shark, trout, flounder, pompano, gafftop, whiting, croaker, sheephead, drum, jack crevalle, Spanish mackerel, and tarpon (USACE May 2007).

County and City Facilities and Opportunities

The counties and cities in the 50-mile region provide numerous public recreational facilities.

Sixteen counties—Aransas, Bee, Calhoun, Colorado, DeWitt, Goliad, Gonzales, Jackson, Karnes, Lavaca, Matagorda, Nueces, Refugio, San Patricio, Victoria, and Wharton Counties—are wholly or partially within the 50-mile region. Six of these, Colorado, Gonzales, Karnes, Lavaca, Nueces, and Wharton Counties, do not have any recreational facilities located within 50 miles of VCS. Table 2.5.2-33 lists the county and city parks within or near the 50-mile region, their locations, and acreages.

Aransas County offers several city parks, a public beach, fishing piers, birding, a community aquatic and skate park, hiking and biking trails, and a freshwater pond. Events held in Aransas Pass include the annual Shrimporee and a lighted boat parade during December (APCC Undated).

Bee County contains nine recreational parks in or near Beeville. These parks include a pool, basketball courts, baseball fields, soccer/football fields, merry-go-rounds, tennis courts, a bowling alley, and nature trails. The county is geographically located in three biological zones, which provide a variety of habitats for bird species. In Beeville County, dove and quail hunting is popular. Events held in Beeville include an annual Chamber of Commerce parade, Western Week Celebration, Junior Livestock Show and Rodeo, and the Diez y Seiz Festival (City of Beeville Mar 2008, CBT Jun 2008).

Calhoun County has a number of public park facilities. Lighthouse Beach and Bird Sanctuary in Port Lavaca offers an elevated walkway stretching over coastal wetlands and a tidal exchange basin. In Port Lavaca, recreational offerings include the Pier Park, a campground, a boardwalk, and a boat ramp. Beyond the Port Lavaca area, the towns of Port O'Connor, Magnolia Beach, and Indianola also offer recreational opportunities, such as the Port O'Connor Kingfisher Beach and Park (PLCCCC Undated). Events in Port Lavaca include a St. Patrick's Day Fun Run/Walk, Seafood Market Days Annual Palm Sunday Barbeque, and the Annual Festival of Lights Night Parade (PLCC Undated). In the town of

Seadrift, the only city on San Antonio Bay, events include a Halloween Parade and Shrimpfest (SCC Undated).

DeWitt County is considered the "Wildflower Capital of Texas" (Yorktown Undated). In the county are several parks, including those in Cuero and Yoakum. Cuero Municipal Park offers an 8.5-acre lake with a lighted fishing pier, a walking trail, ball fields, a rodeo arena, and a swimming pool. There is also a 9-hole golf course and an amphitheater (Cuero Mar 2008). Events in Cuero include an annual Turkeyfest, the Texas River Marathon (a canoe race), and a youth rodeo (CCCA Undated). Yoakum opportunities include the Land of Leather days and Chili Cook-off plus the Tom-Tom Festival, a festival based on the tomato heritage of Yoakum (YACC Undated). The city of Yorktown has the Annual Yorktown Western Days Festival (Yorktown Undated).

Goliad County offers several recreational facilities such as parks, area lakes, public golf courses, and tennis courts. Annual events include the Goliad Market Days, a county fair and rodeo with a parade, a bike ride, and the Hunter's Ball (Goliad Undated).

Jackson County has five public parks. One of them, Brackenridge Plantation Park and Campground, is situated on Lake Texana. It provides fishing, camping, hiking trails, bike trails, birding, an equestrian trail, a nature trail, and a day-use area (BPPC Undated). Brackenridge Plantation Park and Campground is located near Edna, approximately 37 miles from the site. Annual recreational events in the county include the Texana Chili Spill, Go Texas Barbecue, and Christmas in the Outback (JCCCA Undated).

Matagorda County provides several public park facilities within the 50-mile region, all located in Palacios. The city offers playgrounds and shelters available for rent. The port of Palacios also provides boating and fishing opportunities (Palacios Undated). The city of Palacios has events including the Valentine Parade and Ball, Shrimp-o-ree Festival, and the Texas Fishermen's Seafood Festival (PCC Undated).

Refugio County operates two parks. Lions/Shelly Park is situated on the Mission River and has a playground, covered pavilion, picnic tables, nature trails, and a fishing pier. This park is also one of the stations on the Great Texas Coastal Birding Trail. Refugio RV Park is located just two blocks west of Hwy 77 at the south end of the city of Refugio (RCCCEDF Undated a). Refugio County annual events include the Refugio County Fair (CF Undated).

In San Patricio County, there are two municipalities located within or just outside of the 50-mile region: Sinton and Ingleside. Sinton provides a butterfly garden, Welder Park, Grace Coin Park, a wildlife foundation, and golf tournaments. Ingleside provides a skate park, eco-nature tours, birding, cycling, hiking, swimming and water sports, fishing, disco golf, and basketball courts (TCB Undated). Events in Sinton and Ingleside include an Annual Golf Tournament, Annual "Cruise Your Ride to Ingleside" Fly-in/Car Show, Roundup Days Festival and Parade, and the Enchanted Forest Renaissance Faire (ICC Undated; SICC Undated).

Victoria County has 15 recreational facilities, all in the city of Victoria. The parks are owned and maintained by the city of Victoria. The parks include ball fields, tennis courts, basketball courts, a swimming pool, a zoo, and a fishing pond. The city of Victoria provides annual events such as Market Days, Holiday Lighted Parade, and Christmas in the Park. (Victoria Undated a)

The closest county or city recreational facility to the proposed site is Martin L. King, Jr. Park, in Victoria County, approximately 11 miles away. (Victoria May 2008).

The Texas Water Safari is a canoe race on the Guadalupe River from Gonzales to the mouth of the river at San Antonio Bay. Approximately 115 teams enter the race each year and the event attracts thousands of spectators (TWS 2008). The Guadalupe River passes within 2 miles of the VCS site (Figure 2.1-1). The heavy haul road would bridge the Guadalupe River near VCS.

There is a privately owned 2200-acre hunting facility between the VCS site and the Guadalupe River.

2.5.2.6 Housing

2.5.2.6.1 Permanent Housing

In the ROI, residential areas are found in cities, towns, and smaller communities. Most of the housing is concentrated in Victoria County, particularly in and around the city of Victoria. Victoria County has the largest housing stock.

Table 2.5.2-34 provides the number of housing units and housing unit vacancies for Calhoun, DeWitt, Goliad, Jackson, Refugio, and Victoria Counties. In 2006, there were 68,083 housing units in the ROI (USCB 2008), an increase of 3.8% (2504 units) from 2000 (USCB 2000b). Approximately 50% of the units were in Victoria County and 16% in Calhoun County. The majority of all housing in the ROI (52.3%) has been built since 1970. Victoria County has the greatest percentage of housing stock built since 1970 at 58.4%. Refugio County has the smallest percentage of housing inventory built since 1970 at 36.3% (USCB 2000c). Of the 65,579 total units in the ROI in 2000, 15% were vacant (9894 units). Vacancy rates for homeowners varied from 1.6% in Victoria County to 3.1% in Refugio County. Vacancy rates among rental units were substantially higher. They ranged from 6.5% in Refugio County and DeWitt County to 16.0% in Calhoun County (USCB 2000b).

Of the 32,945 housing units in Victoria County in 2000, 3431 were mobile homes (approximately 10.4% of the total units). Of the other ROI counties, Calhoun had 10,238 units, of which 1640 were mobile homes (16.0% of the county's housing units); DeWitt had 8756 housing units, of which 1345 were mobile homes (15.4% of the county's housing units); Goliad had 3426 housing units, of which 828 were mobile homes (24.2% of the county's housing units); Jackson had 6545 housing units, of which 1080 were mobile homes (16.5% of the county's housing units); and Refugio had 3669 housing units, of which 501 were mobile homes (13.7% of the housing units) (USCB 2000c).

Table 2.5.2-35 presents 2000 data on occupied and vacant housing, by tenant characteristics, for the population center of each ROI county (USCB 2000d).

- Port Lavaca (Calhoun County) had 4791 units, of which 602 were vacant (12.6%);

- Cuero (DeWitt County) had 2867 units, of which 367 were vacant (12.8%);
- Goliad (Goliad County) had 877 units, of which 128 were vacant (14.6%);
- Edna (Jackson County) had 2609 units, of which 382 were vacant (14.6%);
- Refugio (Refugio County) had 1312 units, of which 184 were vacant (14.0%);
- Victoria (Victoria County) had 24,192 units, of which 2063 were vacant (8.5%) (USCB 2000d).

The six population centers had a weighted, average vacancy rate of 10.2%.

Counties in the ROI have experienced growth in their single-family housing inventory since the last decennial census. From January 1, 2000 to December 31, 2006, Calhoun County issued 721 single-family dwelling unit permits, DeWitt County issued 48, Jackson County issued 145, Refugio County issued 46, and Victoria County issued 1044. The number of permits issued in Goliad County is not available. In 2006, the average value of the permitted housing units ranged from $127,200 in DeWitt County to $196,300 in Refugio County (TAMU Jan 2008). The counties do not distinguish seasonal/recreational housing from permanent housing when permits are issued.

2.5.2.6.2 Seasonal Housing

In 2000, there were 3130 vacant housing units for seasonal, recreational, or occasional use in the ROI. Fifty-six percent of the vacant seasonal housing units in the ROI, 1751 units, were in Calhoun County (USCB 2000b). Hurricane Carla, a Category 5 tropical storm, made landfall between Port O'Connor and Port Lavaca in September 1961. The storm destroyed or damaged most of the housing in the coastal area of Calhoun County. Approximately 25% of the current housing in Calhoun County was built or re-built during the decade following Hurricane Carla (USCB 2000c).

2.5.2.6.3 Recreational Vehicle Parks with Hook-ups

There are numerous year-round recreational vehicle (RV) parks or campgrounds, with full hookups (water, sewer, and electricity) for private recreational vehicles in the ROI. There are at least 33 RV parks: 22 in Calhoun County (CBT Undated a), four in Victoria County (CBT Undated b), three in Goliad County (PPA 2008, Woodall's Undated), two in Jackson County (JCCCA Undated), one in Refugio County (RCCCEDF Undated b), and one in DeWitt County (CBT Undated c). Monthly rates in late 2007 generally ranged from $300 to $400 per site (TC Undated).

2.5.2.6.4 Hotels and Motels

Hotel/motel data for each county in the ROI is presented in Table 2.5.2-36. In the first quarter of 2007, there were 43 hotels and motels in the ROI. Of those, Victoria County had 17 and Calhoun County had 15. There were nearly 90,100 unoccupied room-nights available in the ROI during the first quarter of 2007. Occupancy rates varied from 37.7% in Refugio County to 60.4% in Victoria County (TOG Undated), with an average occupancy rate in the ROI of 54.4%. Two new hotels are slated to open in Victoria County in 2008. The new hotels would add 158 rooms to the area inventory (VA Oct 2007).

2.5.2.6.5 Housing Values

A 2000 real estate inventory for each county in the ROI, by value of owner-occupied units, is presented in Table 2.5.2-37. In five counties (Calhoun, DeWitt, Goliad, Jackson, and Refugio) the largest portion of their housing inventory was in the category of "less than $50,000." The median price of all owner-occupied housing was $56,400 in Calhoun County, $47,100 in DeWitt County, $57,400 in Goliad County, $52,700 in Jackson County, and $42,600 in Refugio County. The largest portion of housing inventory in Victoria County was in the category of "$50,000 and $99,999." The median value of all owner-occupied units was $73,000. In 2000, approximately 75% of the housing in Victoria County was valued at less than $100,000. (USCB 2000c)

2.5.2.7 Public Services and Community Infrastructure

Public services and community infrastructure include public water supply and wastewater treatment systems, police and fire departments, medical facilities, and schools. Schools are described in Subsection 2.5.2.8. The remaining services are described below.

2.5.2.7.1 Public Water Supply and Wastewater Treatment Systems

The discussion of public water supply systems includes the six counties comprising the ROI; however, water assessment and planning are performed on a regional basis in Texas, as shown in Figure 2.5.2-15. Therefore, these counties are discussed within the context of their respective regions. Table 2.5.2-38 details public water suppliers in the ROI, their current capacities, and their average daily production. Table 2.5.2-39 details wastewater treatment facilities in the ROI. Currently, there is excess production capacity in all of the major water supply facilities and in most of the wastewater treatment facilities.

2.5.2.7.1.1 Public Water Supply

In 1957, in response to the drought of the 1950s, the Texas legislature created the Texas Water Development Board (TWDB) to develop water supplies and prepare plans to meet the state's future water needs. In 1997, the legislature established a water planning process to address water supply issues in light of Texas' population growth trends. (TWDB Undated)

The TWDB divides Texas into 16 water planning regions: Region A through Region P (Figure 2.5.2-15). Each region is represented by a Regional Water Planning Group that prepares a regional water plan for its region. Regional Water Planning Groups are composed of representatives from a variety of interests, including agricultural, industrial, environmental, public, municipal, business, water district, river authority, water utility, county, and power generation. Their plans have engineering, socioeconomic, hydrological, environmental, legal, and institutional components. They include direction for water conservation strategies, meeting future water supply needs, and responding to future droughts. (TWDB Undated)

The six counties comprising the ROI are located in Regions L and P. Calhoun, DeWitt, Goliad, Refugio, and Victoria counties are in Region L, and Jackson County is in Region P. The larger population centers

in the Region L portion of the ROI are Port Lavaca and Seadrift in Calhoun County; Cuero, Yoakum, and Yorktown in DeWitt County; Goliad in Goliad County; Refugio and Woodsboro in Refugio County; and Victoria in Victoria County. The larger population centers in the Region P portion of the ROI are Edna and Ganado in Jackson County. A summary of Regions L and P water demand and supply is provided below, as presented in the 2007 State Water Plan (TWDB Nov 2006).

Region L — Demand, Supply, Additional Water Needs, and Water Management Strategies

Region L contains all or part of 21 counties, including five of the counties in the ROI. Region L contains all or portions of nine river and coastal basins, the Guadalupe Estuary and San Antonio Bay. The largest cities in Region L are San Antonio, Victoria, San Marcos, and New Braunfels.

Between 2010 and 2060, Region L population is projected to increase by almost 75%. Water demands, however, are projected to increase less significantly. The region's total water demand is projected to increase by 29%, from 985,237 acre-feet in 2010 to 1,273,003 acre-feet in 2060 (Table 2.5.2-40). After 2020, municipal water use makes up the largest share of these demands in all decades and is projected to experience the greatest increase over the planning period, from 369,694 acre-feet in 2010 to 597,619 acre-feet in 2060, a 62% increase. However, this increase in demand will be somewhat offset by a decrease in the demand from agricultural irrigation water, which is projected to decline 20%, from 379,026 acre-feet in 2010 to 301,679 acre-feet in 2060. Steam electric demand will increase 118% from 50,427 acre-feet to 109,776 acre-feet. (TWDB Nov 2006)

Major water supply sources in Region L are summarized in Table 2.5.2-41. This data indicates a decrease in regional water supplies from groundwater, surface water, and water reuse, from 1,049,769 acre-feet in 2010 to 1,018,410 acre-feet in 2060.

Water needs for Victoria and Calhoun Counties are discussed in Subsection 2.3.2. Tables 2.3.2-2 and 2.3.2-3 provide a summary of the 2010 through 2060 projected available and unallocated groundwater supplies for Victoria and Calhoun Counties. Table 2.3.2-14 provides a summary of projected surface water demands, supplies, and needs for Victoria and Calhoun Counties from 2000 through 2060. Goliad County's projected water needs for steam electric is projected to increase to 4842 acre-feet in 2060. Victoria County's water needs for manufacturing are projected to increase to 6566 acre-feet in 2060. Water needs for DeWitt and Refugio Counties are not projected to increase during the period from 2010 through 2060. (TWDB Nov 2006)

Water management strategies for the Region L Plan include, but are not limited to, a more coordinated use of surface water and groundwater, reuse, groundwater and seawater desalination, conservation, and the proposed LCRA/San Antonio Water System Project (SAWS Project). In total, these strategies will provide 732,779 acre-feet per year of additional water supply by the year 2060, at a total capital cost of approximately $5.2 billion. (TWDB Nov 2006)

The proposed SAWS Project would reroute Region K water to the San Antonio area (Region L). It is the largest recommended water management strategy for Region L, at an estimated cost of approximately

$2.1 billion. The SAWS Project would provide Region L with approximately 150,000 acre-feet per year by 2050. (TWDB Nov 2006)

Conservation strategies represent 15% of the total amount of water resulting from all recommended water management strategies. Water conservation is included as a strategy for every municipal and non-municipal water user group. (TWDB Nov 2006)

The VCS site does not currently obtain potable water through public water supplies. There are stock wells at the VCS site and a domestic well at the McCan Ranch house.

Region P — Demand, Supply, Additional Water Needs, and Water Management Strategies

Region P contains all or part of three counties, one of which (Jackson County) is located in the ROI. Most of Region P lies inside the Lavaca River Basin, which is the primary source of surface water for the region. Groundwater from the Gulf Coast Aquifer supplies most of the water for the region.

Table 2.5.2-42 provides water demand data for Region P. Projected water demands for Region P indicate a slight reduction, from 225,561 acre-feet in 2010 to 206,908 acre-feet in 2060. (TWDB Nov 2006)

Table 2.5.2-43 provides water supply data for Region P. In 2010, surface water is projected to provide less than 1% of the total supply, with groundwater providing the balance. The principal surface water supply source is Lake Texana, the only reservoir in the region. The Gulf Coast Aquifer provides groundwater in the region. The total surface water and groundwater supply is estimated to remain constant at 209,431 acre-feet per year from 2010 to 2060. (TWDB Nov 2006)

Water user groups in Region P are anticipated to need 50,655 acre-feet of additional water in 2010, under drought conditions, and 31,979 acre-feet by 2060, all of which can be met by pumping additional groundwater during irrigation season and then allowing water levels to recover prior to the next planting season. Irrigation is the only water use group for this region that has a need for additional water from 2010 to 2060, although the level of need is estimated to decline because of a projected decrease in irrigated acreage in the region. Irrigation water needs for Jackson County are projected to increase slightly from 15,735 acre-feet in 2010 to 15,834 acre-feet in 2060, which is less than a 1% increase. (TWDB Nov 2006)

The Region P water management strategy is water conservation for municipal users only. Region P planners state that water conservation is not the most cost-effective method to meet irrigation needs, which are the only projected additional water needs in the region. Planners recommend the continued use of good agricultural practices, and state and federal programs that provide financial and technical assistance to agricultural producers, to achieve irrigation efficiency and overall water conservation. Region P water policy recommendations include establishing fees for groundwater export from the region, basing groundwater availability on an aquifer's sustainable yield, and subjecting regional groundwater used outside of the region to the same protections as the basin of origin for surface water. (TWDB Nov 2006)

2.5.2.7.1.2 Wastewater Treatment Systems

Wastewater is the domestic sewage from homes, communities, farms, businesses, and manufacturing facilities. It also includes industrial waste from manufacturing sources. Wastewater treatment in the region is provided by local jurisdictions and primarily regulated by the Texas Commission on Environmental Quality. Wastewater treatment capacity depends on two factors: water supply and the availability of infrastructure. As stated previously, there is currently excess capacity in most of the wastewater treatment systems in counties in the ROI.

Capacity for Wastewater Treatment

Table 2.5.2-39 details public wastewater treatment facilities, the average flow rates for their plant designs, and their average monthly processing. The rural areas of each county, including the proposed VCS site, are on septic systems.

Infrastructure for Wastewater Treatment

In the event that capacity limits may be approached or exceeded, Texas Administrative Code Title 30 Section 305.126(a) directs that:

> Whenever flow measurements for any sewage treatment plant facility in the state reach 75% of the permitted average daily or annual average flow for three consecutive months, the permittee must initiate engineering and financial planning for expansion and/or upgrading of the wastewater treatment and/or collection facilities. Whenever the average daily or annual average flow reaches 90% of the permitted average daily flow for three consecutive months, the permittee shall obtain necessary authorization from the commission to commence construction of the necessary additional treatment and/or collection facilities."

However, this requirement can be waived if the facility can show that the population served or the expected waste to be processed will not exceed facility design limitations.}

An evaluation of the data listed in Table 2.5.2-39 indicates that the wastewater systems for the city of Port Lavaca, Jackson County Water Control and Improvement District (WCID) No. 2, and Victoria County WCID No. 2 are already in excess of the 75% flow value discussed above.

2.5.2.7.2 Law Enforcement, Fire Protection Services, and Emergency Management

Law Enforcement

Table 2.5.2-44 provides 2005 law enforcement data for the ROI counties. Table 2.5.2-46 provides approximate ratios of residents to law enforcement officers (sworn officers). In the ROI as a whole, the current ratio of residents per officer is approximately 482 to 1. In 2005, the national average was 417 residents per officer. (FBI Sep 2006)

Fire Protection Services

Table 2.5.2-45 provides 2007 fire protection personnel data for the departments for the counties in the ROI. Most firefighters are volunteers, with the exception of the city of Victoria and Port Lavaca fire

departments where most are paid. Table 2.5.2-46 provides approximate ratios of residents to active firefighters. In the ROI, the current ratio of residents per active firefighter is approximately 245 to 1. In 2006, the estimated number of firefighters in the nation was 1,140,900 (USFA 2008) and the USCB population estimate for the nation was 299,398,484 (USCB 2006), resulting in a residents per active firefighter ratio of 262 to 1.

Additionally, in 1998, the state of Texas adopted the Public Protection Classification system (TDI Sep 2007). It is a national system used by the Insurance Services Office (ISO) to reflect a community's local fire protection for property insurance rating purposes. The ISO is an advisory organization that serves the property and casualty insurance industry by providing inspection services, insurance coverage for development, and statistical services. The public fire protection of a city, town, or area is graded using the ISO Fire Suppression Rating Schedule. ISO classifies communities from 1 (the highest rating) to 10 (the lowest rating). Communities are graded on water distribution, fire department equipment and manpower, and fire alarm facilities, among other things (TDI Sep 2007). Table 2.5.2-47 provides Public Protection Classification ratings for the ROI communities that have populations large enough to be counted in the U.S. Census.

Emergency Management

The Governor is responsible for homeland security and emergency management in the state of Texas. The Governor's Division of Emergency Management is responsible for carrying out a comprehensive all-hazard emergency management program for the state and assisting cities, counties, and state agencies in implementing their own emergency management programs. The Governor's Division of Emergency Management, like other state agencies, is also responsible for supporting development and implementation of the Governor's Homeland Security Strategy (TDPS Undated).

A number of other councils and committees, including the state Emergency Management and Homeland Security Council, assist the Governor in matters relating to disaster mitigation, emergency preparedness, disaster response, and recovery (TDPS Undated).

Texas is divided into Disaster Districts, which are the state's regional emergency management organizations. They serve as the initial source of state emergency assistance for local governments. With the exception of Refugio County, the ROI counties are in District 17, the Victoria District. Refugio County is part of District 20, the Corpus Christi District (TDPS Undated).

On the local level, mayors and county judges have responsibility for emergency preparedness and response in their jurisdictions. Local emergency management and homeland security organizations may be organized at the city level, at the county level, or as inter-jurisdictional programs that include one or more counties and cities. Local emergency management organizations may be organized as part of the mayor or county judge's staff, as a separate office or agency, as part of the local fire department or law enforcement agency, etc. Local emergency management and homeland security agencies may be identified as emergency management offices or agencies, homeland security offices or agencies, or some combination of the two. (TDPS Undated)

The mayors and county judges may appoint an Emergency Management Coordinator to manage day-to-day program activities (TDPS Undated). Each of the ROI counties has an Emergency Management Coordinator (TDPS Jan 2008).

2.5.2.7.3 Medical

Table 2.5.2-48 presents hospital use in 2006 and medical practitioner data by county in 2007. As a whole, the ROI has 273 physicians, eight hospitals (four of which are in Victoria County), and 808 staffed beds. The 2006 ROI hospital census shows that the average number of in-patients receiving care each day was 369. A comparison of the number of staffed beds to the hospital census yields a use rate of approximately 46%.

2.5.2.8 Schools

2.5.2.8.1 Public Pre-Kindergarten through Grade 12

This subsection discusses the enrollment, capacity, and facilities of public schools in the ROI. The public school systems in Texas are organized into Independent School Districts (ISDs). For the 2007-2008 school year, the ISDs in the ROI (in whole or in part) have a total enrollment of 31,571 students. The public school systems in the ROI have space available for an additional 14,728 students including the seating of the schools that are planned or under construction. Table 2.5.2-49 provides information on the number and type of public schools in each county. Table 2.5.2-50 summarizes the information on student population and available capacity (including the capacity of schools under construction and the planned new schools) for each ISD. Figure 2.5.2-16 shows the boundaries of each ISD and the location of each campus.

2.5.2.8.1.1 Calhoun County

Calhoun County has one ISD, the Calhoun County ISD, and the ISD's boundaries encompass most of the county (the Seadrift community is a part of the Austwell-Tivoli ISD). The ISD is described below.

Calhoun County ISD

The Calhoun County ISD had a pre-kindergarten through grade 12 total enrollment of 4290 students in November 2007 (Table 2.5.2-50). The 2006-2007 school year enrollment was approximately 4331 students. The existing ISD infrastructure could support approximately 5600 students. Additionally, a new elementary school campus is currently being built and one of the high schools is currently being expanded to include a separate structure for the 9th grade. Upon completion, these projects will expand capacity by an additional 632 students in the ISD. (CCISD Nov 2007, CCISD Apr 2008)

For the 2005-2006 school year, the Calhoun County ISD received 85.23% of its revenue from local property taxes, 3.41% from other local and intermediate taxes (as a result of services rendered to other school districts), 10.75% from state funding, and 0.61% from federal funding (TEA 2007).

2.5.2.8.1.2 DeWitt County

DeWitt County has six ISDs with a pre-kindergarten through grade 12 enrollment of 4405 students in November 2007 (Table 2.5.2-50). The six ISDs in the county can collectively support an additional 1240 public school students (Table 2.5.2-50). Each school district is described below.

Cuero ISD

The Cuero ISD, which partially extends into Gonzales County, had a kindergarten through grade 12 enrollment of 1950 students in November 2007, which is unchanged from the 2006-2007 school year. A junior high school and a high school were recently built, increasing the student capacity of the ISD to 2700. (CISD Nov 2007)

For the 2005-2006 school year, the Cuero ISD received 28.58% of its revenue from local property taxes, 3.37% from other local and intermediate taxes (a result of services rendered to other school districts), and 68.05% from state funding. The ISD received no federal funding. (TEA 2007)

Meyersville ISD

The Meyersville ISD, which extends into Victoria County, had a kindergarten through grade 8 enrollment of 125 students in November 2007. The ISD has a total capacity of 160 students. During the 2006-2007 school year, the district had an enrollment of 130 students. No expansion plans are scheduled. (MISD Nov 2007)

For the 2005-2006 school year, the Meyersville ISD received 63.01% of its revenue from local property taxes, 2.86% from other local and intermediate taxes (a result of services rendered to other school districts), and 34.14% from state funding. The ISD received no federal funding. (TEA 2007)

Nordheim ISD

The Nordheim ISD, which extends into Karnes County, has a 2007–2008 pre-kindergarten through grade 12 enrollment of 82 students on a single campus. The 2006–2007 school year enrollment was 80 students. With the existing infrastructure, the total capacity is 175 students. The Nordheim ISD has no current plans to expand. (NISD Nov 2007)

During the 2005-2006 school year, the Nordheim ISD received 79.74% of its revenue from local property taxes, 1.05% from other local and intermediate taxes (a result of services rendered to other school districts), and 19.22% from state funding. The ISD received no federal funding. (TEA 2007)

Westhoff ISD

The Westhoff ISD, which is completely contained in DeWitt County, has a 2007–2008 school year pre-kindergarten through grade 8 enrollment of 48 students. High school students attend school in the Cuero ISD. In the 2006–2007 school year, enrollment was also 48 students. Although the district could support 160 students, enrollment has never been more than 70 students. No expansion plans are scheduled. (WISD Nov 2007)

For the 2005–2006 school year, the Westhoff ISD received 35.15% of its revenue from local property taxes, 2.75% from other local and intermediate taxes (a result of services rendered to other school districts), and 62.11% from state funding. The ISD received no federal funding. (TEA 2007)

Yoakum ISD

The Yoakum ISD, which extends into Gonzales and Lavaca Counties, has a 2007–2008 school year enrollment in pre-kindergarten through grade 12 of 1550 students. The enrollment in 2006–2007 was 1560 students. The Yoakum ISD schools are currently functioning at capacity. If enrollment increases, the existing infrastructure would not be sufficient. Although there are no plans for expansion, the district acknowledges that it will expand if enrollment increases. (YISD Nov 2007)

For the 2005-2006 school year, the Yoakum ISD received 41.75% of its revenue from local property taxes, 1.39% from other local and intermediate taxes (a result of services rendered to other school districts), 56.45% from state funding, and 0.41% from federal funding (TEA 2007).

Yorktown ISD

The Yorktown ISD, which is completely contained in DeWitt County, has a 2007–2008 school year pre-kindergarten through grade 12 enrollment of 650 students. Enrollment during the 2006–2007 school year was 675 students. The existing infrastructure at Yorktown ISD could support a total of 900 students. The Yorktown ISD has no current plans to expand. (YORKISD Nov 2007)

For the 2005-2006 school year, the Yorktown ISD received 29.29% of its revenue from local property taxes, 1.14% from other local and intermediate taxes (a result of services rendered to other school districts), and 69.57% from state funding. The ISD received no federal funding. (TEA 2007)

2.5.2.8.1.3 Goliad County

Goliad County has one ISD, the Goliad ISD. The ISD is contained within the county boundary and is described below.

Goliad ISD

The Goliad ISD has a 2007–2008 school year pre-kindergarten through grade 12 total enrollment of 1312 students. Enrollment during the 2006–2007 school year was approximately 1332 students. With the existing infrastructure, the Goliad ISD is at capacity. No expansion plans are scheduled. (GISD Nov 2007)

For the 2005–2006 school year, the Goliad ISD received 89.80% of its revenue from local property taxes, 1.35% from other local and intermediate taxes (as a result of services rendered to other school districts), 8.58% from state funding, and 0.27% from federal funding (TEA 2007).

2.5.2.8.1.4 Jackson County

Jackson County has three ISDs wholly contained within the county and portions of the Palacios ISD (Matagorda County) and the Hallettsville ISD (Lavaca County). During the 2007-2008 school year, the five ISDs had a pre-kindergarten through grade 12 enrollment of 5560 students (Table 2.5.2-50).

Currently, the county has space available for an additional 940 students. Each school district is described below.

Edna ISD

The Edna ISD has a 2007–2008 school year enrollment of 1450 students in pre-kindergarten through grade 12. During the 2006–2007 school year, the ISD had an enrollment of 1450 students. A new elementary school will open in the spring of 2008, increasing the capacity of the district to 1800 students. (EISD Oct 2007, EISD Apr 2008)

For the 2005-2006 school year, the Edna ISD received 44.10% of its revenue from local property taxes, 1.73% from other local and intermediate taxes (a result of services rendered to other school districts), and 54.18% from state funding. The ISD received no federal funding. (TEA 2007)

Ganado ISD

The Ganado ISD has a 2007–2008 school year pre-kindergarten through grade 12 enrollment of 640 students. Enrollment for the 2006–2007 school year was 650 students. With the existing infrastructure at the Ganado ISD, the district could support approximately 700 students, or an additional 60 students. Currently, the ISD has no plans for expanding. (GANISD Nov 2007)

For the 2005–2006 school year, the Ganado ISD received 35.49% of its revenue from local property taxes, 1.24% from other local and intermediate taxes (a result of services rendered to other school districts), and 63.27% from state funding. The ISD received no federal funding. (TEA 2007)

Hallettsville ISD

The Hallettsville ISD is primarily located in Lavaca County, although a very small portion of it is in Jackson County. The ISD has a 2007–2008 kindergarten through grade 12 enrollment of 887 students. Enrollment during the 2006–2007 school year was 940 students. The Hallettsville ISD has capacity for 1050 students. No expansion plans are scheduled. (HISD Nov 2007)

For the 2005–2006 school year, the Hallettsville ISD received 89.53% of its revenue from local property taxes, 1.14% from other local and intermediate taxes (a result of services rendered to other school districts), and 9.33% from state funding. The ISD received no federal funding. (TEA 2007)

Industrial ISD

The Industrial ISD, which also extends into Victoria County, has a 2007–2008 school year pre-kindergarten through grade 12 enrollment of 1060 students. The 2006–2007 school year enrollment was 1030 students. The ISD's existing infrastructure could support a total of 1150 students. The ISD is adding classrooms to the two existing elementary schools, but this will not affect enrollment capacity} (IISD Nov 2007, IISD Apr 2008).

For the 2005–2006 school year, the Industrial ISD received 85.22% of its revenue from local property taxes, 2.72% from other local and intermediate taxes (a result of services rendered to other school districts), and 12.06% from state funding. The ISD received no federal funding. (TEA 2007)

Palacios ISD

The Palacios ISD is primarily located in Matagorda County, though a portion of it is in Jackson County. The ISD had a pre-kindergarten through grade 12 enrollment of 1574 students in the 2006–2007 school year. The 2007–2008 enrollment is approximately 1523 students. The existing infrastructure can support a total of 1800 students. No classroom expansions are currently planned. (PISD Sep 2007)

For the 2005–2006 school year, the Palacios ISD received 79.91% of its revenue from local property taxes, 3.61% from other local and intermediate taxes (a result of services rendered to other school districts), 16.32% from state funding, and 0.15% from federal funding. (TEA 2007)

2.5.2.8.1.5 Refugio County

Refugio County has three ISDs with a pre-kindergarten through grade 12 enrollment of 1436 students in the 2007-2008 school year (Table 2.5.2-50). There is space available for an additional 1164 students (Table 2.5.2-50). Each school district is described below.

Austwell-Tivoli ISD

The Austwell-Tivoli ISD, which is primarily in Refugio County but extends into Calhoun County, has a pre-kindergarten through grade 12 enrollment of 155 students in the 2007–2008 school year. During the 2006–2007 school year, the district had an enrollment of approximately 160 students. With the existing infrastructure, the Austwell-Tivoli ISD could support an additional 345 students. Currently, the Austwell-Tivoli ISD has no expansion plans. (ATISD Nov 2007)

For the 2005–2006 school year, the Austwell-Tivoli ISD received 84.79% of its revenue from local property taxes, 6.41% from other local and intermediate taxes (as a result of services rendered to other school districts), 7.58% from state funding, and 1.22% from federal funding (TEA 2007).

Refugio ISD

The Refugio ISD is primarily located in Refugio County, with a noncontiguous portion in Victoria County; the Victoria County portion of this ISD includes most of the proposed VCS site. The ISD had a pre-kindergarten through grade 12 enrollment of 735 students in November 2007. Enrollment for the 2006-2007 school year was 725 students. The existing infrastructure can support approximately 1000 students. The ISD is currently building a separate campus for middle school students, which will expand capacity by an additional 500 students (RISD Nov 2007, RISD Apr 2008).

For the 2005–2006 school year, the Refugio ISD received 87.45% of its revenue from local property taxes, 1.39% from other local and intermediate taxes (a result of services rendered to other school districts), and 11.17% from state funding. The ISD received no federal funding. (TEA 2007)

Woodsboro ISD

The Woodsboro ISD had a pre-kindergarten through grade 12 enrollment of 579 students in November 2006. The 2007–2008 enrollment is approximately 546 students. The existing infrastructure

can support a total of approximately 600 students. The district does not have expansion plans. (WOISD Nov 2007)

For the 2005–2006 school year, the Woodsboro ISD received 34.42% of its revenue from local property taxes, 3.18% from other local and intermediate taxes (a result of services rendered to other school districts), 62.39% from state funding, and 0.02% from federal funding (TEA 2007).

2.5.2.8.1.6 Victoria County

Victoria County has three ISDs plus portions of the Industrial ISD (Jackson County), the Meyersville ISD (DeWitt County), and the Refugio ISD (Refugio County). In the three ISDs completely within Victoria County, pre-kindergarten through grade 12 enrollment is 14,568 students in the 2007–2008 school year (Table 2.5.2-50). The school systems in the county could accommodate an additional 10,042 students, after the schools planned and under construction are completed and the reliance on mobile units is reduced. Each school district is described below.

Bloomington ISD

The Bloomington ISD has a 2007–2008 pre-kindergarten through grade 12 enrollment of 908 students. The 2006-2007 school year enrollment was 921 students. With the existing infrastructure, the capacity is 1050 students. As of 2007, the ISD has no plans for expansion. (BISD Nov 2007)

For the 2005-2006 school year, the Bloomington ISD received 26.58% of its revenue from local property taxes, 0.93% from other local and intermediate taxes (a result of services rendered to other school districts), 72.19% from state funding, and 0.30% from federal funding (TEA 2007).

Nursery ISD

The Nursery ISD has a pre-kindergarten through grade 5 total enrollment of 110 students in November 2007. The 2006–2007 school year also had an enrollment of 110 students. Currently, the school within Nursery ISD is at capacity, however, the ISD is building a new facility to replace the existing structure. The new school will support about 210 students (NUISD Nov 2007, NUISD Apr 2008).

For the 2004–2005 school year, the Nursery ISD received 91.66% of its revenue from local property taxes, 0.91% from other local and intermediate taxes (a result of services rendered to other school districts), and 7.42% from state funding. The ISD received no federal funding. (TEA 2007)

Victoria ISD

One tax parcel of the proposed VCS site lies within the Victoria ISD, which has a pre-kindergarten through grade 12 total enrollment of 13,550 students in November 2007. Enrollment for the 2006–2007 school year was 13,838 students. With the existing facilities, the Victoria ISD could support another 4450 students. The Victoria ISD is currently building five new schools (two elementary, one middle/intermediate/junior, and two high schools), adding space for a net additional 5350 students. The ISD will reduce its reliance on mobile classroom units when the new schools are completed. (VISD Nov 2007, VISD Apr 2008)

For the 2005–2006 school year, the Victoria ISD received 60.44% of its revenue from local property taxes, 1.25% from other local and intermediate taxes (a result of services rendered to other school districts), 37.88% from state funding, and 0.42% from federal funding (TEA 2007).

2.5.2.8.2 Post-Secondary Institutions

There are five post-secondary institutions-three colleges or universities and two vocational schools-within 50 miles of the proposed VCS site. Victoria College is located approximately 13 miles from the proposed site, in the city of Victoria. The college is accredited to award Associate Degrees. In the fall of 2007, Victoria College had an enrollment of 4297 students (VC Oct 2007). The University of Houston — Victoria (UHV) is located approximately 13 miles from the proposed site and is accredited to award both Baccalaureate and Masters Degrees. In the fall of 2007, UHV had an enrollment of 2784 students (UHV Oct 2007). UHV has articulation agreements to allow students from Wharton County Junior College (in nearby Wharton County) or from Victoria College to transfer credits toward earning a Baccalaureate or Masters Degree at UHV (UHV Undated). Coastal Bend College, in Beeville, is located approximately 48 miles from the proposed site. It is accredited to award Associate Degrees. In the fall of 2007, Coastal Bend College had an enrollment of 925 students at the Beeville campus (CBC Jan 2008). In the city of Victoria, there are two vocational schools: the Texas Vocational School and the Victoria Beauty College. The Texas Vocational School has a current total enrollment of 74 students, and the Victoria Beauty College has a current enrollment of 115 students (NCES May 2008). In addition, there is a Texas State Technical College (TSTC) system but there is no campus within 50 miles of the VCS site. However, the college provides a service called "Corporate College" that provides specialized training for businesses and industries on a contractual basis (TSTC Jun 2008). Exelon has had general discussions with TSTC regarding how it might support Exelon's needs in the future should the proposed project proceed to construction.

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Table 2.5.2-1
Employment Trends 1996-2006

	Labor Force			Employment			Unemployment			Unemployment Rate	
Area	1996	2006	Average Annual Percent Change	1996	2006	Average Annual Percent Change	1996	2006	Average Annual Percent Change	1996	2006
United States	133,943,000	151,428,000	1.2%	126,708,000	144,427,000	1.3%	7,236,000	7,001,000	–0.3%	5.4%	4.6%
Texas	9,736,646	11,487,496	1.7%	9,175,983	10,921,673	1.8%	560,663	565,823	0.1%	5.8%	4.9%
Calhoun County	9,786	9,557	–0.2%	9,059	9,084	0.0%	727	473	–4.2%	7.4%	4.9%
DeWitt County	8,094	9,617	1.7%	7,722	9,190	1.8%	372	427	1.4%	4.6%	4.4%
Goliad County	2,680	3,480	2.6%	2,549	3,337	2.7%	131	143	0.9%	4.9%	4.1%
Jackson County	9,143	6,573	–3.2%	8,808	6,266	–3.3%	335	307	–0.9%	3.7%	4.7%
Refugio County	3,009	3,827	2.4%	2,860	3,645	2.5%	149	182	2.0%	5.0%	4.8%
Victoria County	42,103	45,103	0.7%	39,934	43,244	0.8%	2,169	1,859	–1.5%	5.2%	4.1%
ROI	74,815	78,157	0.4%	70,932	74,766	0.5%	3,883	3,391	–1.3%	5.2%	4.3%
ROI as percent of Texas	0.8%	0.7%		0.8%	0.7%		0.7%	0.6%			

Source: BLS 2007a

Table 2.5.2-2 (Sheet 1 of 2)
Employment by Industry 2005

	ROI		Texas	
Summary by Major Industry Sector	**Number of Workers**	**Percent of Total**	**Number of Workers**	**Percent of Total**
Total employment	90,404	100.0%	13,088,946	100.0%
Farm Employment	6,658	7.4%	281,727	2.2%
Mining	3,665	4.1%	244,837	1.9%
Construction	7,037	7.8%	899,172	6.9%
Manufacturing	7,240	8.0%	951,778	7.3%
Wholesale Trade	2,370	2.6%	530,192	4.1%
Retail Trade	10,330	11.4%	1,417,748	10.8%
Transportation and Warehousing	1,687	1.9%	469,746	3.6%
Finance, Insurance, and Real Estate[a]	5,881	6.5%	1,156,780	8.8%
Services[b]	25,660	28.4%	5,189,665	39.6%
Federal and State Government[c]	1,789	2.0%	680,081	5.2%
Local Government	11,019	12.2%	1,147,922	8.8%
Other	7,068	7.8%	119,298	0.9%

Unit Industry	**Calhoun**	**DeWitt**	**Goliad**	**Jackson**	**Refugio**	**Victoria**	**ROI Total**	**Texas**
Total employment	12,787	12,399	3,281	7,823	3,391	50,723	90,404	13,088,946
Wage and salary employment	9,935	7,559	1,617	5,433	2,304	39,792	66,640	10,269,066
Proprietors employment	2,852	4,840	1,664	2,390	1,087	10,931	23,764	2,819,880
Farm proprietors employment	322	1,843	967	1,020	303	1,364	5,819	236,886
Nonfarm proprietors employment	2,530	2,997	697	1,370	784	9,567	17,945	2,582,994
Farm employment	409	2,001	1,076	1,273	421	1,478	6,658	281,727
Nonfarm employment	12,378	10,398	2,205	6,550	2,970	49,245	83,746	12,807,219
Private employment	10,851	8,055	1,697	5,423	2,259	42,653	70,938	10,979,216
Forestry, fishing, related activities, and other	422	(D)	(D)	185	(D)	269	876	68,253
Mining	141	234	(D)	(D)	273	3,017	3,665	244,837
Utilities	(D)	63	(D)	63	14	334	474	51,045
Construction	1,854	680	135	781	(D)	3,587	7,037	899,172

Table 2.5.2-2 (Sheet 2 of 2)
Employment by Industry 2005

Unit Industry (continued)	Calhoun	DeWitt	Goliad	Jackson	Refugio	Victoria	ROI Total	Texas
Manufacturing	3,215	1,258	85	(D)	(D)	2,682	7,240	951,778
Wholesale trade	(D)	212	91	273	42	1,752	2,370	530,192
Retail trade	1,165	1,093	208	670	351	6,843	10,330	1,417,748
Transportation and warehousing	200	179	(D)	100	50	1,158	1,687	469,746
Information	74	58	(D)	88	(D)	659	879	262,195
Finance and insurance	425	534	72	242	121	1,783	3,177	631,849
Real estate and rental and leasing	309	365	63	166	45	1,756	2,704	524,931
Professional and technical services	444	334	86	270	75	2,011	3,220	828,786
Management of companies and enterprises	(D)	(D)	0	0	0	111	111	69,896
Administrative and waste services	(D)	(D)	85	138	65	2,861	3,149	843,486
Educational services	(D)	(D)	(L)	14	(D)	538	552	178,321
Health care and social assistance	(D)	(D)	174	336	(D)	6,240	6,750	1,168,205
Arts, entertainment, and recreation	88	95	29	31	(D)	672	915	200,551
Accommodation and food services	779	479	159	(D)	(D)	3,233	4,650	879,593
Other services, except public administration	548	844	203	414	278	3,147	5,434	758,632
Government and government enterprises	1,527	2,343	508	1,127	711	6,592	12,808	1,828,003
Federal, civilian	42	43	20	34	52	242	433	181,107
Military	94	46	16	32	17	195	400	161,205
State and local	1,391	2,254	472	1,061	642	6,155	11,975	1,485,691
State government	80	506	39	45	28	258	956	337,769
Local government	1,311	1,748	433	1,016	614	5,897	11,019	1,147,922

Source: BEA 2008

Note (D):As reported by the U.S. Bureau of Economic Analysis, "not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals." For this reason, columns may not sum to the totals shown.

Note (L):Less than 10 jobs, but the estimates for this item are included in the totals.

a. In summary area, "Finance, Insurance, and Real Estate" includes the following sectors: finance and insurance, and real estate and rental and leasing.
b. In summary area, "Services" includes the following sectors: Information, Professional and technical services, Management of companies and enterprises, Administrative and waste services, Educational services, Health care and social assistance, Arts, entertainment, and recreation, Accommodation and food services, and Other services, except public administration.
c. In summary area, "Federal and State Government" includes the following sectors: Federal, Civilian, Military, and State government.

Table 2.5.2-3
Major Employers in ROI

Employer	Owner	Type	Number	County
Victoria Independent School District	Public	Public school district	2114	Victoria
The Inteplast Group, Ltd.	Private	Chemical	1700	Calhoun
The Inteplast Group, Ltd.	Private	Plastic film	1600	Jackson
Formosa Plastics	Private	Chemical	1500	Calhoun
Citizens Medical Center	Public	Health care	1027	Victoria
DeTar Healthcare System	Private	Health care	872	Victoria
Dow Chemical – Seadrift Operations	Private	Chemical	660	Calhoun
Alcoa	Private	Chemical	630	Calhoun
County of Victoria	Public	Local government	616	Victoria
Calhoun County Independent School District	Public	Public school district	613	Calhoun
DuPont INVISTA	Private	Fiber/polymer manufacturing	610	Victoria
City of Victoria	Public	Local government	606	Victoria
Tandy Brands Accessories, Inc.	Private	Leather/hunting accessories mfg.	578	DeWitt
Wal-Mart Supercenter	Private	Retail	468	Victoria
University of Houston - Victoria	Public	Education	436	Victoria
First Victoria National Bank	Private	Financial	425	Victoria
Cuero Community Hospital	Public	Health care	420	DeWitt
Cuero Independent School District	Public	Public school district	400	DeWitt
Covalence Plastics	Private	Plastics manufacturing	372	Victoria
King Fisher Marine Service	Private	Service	330	Calhoun
Eddy Packing	Private	Smoked meats	329	DeWitt
Texas Dept. of Criminal Justice	Public	Correctional facility	315	DeWitt
HEB Grocery	Private	Grocery	275	Calhoun
Mount Vernon Mills, Brentex Division	Private	Textiles	244	DeWitt
Yoakum Independent School District	Public	Public school district	235	DeWitt

Sources:
CCEDC Undated
CDC Jul 2006
Victoria Undated b
Yoakum Undated a
JCCC Oct 2007
TWC 2007
VEDC 2007a

Table 2.5.2-4 (Sheet 1 of 2)
Average Annual Wage Trends[a], 2001-2006, ROI and Comparison Areas

Sector/Area	2001	2002	2003	2004	2005	2006	Average Annual Growth Rate
Total, All Industry Sector Wages							
U.S.	$36,157	$36,539	$37,508	$39,134	$40,505	$42,414	3.2%
Texas	$36,794	$36,766	$37,442	$39,100	$40,880	$43,276	3.3%
Calhoun County	$42,734	$44,345	$42,654	$45,488	$47,998	$49,933	3.2%
DeWitt County	$22,244	$22,569	$22,598	$23,859	$27,807	$26,506	3.6%
Goliad County	$23,477	$24,087	$25,715	$25,779	$28,189	$29,836	4.9%
Jackson County	$26,150	$26,131	$27,114	$28,631	$28,747	$31,200	2.4%
Refugio County	$23,082	$22,842	$23,414	$24,397	$25,080	$28,754	2.1%
Victoria County	$29,235	$29,213	$29,808	$31,343	$32,032	$34,704	3.5%
Sector 23, Construction Sector Wages							
U.S.	$38,412	$39,027	$39,509	$40,521	$42,100	$44,496	4.3%
Texas	$36,145	$36,516	$37,301	$38,349	$40,565	$44,551	5.3%
Calhoun County	$34,519	$35,241	$35,198	$37,808	$38,984	$44,614	5.3%
DeWitt County	$23,585	$23,343	$24,223	$23,946	$24,696	$26,207	2.1%
Goliad County	(ND)	(ND)	$28,545	$29,668	$41,400	$51,233	[b]
Jackson County	$28,521	$27,359	$28,753	$31,595	$34,254	$35,095	4.2%
Refugio County	$24,423	$24,034	(ND)	(ND)	(ND)	(ND)	[b]
Victoria County	$42,022	$37,628	$35,786	$37,900	$40,997	$43,240	0.6%
Sector 237, Heavy and Civil Engineering Construction Sector Wages							
U.S.	$43,099	$44,298	$45,417	$47,027	$49,399	$52,617	4.1%
Texas	$38,125	$38,466	$39,905	$40,490	$43,371	$48,466	4.9%
Calhoun County	$41,347	$43,342	$40,057	$39,631	$48,382	$51,390	4.4%
DeWitt County	$32,900	$29,225	$29,194	$31,639	$33,371	$33,150	0.2%
Goliad County	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	[b]
Jackson County	$27,580	$28,761	$32,413	$32,136	(ND)	$36,709	5.9%
Refugio County	(ND)	(ND)	(ND)	$33,461	$34,401	(ND)	[b]
Victoria County	$30,756	$33,093	$33,904	$34,472	$36,172	$42,677	6.8%
Sector 22, Utilities							
U.S.	$65,561	$67,374	$68,651	$72,403	$75,208	$78,341	3.6%
Texas	$76,319	$72,674	$68,589	$72,949	$76,102	$82,032	1.5%
Calhoun County	$62,267	$61,137	$73,571	(ND)	(ND)	(ND)	[b]
DeWitt County	$41,671	(ND)	(ND)	(ND)	$44,688	$45,774	1.9%

Table 2.5.2-4 (Sheet 2 of 2)
Average Annual Wage Trends[a], 2001-2006, ROI and Comparison Areas

Sector/Area	2001	2002	2003	2004	2005	2006	Average Annual Growth Rate
Sector 22, Utilities (continued)							
Goliad County	(ND)	(ND)	(ND)	$69,166	(ND)	$70,386	[b]
Jackson County[c]	$35,546	$35,313	$39,064	$39,962	$46,524	(ND)	7.0%
Refugio County[c]	$37,221	$38,232	$58,736	$60,195	$60,938	(ND)	13.1%
Victoria County	$48,547	$52,377	$59,299	$57,463	$61,280	$62,337	5.1%
Sector 221113, Nuclear electric power generation[d]							
U.S.	$74,294	$77,076	$83,627	$89,590	$91,732	$95,927	5.2%
Source: BLS 2007b							

a. Information reflects privately owned firms and all establishment sizes. Dollars are not adjusted for inflation.
b. Unable to calculate growth rate due to insufficient data.
c. Average annual growth rate is from 2001 to 2005, as data are not available for 2006.
d. Information was not disclosed by the BLS for Texas or the ROI counties for NAICS 221113.

Note: (ND) = "Not Disclosable — data do not meet BLS or State agency disclosure standards."

Table 2.5.2-5
Employment in Construction and Extraction Occupations

	Employment		
Area	**Total Employment**	**Construction and Extraction Occupations**	**Construction and Extraction as percent of Total Employment**
Texas	9,760,960	513,910	5.3%
Victoria MSA[a]	48,020	5,390	11.2%
Victoria MSA as percent of Texas	0.5%	1.0%	

Source: BLS May 2006

a. Victoria MSA = Victoria, Goliad, and Calhoun Counties.

Note: MSA is a U.S. Census Bureau description of a Metropolitan Statistical Area.

Table 2.5.2-6
Per Capita Personal Income 1995-2005

Area	1995	2005	1995–2005 Percent Change Not Adjusted for Inflation	1995–2005 Percent Change Adjusted for Inflation[a]	2005 PCI as Percent of Texas	2005 PCI as Percent of U.S.
United States	$23,076	$34,471	49.4%	16.6%	106.2%	100.0%
Texas	$21,003	$32,460	54.5%	20.6%	100.0%	94.2%
Calhoun	$17,312	$24,561	41.9%	10.7%	75.7%	71.3%
DeWitt	$15,641	$24,281	55.2%	21.1%	74.8%	70.4%
Goliad	$14,794	$23,353	57.9%	23.2%	71.9%	67.7%
Jackson	$20,412	$23,743	16.3%	–9.2%	73.1%	68.9%
Refugio	$21,487	$29,195	35.9%	6.0%	89.9%	84.7%
Victoria	$20,441	$30,667	50.0%	17.1%	94.5%	89.0%
ROI	$19,185	$27,983	45.9%	13.8%	86.2%	81.2%

Sources: BEA 2008, BLS 2007c

a. Inflation calculator from Bureau of Labor Statistics (BLS 2007c).

Table 2.5.2-7 (Sheet 1 of 2)
Road Characteristics and Traffic Statistics

Location Number on Figure 2.5.2-5	Route Segment	Number of Lanes	Type	TXDOT Road Classification	Avg Annual Daily Traffic for 2007 (vehicles per 24-hour)	Threshold Capacity (passenger cars per hour)[a]
1	US Hwy 59 (From Beeville to Berclair)	2[b]	Undivided	Other Rural Principal Arterial	5,800	4,200[c]
2	US Hwy 59 (From Berclair to Goliad)	2[b]	Undivided	Other Rural Principal Arterial	4,800	4,200[c]
3	US Hwy 59 (From Goliad to Victoria County Line)	4	Undivided	Other Rural Principal Arterial	10,100	10,300[c]
4	Hwy 59 to Hwy 77(via Hwy 59 loop south of Victoria)	4	Divided	Other Rural Principal Arterial	6,100	11,800[c]
5	Hwy 77 S to Hwy 77 (intersection of US Hwy 59 and US Hwy 77)	4	Undivided	Rural Major Arterial	1,850	27,000
6	Hwy 59 loop to Hwy 87	4	Divided	Other Rural Principal Arterial	19,900	11,800[c]
7	Hwy 87 (south from Victoria to Placedo)	4	Divided	Rural Minor Arterial	9,700	11,800[c]
8	Hwy 87 (south from Placedo to State Route 35)	4	Divided	Rural Minor Arterial	7,800	11,800[c]
9	State Route 185 (south from Victoria to Bloomington)	2	Undivided	Rural Major Collector	26,000	2,300
10	State Route 185 (Bloomington to State Route 35)	2	Undivided	Rural Major Collector	5,100	2,300
11	County Road 616 (LaSalle to Placedo)	2	Undivided	Rural Major Collector	600	2,300
12	County Road 616 (Placedo to Bloomington	2	Undivided	Rural Major Collector	900	2,300
13	State Route 35 (Port Lavaca to Green Lake)	2	Undivided	Rural Minor Arterial	5,000	4,200[c]
14	State Route 35 (State Route 185 to Refugio County Line)	2	Undivided	Rural Minor Arterial	3,100	4,200[c]
15	State Route 35 (from Refugio County line to County Road 774)	2	Undivided	Rural Minor Arterial	4,000	4,200[c]
16	State Route 239 (Tivoli to Hwy 77)	2	Undivided	Rural Major Collector	3,300	2,300
17	Hwy 77 (Hwy 59 loop south to Refugio County Line)	4	Divided	Other Rural Principal Arterial	16,300	11,800[c]
18	Hwy 77 (Refugio County line south to Refugio)	4	Divided	Other Rural Principal Arterial	16,000	11,800[c]
19	State Route 239 (Hwy 77 to Goliad)	2	Undivided	Rural Major Collector	720	2,300

Table 2.5.2-7 (Sheet 2 of 2)
Road Characteristics and Traffic Statistics

Location Number on Figure 2.5.2-5	Route Segment	Number of Lanes	Type	TXDOT Road Classification	Avg Annual Daily Traffic for 2007 (vehicles per 24-hour)	Threshold Capacity (passenger cars per hour)[a]
20	State Route 202 (Refugio to County Road 2441)	2	Undivided	Rural Major Collector	1,150	2,300
21	State Route 202 (County Road 2441 to Beeville)	2	Undivided	Rural Major Collector	4,100	2,300

Sources: TXDOT Sep 2007a; TXDOT Sep 2007b; TXDOT Sep 2007c; TXDOT Sep 2007d; TXDOT Sep 2007e; TXDOT Mar 1993a; TXDOT Mar 1993b; TXDOT Dec 1998a; TXDOT Dec 1998b; TXDOT Sep 2001; TXDOT Mar 2008.

a. Capacity used in travel demand modeling by TXDOT, metropolitan planning organizations, and local governments. The capacity is typically based on level of service C (stable flow) based on the Transportation Research Board Highway Capacity Manual. Level of service A or B (free flow to reasonably free flow) may also be used as the threshold capacity level in less congested urban areas. (TXDOT Sep 2001).

b. Just completed "Super 2" passing lanes.

c. TXDOT does not provide a threshold capacity for these functional classes in rural areas. The suburban fringe area estimate was used to approximate rural areas.

Table 2.5.2-8
Victoria Barge Canal, Number of Trips, 2001-2005

Year	Inbound	Outbound	Total	Average per week
2001	3863	3886	7749	149
2002	4058	4057	8115	156
2003	3770	3846	7616	146
2004	3258	3229	6487	125
2005	2576	2599	5175	100

Source: USACE 2001; USACE 2002; USACE 2003; USACE 2004; USACE 2005

Table 2.5.2-9
Victoria Barge Canal Docks

Name	Location	Town (County)	Mile	Bank	Owner
Dow Seadrift Operations Slip	At head of private channel extending east from Mile 14.3 Victoria Barge Canal, approx. 3 miles below SR 35 Bridge, Seadrift	Seadrift (Calhoun)	14	East	Union Carbide Corp., a subsidiary of The Dow Chemical Co.
Seadrift Coke, Hydrocarbon Dock	Mile 15.6 Victoria Barge Canal, approximately 1.5 miles below SR 35 Bridge, Seadrift	Seadrift (Calhoun)	15	East	Seadrift Coke, LP
Seadrift Coke, Coke Loading Dock	Mile 15.6, Victoria Barge Canal, approximately 1.5 miles below SR 35 Bridge, Seadrift	Seadrift (Calhoun)	15	East	Seadrift Coke, LP
BP Chemicals Corp., Green Lake Plant Wharf	Mile 20.6, Victoria Barge Canal, approximately 3.5 miles above SR 35 Bridge, Green Lake	Green Lake (Calhoun)	20	East	BP Chemicals Corp
DuPont INVISTA Victoria Plant, Petrochemical Division, Dock No. 6	Mile 32.9, Victoria Barge Canal, lower portion of rectangular slip; approximately 2 miles below Pickering Turning Basin, Bloomington	Bloomington (Victoria)	32	East	DuPont INVISTA
DuPont INVISTA Victoria Plant, Petrochemical Division, Dock No. 5	Mile 32.9, Victoria Barge Canal, lower portion of rectangular slip; approximately 2 miles below Pickering Turning Basin, Bloomington	Bloomington (Victoria)	32	East	DuPont INVISTA
DuPont INVISTA Victoria Plant, Petrochemical Division, Dock No. 3	Mile 32.9, Victoria Barge Canal, lower portion of rectangular slip; approximately 2 miles below Pickering Turning Basin, Bloomington	Bloomington (Victoria)	32	East	DuPont INVISTA
DuPont INVISTA Victoria Plant, Petrochemical Division, Dock No. 1	Mile 33.0, Victoria Barge Canal, lower portion of rectangular slip; approximately 2 miles below Pickering Turning Basin, Bloomington.	Bloomington (Victoria)	33	East	DuPont INVISTA
Fordyce, Parker Dock	Mile 34.7, Victoria Barge Canal, below Pickering Turning Basin, Bloomington	Bloomington (Victoria)	34	East	Fordyce, Ltd.
Fordyce, Briggs Dock	Mile 35.0, Victoria Barge Canal, northeast portion of Pickering Turning Basin, Bloomington	Bloomington (Victoria)	35	North	Fordyce, Ltd.
Victoria County Navigation District, Barge Dock	Mile 35.0, Victoria Barge Canal, northwest portion of Pickering Turning Basin, Bloomington	Bloomington (Victoria)	35	North	Victoria Co. Navigation District

Source: USACE 2008a

Table 2.5.2-10
Port of Victoria, Freight Tonnage, 1992-2006

Year	Thousands of Short Tons	Rank Among U.S. Ports
1992	4265	—
1993	3937	—
1994	4567	—
1995	4624	—
1996	4351	—
1997	5000	—
1998	5298	—
1999	5522	—
2000	5104	—
2001	4733	—
2002	4734	77
2003	4750	81
2004	3712	91
2005	3224	98
2006	3556	96

Source: USACE 2001; USACE 2002; USACE 2003; USACE 2004; USACE 2005, USACE 2008b

Table 2.5.2-11
Characteristics of Public Airports within or near 50 Miles of Proposed VCS Site

Name (FAA Designation)	Location	Owner	Average Daily Operations	Number of Aircraft Based at Field	Military Use	Commercial Passenger Service
Aransas County Airport (KRKP)	Rockport, Aransas County	Aransas County	225	70	40%	No
Calhoun County Airport (KPKV)	Port Lavaca, Calhoun County	Calhoun County	18	18	23%	No
Jackson County Airport (26R)	Edna, Jackson County	Jackson County	106	18	2%	No
Yoakum Municipal (T85)	Lavaca County	City of Yoakum	3.3	4	—	No
Palacios Municipal (KPSX)	Palacios, Matagorda County	City of Palacios	8.1	5	49%	No
Rooke Field (KRFG)	City of Refugio, Refugio County	Refugio County	12.3	21	—	No
Victoria Regional (VCT)	City of Victoria, Victoria County	Victoria County	111	50	44%	Yes
T. P. McCampbell (KTFP)	Ingleside, San Patricio County	San Patricio County	30	37	—	No
Beeville Municipal Airport (KBEA)	Beeville, Bee County	City of Beeville	13	15	—	No
Goliad County Industrial Airpark (7T3)	Berclair, Goliad County	Goliad County	Not Available	2	—	No
Cuero Municipal Airport (T71)	Cuero, DeWitt County	City of Cuero	5	6	—	No
Alfred C. "Bubba" Thomas Airport (T69)	Sinton, San Patricio County	San Patricio County	28	39	—	No
Kames County Airport (2R9)	Kenedy, Karnes County	City of Kenedy	6	7	—	No

Sources: AN Feb 2008a; AN Feb 2008b; AN Feb 2008c; AN Feb 2008d; AN Feb 2008e; AN Feb 2008f; AN Feb 2008g; AN Jul 2008a, AN Jul 2008b, AN Jul 2008c, AN Jul 2008d, AN Jul 2008e, AN Jul 2008f; TXDOT 2007.

Table 2.5.2-12
Victoria Regional Airport Passenger Boardings, 2001–2006

Year	Total Passenger Boardings
2001	15,638
2002	13,758
2003	11,853
2004	10,763
2005	10,932
2006	9,113
Percent Change, 2001–2006	–41.7%

Table 2.5.2-13
Texas State Expenditures in ROI Counties, 2006

Area	Total	Intergovernmental Payments	Labor Costs	Public Assistance	Highway Construction/ Maintenance	Operating Expenses	Capital Outlays	Misc.
Texas Total	$71,542,126,874	$19,356,701,100	$17,479,332,269	$24,189,679,738	$5,574,037,267	$1,757,367,816	$311,885,587	$2,873,123,097
Calhoun County	49,731,763	8,001,686	7,527,359	16,973,826	13,695,354	938,913	1,476,981	1,117,643
DeWitt County	73,531,924	28,366,284	10,111,328	22,693,439	10,687,138	1,526,465	0	147,270
Goliad County	34,227,763	4,120,994	6,467,162	5,786,077	16,756,016	969,131	0	128,385
Jackson County	33,920,498	10,582,716	2,385,020	11,686,702	5,997,933	561,157	21,803	2,685,168
Refugio County	23,178,337	5,131,056	4,112,508	8,147,255	5,187,484	375,332	0	224,700
Victoria County	255,328,884	72,566,221	40,585,476	114,971,104	15,232,342	3,820,748	1,645,286	6,507,706
ROI Total	469,919,169	128,768,957	71,188,853	180,258,403	67,556,267	8,191,746	3,144,070	10,810,872
ROI as Percent of State Total	0.7%	0.7%	0.4%	0.7%	1.2%	0.5%	1.0%	0.4%
Percent by Category		27.4%	15.1%	38.4%	14.4%	1.7%	0.7%	2.3%

Source: TCPA 2007

Table 2.5.2-14
County and City Sales Tax Rates ROI 2008

Taxing Unit[a]	Tax Rates			
	State	County	City	Total
Calhoun County	6.25%	0.5%	—	6.75%
Port Lavaca	6.25%	0.5%	1.5%	8.25%
Seadrift	6.25%	0.5%	1.5%	8.25%
DeWitt County	6.25%	—	—	6.25%
Cuero	6.25%	—	2.0%	8.25%
Nordheim	6.25%	—	1.0%	7.25%
Yoakum	6.25%	—	2.0%	8.25%
Yorktown	6.25%	—	1.5%	7.75%
Goliad County	6.25%	—	—	6.25%
Goliad (city)	6.25%	—	2.0%	8.25%
Jackson County	6.25%	0.5%	—	6.75%
Edna	6.25%	0.5%	1.5%	8.25%
Ganado	6.25%	0.5%	1.5%	8.25%
LaWard	6.25%	0.5%	1.0%	7.75%
Refugio County	6.25%	—	—	6.25%
Austwell	6.25%	—	1.0%	7.25%
Bayside	6.25%	—	1.0%	7.25%
Refugio (city)	6.25%	—	2.0%	8.25%
Woodsboro	6.25%	—	1.0%	7.25%
Victoria County	6.25%	0.5%	—	6.75%
Victoria (city)	6.25%	0.5%	1.5%	8.25%

Source: TCPA 2008d

a. Only communities with a local sales tax are shown in the table.
— Entity does not tax

Table 2.5.2-15
Total Real Property Tax Rates ROI Counties 2000 - 2006[a]

County	2000	2001	2002	2003	2004	2005	2006
Calhoun County	0.3750	0.3750	0.4244	0.5210	0.5210	0.5210	0.4900
DeWitt County	0.5466	0.5272	0.6072	0.6823	0.6930	0.6317	0.7224
Goliad County	0.7645	0.6840	0.7820	0.7840	0.6847	0.6671	0.5554
Jackson County	0.5450	0.5076	0.6186	0.6186	0.6334	0.6233	0.5387
Refugio County	0.6277	0.6169	0.6386	0.6218	0.5375	0.4625	0.3998
Victoria County	0.3410	0.3485	0.3601	0.3986	0.3986	0.3986	0.3986

Source: TAOC 2007a

a. Property tax rates shown as dollars per $100 of taxable value

Table 2.5.2-16
Total Real Property Taxes, Victoria County 2001-2006

	Total Market Value		Total Taxable Value	Total Levies	
	With Exempt[a]	Without Exempt[b]	General Fund[c]	General Fund Levy[d]	Total County Levy[e]
2000	$4,057,724,176	$3,842,560,406	$3,324,392,653	$9,507,762	$11,336,177
2001	4,218,514,902	3,985,262,147	3,528,394,928	10,708,678	12,296,455
2002	4,263,350,440	4,019,870,328	3,555,123,916	11,379,951	12,802,000
2003	4,301,873,415	4,053,129,665	3,548,119,389	12,546,150	14,142,803
2004	4,519,428,703	4,266,076,342	3,707,127,542	13,108,403	14,776,610
2005	4,745,388,483	4,485,528,573	3,941,782,441	13,741,054	15,711,945
2006	5,515,968,648	5,245,209,808	4,237,939,605	14,561,561	16,892,428

Source: TAOC 2007b

a. Total Market Value, With Exempt: Total market value before 10% cap on homestead appraisals. Includes the value of all totally exempt properties
b. Total Market Value, Without Exempt: Total market value of taxable property prior to adjustments for partial exemptions or the 10% cap on residence homesteads. Does not include totally exempt properties.
c. Total Taxable Value, General Fund: Total taxable value for county tax purposes. Used with both the General Fund and Special Road & Bridge Fund tax rates to determine the levies for those funds.
d. Totals, General Fund Levy: Actual total county tax levy for General Fund.
e. Totals, Total County Levy: Actual total county tax levy. It includes the General Fund, Special Road & Bridge Fund, and the Farm-to-Market/Flood Control Fund.

Table 2.5.2-17
Real Property Taxes for Cities in the ROI 2005

County/City	Percent Homestead Exemption	Taxable Value	Tax Rate[a]	2005 Tax Levy
Calhoun County				
Point Comfort	20%	$56,717,894	0.5429	$307,921
Port Lavaca	0%	354,308,927	0.7200	2,551,024
Seadrift	20%	32,453,573	0.4154	134,812
DeWitt County				
Cuero	0%	$170,989,570	0.2883	$493,031
Nordheim	0%	5,100,640	0.4600	23,463
Yoakum	0%	161,288,980	0.0942	151,950
Yorktown	0%	42,420,970	0.5591	237,171
Goliad County				
Goliad [City]	0%	$48,381,542	0.5271	$255,020
Jackson County				
Edna	0%	$137,590,564	0.3885	$534,539
Ganado	0%	47,797,512	0.6308	301,507
Refugio County				
Austwell	0%	$3,715,950	0.4931	$18,324
Bayside	0%	8,319,410	0.9215	76,664
Refugio [City]	0%	56,685,520	0.7966	451,557
Woodsboro	0%	22,551,860	0.8620	194,937
Victoria County				
Victoria [City]	0%	$2,337,399,369	0.6900	$16,128,056

Source: TCPA Dec 2006

a. Tax Rates are shown as dollars per $100 of taxable value.

Table 2.5.2-18 (Sheet 1 of 2)
Special Taxing Districts in ROI 2005

County/Special District	Market Value	Taxable Value	Total Tax Rate[a]	Tax Levy
Calhoun County				
Port O'Connor MUD	$200,221,578	$184,462,966	0.20000	$368,926
Calhoun County Drainage District #6	4,838,632	4,520,810	0.52600	2378
Calhoun County Navigation District	2,897,120,880	2,041,437,408	0.00430	87,781
Calhoun County WCID #1	536,254,010	527,847,463	0.04260	224,863
Calhoun County Drainage District #11	9,643,986	9,639,954	0.14850	14,315
Calhoun County Drainage District #10	63,326,170	63,006,483	0.24500	154,366
Calhoun County Drainage District	6,495,539	6,489,909	0.29050	18,853
DeWitt County				
Pecan Valley Water District	$1,305,635,170	$775,112,660	0.01500	$116,281
DeWitt Drainage District #1	184,732,670	168,724,110	0.06135	103,512
DeWitt Medical District #1	687,494,230	419,497,670	0.11899	499,163
Yoakum Hospital District	281,300,920	162,407,740	0.22000	357,324
Ecleto Creek Watershed District	8,081,200	1,218,810	0.00960	117
Goliad County				
San Antonio River Authority	$1,195,937,653	$738,686,310	0.016425	$121,329
Goliad County Ground WCD	1,195,937,653	724,800,977	0.0098	71,031
Jackson County				
Jackson County FCD	$1,313,816,862	$928,709,959	0.1054	$978,860
Jackson County WCID #1	11,535,160	10,498,922	0.1416	14,866
Jackson County ESD	527,303,050	441,118,378	0.0298	131,453
Jackson County Hospital District	1,333,000,040	991,416,449	0.2661	2,638,159
Jackson County WCID #2	5,967,843	5,780,087	0.02396	13,849
Refugio County				
Refugio Ground WCD	$1,183,857,000	$979,942,630	0.0200	$195,982
Refugio County Drainage District #1	528,808,460	471,897,210	0.0837	394,978
Refugio Co Memorial Hospital District	1,183,857,000	979,942,630	0.2475	2,425,366
Refugio County WCID #1	6,494,990	6,387,000	0.5222	33,353
Refugio County WCID #2	1,177,362,010	974,543,200	0.0012	11,691
Victoria County				
Quail Creek MUD	$52,777,170	$52,039,202	0.1840	$99,752
Victoria County WCID #1	27,186,829	26,052,492	0.4947	128,882
Victoria County Drainage District #2	102,620,393	90,090,457	0.1240	111,712
Victoria Junior College District	4,761,445,489	3,954,923,444	0.1416	5,600,173

Table 2.5.2-18 (Sheet 2 of 2)
Special Taxing Districts in ROI 2005

County/Special District	Market Value	Taxable Value	Total Tax Rate[a]	Tax Levy
Victoria County (continued)				
Victoria County Navigation District	4,501,408,692	4,060,836,063	0.0369	1,498,449
Victoria County WCID #2	10,089,981	10,014,909	0.9016	90,294
Victoria County Drainage District #3	1,146,102,044	1,093,018,647	0.046	502,789

Source: TCPA Dec 2006

a. Tax Rates are shown as dollars per $100 of taxable value.

Table 2.5.2-19
Proposed VCS Site, Parcels and Assessed Value 2007

Parcel ID	Acreage	Total Taxable Value, 2007	Property Location	ISD
R29444	4,007	$298,320	McFaddin Rail Rd	Refugio ISD
R32186	2,600	178,040	US Hwy 77	Refugio ISD
R32742	4,397	329,780	McFaddin Rail Rd	Refugio ISD
R34801	215	15,760	McFaddin Rail Rd	Refugio ISD
R36939	13	960	McFaddin Rail Rd	Victoria ISD
R81237	8	600	McFaddin Rail Rd	Refugio ISD
R81437	162	12,120	McFaddin Rail Rd	Refugio ISD
R81480	30	2,230	McFaddin Rail Rd	Refugio ISD
R84158	146	19,860	Hwy 77	Refugio ISD
Total[a]	11,576	$857,670		

Source: VCTX 2007

a. Numbers do not match the total due to rounding

Table 2.5.2-20
Total Property Taxes on Proposed VCS Site, Victoria County and Special Districts: 2006–2007

Taxing Entity/Year		Assessed	Taxable	Rate	Tax
County of Victoria General Fund					
	2007	$17,371,570	$857,670	0.3436	$2947
	2006	$17,371,570	$857,670	0.3436	$2947
County of Victoria Special Road and Bridge Fund					
	2007	$17,371,570	$857,670	0.0550	$471
	2006	$17,371,570	$857,670	0.0550	$471
Victoria Junior College District					
	2007	$17,371,570	$857,670	0.1445	$1239
	2006	$17,371,570	$857,670	0.1416	$1214
Victoria County Navigation District					
	2007	$17,371,570	$857,670	0.0317	$272
	2006	$17,371,570	$857,670	0.0335	$287
UWD Victoria County Groundwater District					
	2007	$17,352,460	$856,710	0.0100	$86
	2006	$17,352,460	$856,710	0.0100	$86
2007 Total					$5015
2006 Total					$5006
2006 Payment, as Percent of Victoria County's Total 2006 Tax Revenues = 0.03%					

Source: VCTX 2007
Data before 2006 is not available.

Table 2.5.2-21
Refugio ISD Property Values 2001–2007

Year	Total Property Value	Percent Change from Previous Year
2001	$439,463,325	—
2002	292,697,938	–33.4%
2003	310,933,757	6.2%
2004	387,192,158	24.5%
2005	414,065,232	6.9%
2006	483,358,975	16.7%
2007	480,471,469	–0.6%

Source: RISD Feb 2008

Table 2.5.2-22
Refugio ISD District Revenues 2001–2002 to 2007–2008 School Years

School Year	Total District Revenue	Excess Percent (Goes to State)[a]	Revenue Remaining in District	Percent Change in Total Revenue from Previous Year
2001–2002	$5,285,864	0.00%	$5,285,864	
2002–2003	4,258,754	0.00%	4,258,754	–19.4%
2003–2004	4,524,086	0.00%	4,524,086	6.2%
2004–2005	5,445,857	0.00%	5,445,857	20.4%
2005–2006	5,863,991	0.00%	5,863,991	7.7%
2006–2007	6,359,442	0.00%	6,359,442	8.4%
2007–2008	4,846,993	6.62%	4,526,286	–23.8%

Source: RISD Feb 2008

a. Refugio ISD became a Chapter 41 (“property-wealthy”) district in the 2007–2008 school year.

Table 2.5.2-23
ISD Property Taxes Paid on Proposed VCS Site ISDs 2006–2007

Taxing Entity/Year	Assessed	Taxable	Rate[a]	Tax
Refugio ISD (8 of 9 parcels)				
2007	$17,352,460	$856,710	1.1875	$10,174
Pct of Refugio ISD revenues				0.21%
2006	$17,352,460	$856,710	1.4396	$12,334
Pct of Refugio ISD revenues				0.19%
Victoria ISD (1 of 9 parcels)				
2007	$19,110	$960	1.2337	$12
2006	$19,110	$960	1.4285	$14

a. Tax rates are shown as dollars per $100 of taxable value.

Table 2.5.2-24
Victoria County Revenues 2006

Revenues	Actual Dollars	Percent of Total
Taxes — ad valorem (property)	12,469,394	—
Taxes — Sales	6,980,525	—
Total Taxes	$19,449,919	67.3%
Fees	1,868,725	6.5%
Intergovernmental	4,425,115	15.3%
Fines & forfeitures	1,543,819	5.3%
Interest	807,628	2.8%
Licenses & permits	36,065	0.1%
Contributions	5,884	0.0%
Miscellaneous	760,805	2.6%
Total	$28,897,960	100.0%

Source: VCA Jun 2007

Table 2.5.2-25 (Sheet 1 of 2)
Victoria County Expenditures 2006

Expenditure Item	Actual Amounts	Subtotal	Percent of Total
General Government			
County Judge	$186,987	—	—
Commissioners' Court	81,125	—	—
Records management	20,926	—	—
County clerk	551,006	—	—
Veterans Service officer	50,592	—	—
Heritage Director	50,623	—	—
Non-departmental	2,153,247	—	—
County courts at law (two)	434,557	—	—
District court	779,513	—	—
District clerk	578,485	—	—
Justices of the peace (four)	604,621	—	—
Criminal district attorney	862,640	—	—
Election administrator	243,077	—	—
County auditor	388,340	—	—
County treasurer	249,038	—	—
Tax assessor-collector	602,600	—	—
Administrative services	211,493	—	—
Information technology	2,137,276	—	—
Building maintenance	1,198,943	—	—
Adult probation department	7960	—	—
Juvenile detention facility	2,699,441	—	—
Juvenile board	90,935	—	—
Total general government		$14,183,425	54.0%
Public Safety			
Fire marshal	303,581	—	—
Sheriff	9,664,983	—	—
Constables (four)	117,916	—	—
Non-departmental	428,984	—	—
Total public safety		10,515,464	40.1%
Culture and Recreation			
Parks and recreation	106,151	—	—
Extension service	254,541	—	—
Non-departmental (library)	932,307	—	—

Table 2.5.2-25 (Sheet 2 of 2)
Victoria County Expenditures 2006

Expenditure Item	Actual Amounts	Subtotal	Percent of Total
Total culture and recreation		1,292,999	4.9%
Public health – Total		107,761	0.4%
Capital outlay		155,250	0.6%
Total expenditures		$26,254,899	5.9%

Source: VCA Jun 2007

Table 2.5.2-26
Recap of Victoria County Revenues and Expenditures, 2006

Item	Amount	Difference
Total Revenues[a]	$28,897,960	
Total Expenditures[b]	26,254,899	
Surplus		$2,643,061

Source: VCA Jun 2007

a. (Table 2.5.2-24)
b. (Table 2.5.2-25)

Table 2.5.2-27
Sales Tax Allocations, Victoria County 1997–2007

	Not Adjusted for Inflation		Adjusted for Inflation[a]	
Year	Sales Tax Allocations (nominal dollars)	Percent Change from Previous Year	Sales Tax Allocations (2007 dollars)	Percent Change from Previous Year
1997	$4,074,421.63	—	$5,263,543.96	—
1998	4,382,895.57	7.6%	5,575,205.05	5.9%
1999	4,503,100.82	2.7%	5,604,333.54	0.5%
2000	4,729,825.28	5.0%	5,695,072.20	1.6%
2001	4,992,319.53	5.5%	5,844,819.95	4.3%
2002	4,858,298.12	–2.7%	5,599,384.24	–4.2%
2003	4,921,322.62	1.3%	5,474,615.35	–2.2%
2004	5,546,860.42	12.7%	6,088,391.39	11.2%
2005	5,883,458.11	6.1%	6,246,226.06	2.6%
2006	6,918,442.97	17.6%	7,115,495.05	13.9%
2007	7,179,369.90	3.8%	7,179,369.90	0.9%
10-yr increase	76.2%		36.4%	
Average annual increase	5.8%		3.2%	

Source: TCPA 2008g

a. Inflation calculator from BLS 2007c (dollars converted to 2007 dollars).

Table 2.5.2-28
City of Victoria Budgeted Revenues, Fiscal Year 2006–2007

Function	Budgeted Amount	Percent of Total
Taxes	$23,853,036	62.7%
Franchise Fees	4,625,000	12.2%
Fines and Forfeitures	1,270,000	3.3%
Licenses and Permits	539,825	1.4%
Charges for Services	1,545,100	4.1%
Intergovernmental	2,217,493	5.8%
Miscellaneous	659,925	1.7%
Other Financing Sources	3,324,989	8.7%
Total	$38,035,368	100.0%

Table 2.5.2-29
City of Victoria Budgeted Expenditures Fiscal year 2006-2007

Function	Amount	Percent of Total
General Administration	$2,406,974	6.4%
Public Safety	19,666,245	52.1%
Development	8,892,393	23.6%
Building Services	669,359	1.8%
Recreation	4,768,563	12.6%
Non-departmental	1,348,234	3.6%
Total	$37,751,768	100.0%

Source: Victoria 2007

Table 2.5.2-30
Recap of City of Victoria Revenues and Expenditures FY 2006

Item	Amount	Difference
Total Budgeted Revenues[a]	$38,035,368	
Total Budgeted Expenditures[b]	37,751,768	
Surplus		$283,600

Source: Victoria 2007

a. (Table 2.5.2-28)
b. (Table 2.5.2-29)

Table 2.5.2-31
Sales Taxes, City of Victoria 1997–2007

Year	Sales Tax Allocations (current dollars)	Percent Change from Previous Year	Sales Tax[a] Allocations (2007 dollars)	Percent Change from Previous Year
1997	$11,537,600	—	$14,905,000	—
1998	12,371,500	5.6%	15,737,600	5.6%
1999	12,963,800	2.5%	16,134,300	2.5%
2000	13,462,500	0.5%	16,209,300	0.5%
2001	14,576,000	5.8%	17,065,000	5.8%
2002	13,953,100	–5.8%	16,081,000	–5.8%
2003	14,271,500	0.0%	16,082,500	0.0%
2004	15,285,300	4.3%	16,777,300	4.3%
2005	16,590,100	5.0%	17,612,900	5.0%
2006	18,696,700	9.2%	19,229,500	9.2%
2007	19,615,200	2.0%	19,615,200	2.0%
10-yr increase	70.0%		31.6%	
Average annual increase	5.5%		2.8%	

Source: TCPA 2008g

a. Inflation calculator: BLS 2007c (dollars converted to 2007 dollars).

Table 2.5.2-32
Wildlife Management Areas, National Wildlife Refuges, and State Parks within 50 Miles of the VCS Site[a]

Name	Acreage	Location	Annual Visitors	Peak Daily Visitors
Matagorda Island WMA[b,c]	56,688	Calhoun County	1,100	—
Guadalupe Delta WMA[b]	7,411	Northeast of Tivoli in Victoria, Refugio, and Calhoun Counties	3,500	—
Welder Flats WMA[b,d]	1,480	Southeast of Seadrift in Calhoun County	—	—
Aransas National Wildlife Refuge	115,670	Aransas, Refugio, and Calhoun Counties (some areas non-contiguous, see Figure 2.5.2-14)	65,000	600
Goliad State Park[e]	188	South of Goliad in Goliad County	23,973	412
Goose Island State Park[e]	321	North of Rockport in Aransas County	90,033	2,405
Lake Texana State Park[e]	575	East of Edna in central Jackson County	48,821	560
Fannin Battleground State Historic Site[f]	14	Goliad County	—[g]	—

Sources: TPWD May 2008a, TPWD May 2008b USFWS 2008, USFWS May 2008.

a. TPWD acknowledges that there is a basic lack of user and nonuser information on local and state parks.
b. Visitor information has not been collected for 3 years at WMAs. Data listed is for 2004.
c. Matagorda Island WMA is partially owned by the General Land Office and Fish and Wildlife Services, thus not all visitors are counted. Visitors listed were counted by TPWD.
d. Information is not available for Welder Flats WMA since it is submerged
e. Visitor information is for the fiscal year 2007.
f. Fannin Battleground State Historic Site is a historic site operated by the Texas Historical Commission.
g. TPWD stated that visitor information is included in Goliad State Park due to close proximity.

Table 2.5.2-33 (Sheet 1 of 3)
County and City Parks within or near the 50-Mile Region[a]

Name	Location	Acres	Recommended Park Acres/ Population
Community Park	Aransas County	—	—
Newbury Park	Aransas County	—	—
Rockport Beach Park	Aransas County	44.0	14.5/1000
Community Aquatic and Skate Park	Aransas County	12.3	14.5/1000
Magnolia Park	Aransas County	1.9	Variable
Mathis Park	Aransas County	1.0	1.25/1000
Memorial Park	Aransas County	52.0	14.5/1000
Spencer Park	Aransas County	0.7	1.25/1000
Triangle Park	Aransas County	0.4	0.35/1000
Tule Park	Aransas County	2.0	1.25/1000
Wetland Park	Aransas County	5.0	Variable
Zachary Taylor Park	Aransas County	0.5	0.35/1000
Veterans Park	Bee County	—	—
Koehler Park	Bee County	—	—
Klipstein Park	Bee County	—	—
Flournoy Park	Bee County	—	—
Poesta Park	Bee County	—	—
Trevino Park	Bee County	—	—
Carlos Reyes Park	Bee County	—	—
Moore Park	Bee County	—	—
Martin Luther King Park/City Pool	Bee County	—	—
Lighthouse Beach and Bird Sanctuary	Calhoun County	—	—
Formosa Wetlands Walkway and Alcoa Bird Tower	Calhoun County	—	—
Port O'Connor Kingfisher Beach and Park	Calhoun County	—	—
Pier Park	Calhoun County	0.68	10/1000
Tilley Park	Calhoun County	10.1	10/1000
Wilson Park	Calhoun County	101.9	10/1000
George Adams Park	Calhoun County	1.68	10/1000
Bayfront Park	Calhoun County	41.3	10/1000
Old City Hall Park	Calhoun County	—	10/1000

Table 2.5.2-33 (Sheet 2 of 3)
County and City Parks within or near the 50-Mile Region[a]

Name	Location	Acres	Recommended Park Acres/ Population
Sulton Park	Calhoun County	3.6	10/1000
Little Chocolate Bayou Park and Community Garden	Calhoun County	41.0	10/1000
Bauer Community Center	Calhoun County	4.5	10/1000
Swan Point Park	Calhoun County	—	—
Cuero Municipal Park	DeWitt County	—	—
Daule Park	DeWitt County	—	—
Alexander Park	DeWitt County	—	—
Municipal Park	DeWitt County	—	—
Hub City RV Park	DeWitt County	—	—
Mack Jamison Park	DeWitt County	—	—
Centennial Park	DeWitt County	—	—
Coleto Creek Park and Reservoir	Goliad County	190	4000 visitors per day
Fannin Plaza	Goliad County	—	—
Brackenridge Plantation Park and Campground	Jackson County	—	—
Shady Oaks RV Resort	Jackson County	—	—
Bennet Park	Jackson County	—	—
Devers Creek Park	Jackson County	—	—
Shelby Park	Jackson County	—	—
East Bay Park	Matagorda County	7.35	10/1000
South Bay Park	Matagorda County	18.35	10/1000
Downtown Park	Matagorda County	1.50	10/1000
Railroad Park	Matagorda County	29.19	10/1000
Rorem Street Park	Matagorda County	1.65	10/1000
Texas Street Park	Matagorda County	2.89	10/1000
Swimming Pool	Matagorda County	1.28	1/20000
Golf Course — 9 holes	Matagorda County	103.60	1/25000
Foley Reserve Park	Matagorda County	6.00	10/1000
Tanner Flats Park	Matagorda County	5.58	10/1000
Old Landfill Park	Matagorda County	6.31	10/1000
Lions/Shelly Park	Refugio County	—	—
Refugio RV Park	Refugio County	—	—
Skate Park	San Patricio County	—	—
Cove park	San Patricio County	—	—

Table 2.5.2-33 (Sheet 3 of 3)
County and City Parks within or near the 50-Mile Region[a]

Name	Location	Acres	Recommended Park Acres/ Population
N.O. Simmons park	San Patricio County	—	—
Faith Park	San Patricio County	—	—
Lake Whitney	San Patricio County	—	—
Live Oak Park	San Patricio County	—	—
Oak Park	San Patricio County	—	—
Rob and Bessie Welder park	San Patricio County	—	—
Welder Park	San Patricio County	—	—
Speck Eakin Park	San Patricio County	—	—
Butterfly garden	San Patricio County	—	—
Grace Coin park	San Patricio County	—	—
Liberty Square Mural	San Patricio County	—	—
DeLeon Plaza	Victoria County	1.8	Variable
Ethel Lee Tracy Park	Victoria County	30.5	10,000 – 50,000
Green Belt Park	Victoria County	12.9	2,000 -10,000
Hopkins Park	Victoria County	11.6	2,000 -10,000
Memorial Park	Victoria County	1.2	2,000 -10,000
Pine Street Community Park	Victoria County	3.3	2,000 -10,000
Queen City Park	Victoria County	2.1	2,000 -10,000
Riverside Park	Victoria County	565.1	Entire urban area
Ted B. Reed Park	Victoria County	10.0	2,000 -10,000
Will Rogers Park	Victoria County	1.9	2,000 -10,000
Boulevard Park	Victoria County	1.4	2,000 -10,000
Brownson Park	Victoria County	0.9	2,000 -10,000
Community Center Park	Victoria County	73.2	10,000 – 50,000
Martin Luther King, Jr. Park	Victoria County	1.7	2,000 -10,000
Meadowlane Park	Victoria County	1.2	2,000 -10,000

Sources: Aransas Pass 2008; Aransas Pass May 2008; City of Beeville Mar 2008; City of Beeville May 2008; City of Cuero May 2008; City of Indianola May 2008; City of Ingleside Jun 2008; City of Ingleside May 2008; City of Palacios May 2008; City of Port Lavaca May 2008; City of Sinton June 2008; City of Victoria May 2008; City of Yoakum May 2008; Coleto Creek Park June 2008; Cuero Mar 2008; Cuero May 2008; GBRA Jun 2008; JCCCA Undated; PLCCCC Undated; Port Lavaca Undated; RCCCEDF Undated a; Refugio County May 2008; Rockport Undated; Yoakum Undated b.

a. TPWD acknowledges that there is a basic lack of user and non-user information on local and state parks.

Table 2.5.2-34
ROI Housing, 2000–2005

County	2006 Housing Units[a]	Percent of 2006 ROI Total	2000 Housing Units[b]	2000 to 2006 Growth	2000 Occupied Units[b]	2000 Owner Occupied Units[b]	2000 Rental Occupied Units[b]	2000 Vacant Units[b]	2000 Homeowner Vacancy Rate[b]	2000 Rental Vacancy Rate[b]	2000 Median Value Owner-occupied Housing[a]
Calhoun	10,882	16.0%	10,238	6.3%	7,442	5,417	2,025	2,796	2.1%	16.0%	$56,400
DeWitt	8,949	13.1%	8,756	2.2%	7,207	5,514	1,693	1,549	2.6%	6.5%	$47,100
Goliad	3,556	5.2%	3,426	3.8%	2,644	2,116	528	782	3.0%	7.2%	$57,400
Jackson	6,656	9.8%	6,545	1.7%	5,336	3,936	1,400	1,209	1.7%	15.5%	$52,700
Refugio	3,727	5.5%	3,669	1.6%	2,985	2,236	749	684	3.1%	6.5%	$42,600
Victoria	34,313	50.4%	32,945	4.2%	30,071	20,265	9,807	2,874	1.6%	11.2%	$73,300
ROI Total	68,083	100.0%	65,579	3.8%	55,685	39,484	16,202	9,894	—	—	—

a. {USCB 2008}
b. {USCB 2000b}

Table 2.5.2-35
ROI Population Center Housing, 2000–2005

County Population Center	2000 Housing Units[b]	2000 Occupied Units[b]	2000 Owner-Occupied Units[b]	2000 Rental-Occupied Units[b]	2000 Vacant Units[b]	2000 Percent Vacant[b]	2000 Homeowner Vacancy Rate[b]	2000 Rental Vacancy Rate[b]	2000 Median Value Owner-Occupied Housing[a]
Port Lavaca (Calhoun)	4,791	4,189	2,743	1,446	602	12.6%	1.6%	15.6%	$56,600
Cuero (DeWitt)	2,867	2,500	1,751	749	367	12.8%	2.9%	6.0%	$43,200
Goliad (Goliad)	877	749	505	244	128	14.6%	5.4%	8.6%	$58,000
Edna (Jackson)	2,609	2,227	1,397	830	382	14.6%	2.3%	18.5%	$49,600
Refugio (Refugio)	1,312	1,128	806	322	184	14.0%	3.5%	6.9%	$41,400
Victoria (Victoria)	24,192	22,129	13,461	8,668	2,063	8.5%	1.4%	11.3%	$72,600
Totals	36,648	32,922	20,663	12,259	3,726	10.2%	–-	–-	–-

a. USCB 2000e}
b. {2USCB 2000d}

Table 2.5.2-36 (Sheet 1 of 2)
Hotel/Motel Data, First Quarter, 2007

City/Town/Place	Rate	Number of Hotels[a]	Room Nights Available[b]	Revenue (dollars)	Percent Occupancy	Room Nights Sold
Calhoun County						
Port Lavaca	$00–39.99	2	7,500	98,000	39.2	2,900
	$40–49.99	1	4,800	109,000	46.9	2,200
	$50–59.99	2	13,600	335,000	48.8	6,600
	$80–89.99	1	4,500	272,000	73.2	3,300
Port O Connor	$40–49.99	1	3,200	24,000	19	600
	$60–69.99	2	4,700	146,000	48.2	2,300
	$80–89.99	1	700	18,000	29.2	200
	$90–99.99	1	4,500	42,000	10.2	500
Seadrift	$40–49.99	2	4,300	82,000	42.2	1,800
	$60–69.99	1	1,100	19,000	27.5	300
	$80–89.99	1	1,100	54,000	55.6	600
Total		15	50,000	1,199,000	42.6	21,300
DeWitt County						
Cuero	$00–39.99	2	5,400	54,000	39	2,100
	$70–79.99	1	2,800	161,000	78.4	2,200
Yoakum	$60–69.99	1	2,300	99,000	69.5	1,600
Total		4	10,500	314,000	56.2	5,900
Goliad County						
Goliad	$00–39.99	2	5,300	104,000	55.4	2,900
Total		2	5,300	104,000	54.7	2,900

Table 2.5.2-36 (Sheet 2 of 2)
Hotel/Motel Data, First Quarter, 2007

City/Town/Place	Rate	Number of Hotels[a]	Room Nights Available[b]	Revenue (dollars)	Percent Occupancy	Room Nights Sold
Jackson County						
Edna	$40–49.99	2	5,700	123,000	49.1	2,800
Total		2	5,700	123,000	49.1	2,800
Refugio County						
Refugio	$00–39.99	1	1,500	14,000	36.3	600
	$40–49.99	1	4,000	76,000	38.9	1,500
	$70–79.99	1	1,400	39,000	38.3	500
Total		3	6,900	129,000	37.7	2,600
Victoria County						
Victoria	$00–39.99	7	41,000	622,000	51.5	21,100
	$40–49.99	1	7,200	244,000	76.1	5,500
	$50–59.99	1	9,000	255,000	51.3	4,600
	$60–69.99	5	45,100	1,803,000	61.1	27,500
	$80–89.99	1	5,800	380,000	76.3	4,400
	$90–99.99	2	11,000	845,000	79.8	8,800
Total		17	119,100	4,149,000	60.4	71,900
6-County						
ROI Total		43	197,500	6,018,000	54.4	107,400

Source: TOG Undated

a. Only properties with revenues exceeding $18,000 in the current quarter.
b. Room Nights Available – the number of rooms in a hotel multiplied by the number of nights in the current quarter.

Table 2.5.2-37
ROI Housing Inventory by Price Range, 2000[a]

Value	Calhoun County		DeWitt County		Goliad County		Jackson County		Refugio County		Victoria County		ROI	
	Number of Units	%	Number of Units	%	Number of Units	%	Number of Units	%	Number of Units	%	Number of Units	%	Number of Units	%
Less than $50,000	1,766	43.3	1,849	53.8	426	43.7	1,232	46.8	1,050	60.7	4,304	26.8	10,627	36.8
$50,000 to $99,999	1,697	41.6	1,141	33.2	333	34.2	1,021	38.8	507	29.3	7,685	47.9	12,384	42.9
$100,000 to $149,999	391	9.6	288	8.4	146	15	222	8.4	123	7.1	2,329	14.5	3,499	12.1
$150,000 to $199,999	163	4	106	3.1	49	5	115	4.4	24	1.4	1,060	6.6	1,517	5.2
$200,000 to $299,999	63	1.5	25	0.7	16	1.6	36	1.4	10	0.6	444	2.8	594	2.1
$300,000 to $499,999	0	0	5	0.1	2	0.2	4	0.2	2	0.1	181	1.1	194	0.7
$500,000 to $999,999	0	0	15	0.4	2	0.2	0	0	0	0	37	0.2	54	0.2
$1,000,000 or more	0	0	5	0.1	0	0	0	0	15	0.9	11	0.1	31	0.1
Total Units	4,080	100.0	3,434	100.0	974	100.0	2,630	100.0	1,731	100.0	16,051	100.0	28,900	100.0
Median Value	$56,400		$47,100		$57,400		$52,700		$42,600		$73,300		N/A	

N/A - Not available

a. Owner-occupied units with a mortgage

Source: USCB 2000c

Table 2.5.2-38 (Sheet 1 of 2)
Major Water Suppliers in the ROI

System Name	Population Served[a,b]	Primary Water Source[c]	{Total Production Capability (MGD)[c]	Max Purchased Capacity (MGD)[c]	Average Daily Consumption (MGD)[c]}	Percent Utilized Capacity	Percent Available Capacity
Calhoun County							
Calhoun County Rural Water System	7,041	Purchased Surface Water	2.26	N/A	0.205	9.1	90.9
City of Point Comfort	1,296	Surface Water	1.152	N/A	0.136	11.8	88.2
City of Port Lavaca	12,000	Purchased Surface Water	N/A	N/A	1.210	N/A	100.0
City of Seadrift	4,338	Groundwater	2.304	N/A	0.104	4.5	95.5
Port O'Connor MUD	3,810	Purchased Groundwater	1.044	N/A	N/A	N/A	
County Subtotal	28,485		6.76		1.655	24.5	75.5
DeWitt County							
City of Cuero	6,571	Groundwater	7.740	N/A	1.680	21.7	78.3
City of Yoakum	5,731	Groundwater	4.212	7.920	0.771	18.3	81.7
City of Yorktown	2,207	Groundwater	2.030	N/A	0.265	13.1	86.9
County Subtotal	14,509		13.982		2.716	19.4	80.6
Goliad County							
City of Goliad	2,018	Groundwater	1.656	N/A	0.376	22.7	77.3
County Subtotal	2,018		1.656		0.376	22.7	77.3
Jackson County							
City of Edna	5,999	Groundwater	3.300	1.656	0.594	18.0	82.0
City of Ganado	2,376	Groundwater	2.660	1.296	0.195	7.3	92.7
Jackson County WCID 1	700	Groundwater	0.403	N/A	0.058	14.4	85.6
Jackson County WCID 2	600	Groundwater	0.324	N/A	0.050	15.4	84.6
County Subtotal	9,675		6.687		0.897	13.4	86.6
Refugio County							
City of Bayside	714	Groundwater	0.165	N/A	N/A		
City of Refugio	2,941	Groundwater	2.736	N/A	0.524	19.2	80.8
City of Woodsboro	1,750	Groundwater	1.188	N/A	0.203	17.1	82.9
County Subtotal	5,405		4.089		0.727	17.8	82.2

Table 2.5.2-38 (Sheet 2 of 2)
Major Water Suppliers in the ROI

System Name	Population Served[a,b]	Primary Water Source[c]	{Total Production Capability (MGD)[c]	Max Purchased Capacity (MGD)[c]	Average Daily Consumption (MGD)[c]}	Percent Utilized Capacity	Percent Available Capacity
Victoria County							
City of Victoria	61,055	Surface Water	36.657	N/A	9.920	27.1	72.9
Quail Creek MUD	1,533	Groundwater	2.261	0.720	0.148	6.5	93.5
Victoria County WCID 1	2,800	Groundwater	0.994	N/A	0.245	24.6	75.4
Victoria County WCID 2	696	Groundwater	0.288	N/A	0.060	20.8	79.2
County Subtotal	66,084		40.2		10.373	25.8	74.2
ROI Total	126,176	---	73.374	---	16.744	22.8	77.2

a. USEPA 2007
b. TCEQ 2007
c. Data selected based on major populations served per county. Year of data not provided. Data extracted from TCEQ database that is updated continuously.
WCID = Water Control and Improvement District
MUD = Municipal Utilities Department
N/A = Not Available

Table 2.5.2-39 (Sheet 1 of 3)
Wastewater Treatment Systems in the ROI

System Name (TPDES #)[a]	Plant Designed Average Flow (MGD)[b]	Wastewater Processed (MGD)[a]	Period[a]
Calhoun County			
City of Point Comfort (10599001)	0.2	Monthly Avg. Min. 0.029 Monthly Avg. Max. 0.126 Monthly Avg. 0.057	September 2006 – August 2007
City of Port Lavaca (10251001)	1.5	Monthly Avg. Min. 1.14 Monthly Avg. Max. 1.39 Monthly Avg. 1.24	October 2006 – September 2007
City of Seadrift (0822001)	0.3	Monthly Avg. Min. 0.08 Monthly Avg. Max. 0.34 Monthly Avg. 0.15	September 2006 – August 2007
Port O'Connor MUD (13693001)	0.6	Monthly Avg. Min. 0.070 Monthly Avg. Max. 0.277 Monthly Avg. 0.110	September 2006 – August 2007
Guadalupe-Blanco River Authority (13954001)	0.03	Monthly Avg. Min. 0.004 Monthly Avg. Max. 0.017 Monthly Avg. 0.009	September 2006 – August 2007
South-Central Calhoun County W. (13774001)	0.075	Monthly Avg. Min. 0.013 Monthly Avg. Max. 0.03 Monthly Avg. 0.021	August 2006 – July 2007
DeWitt County			
City of Cuero (10403002)	1.5	Monthly Avg. Min. 0.484 Monthly Avg. Max. 0.963 Monthly Avg. 0.900	August 2006 – July 2007
City of Yoakum (10463001)	0.95	Monthly Avg. Min. 0.468 Monthly Avg. Max. 1.142 Monthly Avg. 0.647	October 2006 – September 2007
City of Yorktown (10323001)	0.26	Monthly Avg. Min. 0.105 Monthly Avg. Max. 0.211 Monthly Avg. 0.152	September 2006 – August 2007
Goliad County			
City of Goliad (10458001)	0.35	Monthly Avg. Min. 0.159 Monthly Avg. Max. 0.400 Monthly Avg. 0.240	September 2006 – August 2007

Table 2.5.2-39 (Sheet 2 of 3)
Wastewater Treatment Systems in the ROI

System Name (TPDES #)[a]	Plant Designed Average Flow (MGD)[b]	Wastewater Processed (MGD)[a]	Period[a]
Jackson County			
City of Edna (10164001)	1.8	Monthly Avg. Min. 0.575 Monthly Avg. Max. 1.13 Monthly Avg. 0.713	September 2006 – August 2007
City of Ganado (10010001)	0.35	Monthly Avg. Min. 0.147 Monthly Avg. Max. 0.385 Monthly Avg. 0.201	September 2006 – August 2007
City of La Ward (13479001)	0.013	Monthly Avg. Min. 0.0002 Monthly Avg. Max. 0.0039 Monthly Avg. 0.0017	September 2006 – August 2007
Jackson County WCID No. 1 (10911001)	0.062	Monthly Avg. Min. 0.021 Monthly Avg. Max. 0.261 Monthly Avg. 0.042	August 2006 – July 2007
Jackson County WCID No. 2 (10196001)	0.045	Monthly Avg. Min. 0.023 Monthly Avg. Max. 0.163 Monthly Avg. 0.045	October 2006 – September 2007
Refugio County			
City of Austwell (11117001)	0.06	Monthly Avg. Min. 0.005 Monthly Avg. Max. 0.033 Monthly Avg. 0.010	September 2006 – August 2007
Refugio County WCID No. 1 (10256001)	0.075	Monthly Avg. Min. 0.034 Monthly Avg. Max. 0.079 Monthly Avg. 0.046	August 2006 – July 2007
Town of Bayside (13892001)	N/A	Monthly Avg. Min. 0.003 Monthly Avg. Max. 0.040 Monthly Avg. 0.009	September 2006 – August 2007
Town of Refugio (10255001)	0.576	Monthly Avg. Min. 0.210 Monthly Avg. Max. 0.544 Monthly Avg. 0.284	September 2006 – August 2007
Town of Woodsboro (10156001)	0.25	Monthly Avg. Min. 0.083 Monthly Avg. Max. 0.100 Monthly Avg. 0.091	September 2006 – August 2007

Table 2.5.2-39 (Sheet 3 of 3)
Wastewater Treatment Systems in the ROI

System Name (TPDES #)[a]	Plant Designed Average Flow (MGD)[b]	Wastewater Processed (MGD)[a]	Period[a]
Victoria County			
Aqua Utilities, Inc. (10742001)	0.05	Monthly Avg. Min. 0.020 Monthly Avg. Max. 0.040 Monthly Avg. 0.026	September 2006 – August 2007
City of Victoria & Guadalupe (10466001)	2.5	Monthly Avg. Min. 0.9 Monthly Avg. Max. 1.1 Monthly Avg. 0.98	October 2006 – September 2007
Guadalupe-Blanco River Authority (11078001)	9.6	Monthly Avg. Min. 5.7 Monthly Avg. Max. 7.7 Monthly Avg. 6.5	October 2006 – September 2007
Quail Creek MUD (12226001)	0.22	Monthly Avg. Min. 0.100 Monthly Avg. Max. 0.157 Monthly Avg. 0.118	September 2006 – August 2007
Victoria County WCID No. 2 (12743001)	0.072	Monthly Avg. Min. 0.036 Monthly Avg. Max. 0.113 Monthly Avg. 0.069	November 2006 – October 2007
Victoria County WCID No. 1 (10513002)	N/A	Monthly Avg. Min. 0.172 Monthly Avg. Max. 0.324 Monthly Avg. 0.217	August 2006 – July 2007
ROI Total	21.438	Monthly Avg. 12.9	–

a. TCEQ Nov 2007
b. TCEQ Dec 2007

WCID = Water Control and Improvement District
MUD = Municipal Utilities Department
N/A = Not available

Table 2.5.2-40
Region L - Projected Water Demands for 2010 and 2060

Category	2010 (acre-feet)	2060 (acre-feet)	Percent change in demand 2010–2060	Percent of overall demand in 2010	Percent change in relative share of overall demand 2010–2060
Municipal	369,694	597,619	+62	38	+9
County-other	26,302	39,616	+51	3	0
Manufacturing	119,310	179,715	+51	12	+2
Mining	14,524	18,644	+28	1	0
Irrigation	379,026	301,679	–20	38	–15
Steam-electric	50,427	109,776	+118	5	+4
Livestock	25,954	25,954	0	3	–1
Region L total	985,237	1,273,003	+29	—	—

Source: TWDB Nov 2006

Table 2.5.2-41
Region L - Existing Major Water Supply Sources

Water Supply Source	2010 (acre-feet)	2060 (acre-feet)
Surface water		
Guadalupe River run-of-river	123,328	123,328
Canyon Lake	59,820	55,153
Calaveras Lake	36,900	36,900
Lake Texana	32,604	32,604
Guadalupe River Combined run-of-river irrigation	18,184	18,184
Livestock Local Supply	13,230	13,150
Coleto Creek Lake	12,500	12,500
Victor Braunig Lake	12,000	12,000
Other Surface Water	25,414	25,414
Surface water subtotal	333,980	329,233
Groundwater		
Edwards (Balcones Fault Zone) Aquifer	343,799	343,799
Carrizo-Wilcox Aquifer	256,735	235,072
Gulf Coast Aquifer	58,926	55,580
Queen City Aquifer	12,742	11,111
Other groundwater	12,934	11,842
Groundwater subtotal	685,136	657,404
Reuse		
Direct Reuse	30,653	31,773
Reuse subtotal	30,653	31,773
Region L total	**1,049,769**	**1,018,410**

Source: TWDB Nov 2006

Note:Water supply sources are listed individually if 10,000 acre-feet per year or greater in 2010. Values include only water supplies that are physically and legally available to users during a drought of record.

Table 2.5.2-42
Region P- Projected Water Demands for 2010 and 2060

Category	2010 (acre-feet)	2060 (acre-feet)	Percent change in demand 2010–2060	Percent of overall demand in 2010	Percent change in relative share of overall demand 2010–2060
Municipal	4,765	4,445	–7	2	0
County-other	2,406	2,096	–13	1	0
Manufacturing	1,089	1,425	+31	0	0
Mining	164	192	+17	0	0
Irrigation	213,638	195,251	–9	95	0
Steam-electric	0	0	0	0	0
Livestock	3,499	3,499	0	2	0
Region P total	225,561	206,908	–8	–	–

Source: TWDB Nov 2006

Table 2.5.2-43
Region P - Existing Major Water Supply Sources

Water Supply Source	2010 (acre-feet)	2060 (acre-feet)
Surface water		
Lake Texana	1,832	1,832
Surface water subtotal	1,832	1,832
Groundwater		
Gulf Coast Aquifer	207,599	207,599
Groundwater subtotal	207,599	207,599
Region P total	209,431	209,431

Source: TWDB Nov 2006)

Note: Water supply sources are listed individually if 10,000 acre-feet per year or greater in 2010. Values include only water supplies that are physically and legally available to users during a drought of record.

Table 2.5.2-44
Law Enforcement Personnel, 2005

Political Jurisdiction	Total Law Enforcement Employees	Total Police Officers[a]	Total Civilians[b]
Calhoun County and City Personnel			
Calhoun County	56	22	34
Point Comfort	1	1	0
Port Lavaca	25	19	6
Seadrift	2	2	0
TOTAL	84	44	40
DeWitt County and City Personnel			
DeWitt County	28	10	18
Cuero	14	13	1
Yoakum	17	10	7
Yorktown	4	4	0
TOTAL	63	37	26
Goliad County and City Personnel			
Goliad County	25	10	15
TOTAL	25	10	15
Jackson County and City Personnel			
Jackson County	24	14	10
Edna	11	9	2
Ganado	4	3	1
TOTAL	39	26	13
Refugio County and City Personnel			
Refugio County	32	10	22
Refugio	13	9	4
TOTAL	45	19	26
Victoria County and City Personnel			
Victoria County	155	88	67
Victoria	132	95	37
TOTAL	287	183	104
TOTAL ROI (All Counties)	543	319	224

Source: FBI Sep 2006

a. Individuals who ordinarily carry a badge and a firearm and have full arrest powers.
b. Personnel such as clerks, radio dispatchers, stenographers, jailers, and mechanics.

Table 2.5.2-45 (Sheet 1 of 2)
Fire Protection Personnel, 2007[a]

Fire Dept Name	Dept Type	Organization Type	Number Of Stations	Active Firefighters (Career)	Active Firefighters (Volunteer)	Active Firefighters (Paid per Call)	Non-Firefighting (Civilian)	Non-Firefighting (Volunteer)
Calhoun County								
Magnolia Beach Volunteer Fire Department	Volunteer	Local	1	0	11	0	0	2
Olivia-Port Alto Volunteer Fire Department	Volunteer	Local	1	0	20	0	0	0
Port Lavaca Fire Department	Mostly Career	Local	2	16	11	0	1	0
Port O'Connor Volunteer Fire Department	Volunteer	Local	1	0	20	0	0	10
Seadrift Volunteer Fire Department	Volunteer	Local	1	0	15	0	0	2
Thomaston Volunteer Fire Department	Volunteer	Non-governmental VFD	1	0	8	0	0	12
DeWitt County								
Cuero Fire Department	Mostly Volunteer	Local	1	6	45	0	0	0
Meyersville Volunteer Fire Department	Volunteer	Local	1	0	20	0	0	0
Westhoff Volunteer Fire Department	Volunteer	Local	1	0	15	0	0	10
Goliad County								
Ander-Weser Volunteer Fire Department	Volunteer	Local	1	0	20	0	0	25
Goliad Volunteer Fire Department	Volunteer	Local	1	0	25	0	0	0
Weesatche Volunteer Fire Department	Volunteer	Local	1	0	25	0	0	1
Jackson County								
Edna Fire Department	Mostly Volunteer	Local	1	8	22	0	1	0
Ganado Volunteer Fire Department	Volunteer	Local	1	0	0	26	0	0
La Ward Volunteer Fire Department	Volunteer	Local	1	0	15	0	0	3

Table 2.5.2-45 (Sheet 2 of 2)
Fire Protection Personnel, 2007[a]

Fire Dept Name	Dept Type	Organization Type	Number Of Stations	Active Firefighters (Career)	Active Firefighters (Volunteer)	Active Firefighters (Paid per Call)	Non-Firefighting (Civilian)	Non-Firefighting (Volunteer)
Refugio County								
Bayside Volunteer Fire Department	Volunteer	Local	1	0	15	0	0	0
Refugio Volunteer Fire Department	Volunteer	Local	1	0	25	0	0	0
Tivoli Volunteer Fire Department	Volunteer	Local	1	0	20	0	0	0
Woodsboro Fire Department	Volunteer	Contract fire department	1	0	28	0	0	1
Victoria County								
Bloomington Volunteer Fire Department, Inc.	Volunteer	Local	1	0	22	0	0	12
Lone Tree Volunteer Fire Department	Volunteer	Local	1	0	10	0	0	80
Nursery Volunteer Fire Department	Volunteer	Local	1	0	14	0	0	0
Placedo Volunteer Fire Department	Volunteer	Local	1	0	18	0	0	4
Quail Creek Volunteer Fire Department	Volunteer	Local	1	0	20	0	0	14
Raisin Volunteer Fire Department	Volunteer	Local	4	0	15	0	0	20
Telferner Volunteer Fire Department	Volunteer	Local	1	0	6	0	0	3
Victoria Fire Department	Career	Local	4	107	0	0	3	0
TOTAL – ROI (All Counties)			34	137	465	26	5	199

Source: (USFA 2007)

a. Data is obtained from the U. S. Fire Administration's (USFA) National Fire Department Census. Responses to this census are voluntary and the USFA estimates that, as of 2006, approximately 81% of the nation's fire departments have responded (USFA 2007).

Table 2.5.2-46
Police and Fire Protection Ratios

County	Total Population (2000)	Sworn Officers (2005)	Ratio of Residents per Officer[a]	Active Firefighters (career, volunteer, and paid per call) (2007)	Ratio of Residents per Active Firefighter[b]
Calhoun	20,647	44	469:1	101	204:1
DeWitt	20,013	37	541:1	86	233:1
Goliad	6,928	10	693:1	70	99:1
Jackson	14,391	26	554:1	71	203:1
Refugio	7,828	19	412:1	88	89:1
Victoria	84,088	183	459:1	212	397:1
ROI	153,895	319	482:1	628	245:1

Sources: Tables 2.5.1-4, 2.5.2-44, 2.5.2-45

a. Total population in 2000 divided sworn officers in 2005.
b. Total population in 2000 divided by active firefighters in 2007.

Table 2.5.2-47 (Sheet 1 of 2)
Public Protection Classification Ratings in the ROI

City/Town/Community/Fire Department	County	Zip Code	Public Protection Classification[a]
Point Comfort Fire Department	Calhoun	77978	5
Point Comfort Outside of Point Comfort Fire Department protection area	Calhoun	77978	5/9
Port Lavaca Fire Department	Calhoun	77972	4
Port Lavaca Fire Department	Calhoun	77979	4
Port Lavaca Outside of Port Lavaca Fire Department protection area	Calhoun	77979	4/9
Port O'Connor Fire Department	Calhoun	77982	8
Seadrift Fire Department	Calhoun	77983	7
Cuero Fire Department	DeWitt	77954	5
Hochheim Fire Department	DeWitt	77967	10
Nordheim Fire Department	DeWitt	78141	8
Weesatche Volunteer Fire Department	DeWitt	78164	9/10
Westhoff Fire Department	DeWitt	77994	10
Yoakum Fire Department	DeWitt	77995	5
Yorktown Fire Department	DeWitt	78164	7
Berclair Fire Department	Goliad	78107	10
Fannin Fire Department	Goliad	77960	10
Goliad Fire Department	Goliad	77963	7
Raisin Volunteer Fire Department	Goliad	77960	10
Weesatche Volunteer Fire Department	Goliad	77993	9/10
Caranacuhua Volunteer Fire Department	Jackson	77465	10
Edna Fire Department	Jackson	77957	6
Francitas Volunteer Fire Department	Jackson	77961	9/10
Ganado Fire Department	Jackson	77962	7
La Salle Fire Department	Jackson	77969	10
La Ward Fire Department	Jackson	77970	9/10
La Ward Volunteer Fire Department	Jackson	77970	9/10
Lolita Fire Department	Jackson	77971	7/9
Lolita Volunteer Fire Department	Jackson	77971	7/9
Vanderbilt Volunteer Fire Department	Jackson	77991	7/9
Austwell Fire Department	Refugio	77950	10
Bayside Fire Department	Refugio	78340	7/9
Bayside Fire Department	Refugio	78340	7/9

Table 2.5.2-47 (Sheet 2 of 2)
Public Protection Classification Ratings in the ROI

City/Town/Community/Fire Department	County	Zip Code	Public Protection Classification[a]
Refugio Fire Department	Refugio	78377	5
Refugio - Outside of Refugio Fire Department protection area	Refugio	78377	9/10
Tivoli Fire Department	Refugio	77990	10
Woodsboro Fire Department	Refugio	78393	7
Bloomington Fire Department	Victoria	77951	9/10
Bloomington Volunteer Fire Department	Victoria	77951	9/10
Crescent Valley Fire Department	Victoria	77905	9/10
Crescent Valley Volunteer Fire Department	Victoria	77905	9/10
Inez Fire Department	Victoria	77968	10
Lone Tree Volunteer Fire Department	Victoria	77977	9/10
Mcfaddin Fire Department	Victoria	77973	10
Mcfaddin Volunteer Fire Department	Victoria	77973	10
Placedo Fire Department	Victoria	77977	10
Quail Creek Volunteer Fire Department	Victoria	77905	5/8B[b]
Raisin Volunteer Fire Department	Victoria	77901	10
Telferner Volunteer Fire Department	Victoria	77988	9/10
Victoria Fire Department	Victoria	77901	4
Victoria Fire Department	Victoria	77904	4
Victoria Fire Department	Victoria	77905	4
Victoria - Outside of Victoria Fire Department protection area	Victoria	77905	9/10

Source: TDI Jan 2008

a. For Public Protection Classifications with two numbers, the first number is the Public Protection Classification for buildings within 1000 feet of a fire hydrant and 5 road miles of a recognized fire department. The second number is for buildings more than 1000 feet from a fire hydrant but within 5 road miles of a recognized fire department (TDI Sep 2007).

b. 8B = the rating is actually between 8 and 9.

Table 2.5.2-48
2006 Hospital Data and 2007 Physician Data

Facility Name	Staffed Beds	Admissions[a]	Daily Census[b]	Outpatient Visits[a]	Personnel[c]	No. of Physicians
Calhoun County						
Memorial Medical Center	25	1385	13	29,674	188	NA
County Total	25	1385	13	29,674	188	20
DeWitt County						
Cuero Community Hospital	60	2706	27	142,077	349	NA
County Total	60	2706	27	142,077	349	14
Goliad County						
County Total	0	0	0	0	0	3
Jackson County						
Jackson County Hospital District	54	403	32	NA	108	NA
County Total	54	403	32	NA	108	4
Refugio County						
Refugio County Memorial Hospital	20	303	3	31,283	99	NA
County Total	20	303	3	31,283	99	2
Victoria County						
Citizens Medical Center	296	11,557	150	95,958	1027	NA
DeTar Health Care System	308	9385	116	84,106	872	NA
Triumph Hospital of Victoria	23	223	15	0	58	NA
Victoria Warm Springs Hospital	22	260	13	5136	73	NA
County Total	649	21,425	294	185,200	2030	230
ROI						
ROI TOTAL	808	26,222	369	388,234	2774	273

Sources: AHA 2006 and AMA 2005

a. Total during most recent 12-month period for which data was collected.
b. Average daily census during most recent 12-month period for which data was collected.
c. Hospital personnel list does not include doctors that serve patients in the hospital, but are not employed by the hospital.
N/A – Not Available

Table 2.5.2-49
Public School Campuses in the ROI, 2007–2008 Academic Year

	Primary/Elementary		Middle/Intermediate/Junior High		High School		Alternative/ Magnet	Total	
ISD	**Current**	**Proposed**	**Current**	**Proposed**	**Current**	**Proposed**		**Current[e]**	**Proposed**
Calhoun County									
Calhoun County	5	1	2	0	2	1	1	10	2
DeWitt County									
Cuero	2	0	2	0	1	0	1	6	0
Meyersville	1	0	1	0	0	0	0	1	0
Nordheim	1	0	1	0	1	0	0	1	0
Westhoff	1	0	1	0	0	0	0	1	0
Yoakum	3	0	1	0	1	0	0	5	0
Yorktown	1	0	1	0	1	0	1	4	0
Goliad County									
Goliad	1	0	2	0	1	0	0	4	0
Jackson County									
Edna	1	1[a]	1	0	1	0	0	3	1
Ganado	1	0	1	0	1	0	0	3	0
Hallettsville	1	0	1	0	1	0	0	3	0
Industrial	2	2[b]	1	0	1	0	1	4	2
Palacios	1	0	2	0	1	0	1	5	0
Refugio County									
Austwell-Tivoli	1	0	1[c]	0	1	0	0	2	0
Refugio	1	0	0	1	1	0	0	2	1
Woodsboro	1	0	1[c]	0	1	0	0	2	0
Victoria County									
Bloomington	2	0	1	0	1	0	0	4	0
Nursery	1	1[d]	0	0	0	0	0	1	1
Victoria	15	2	3	1	3	2	1	21	5

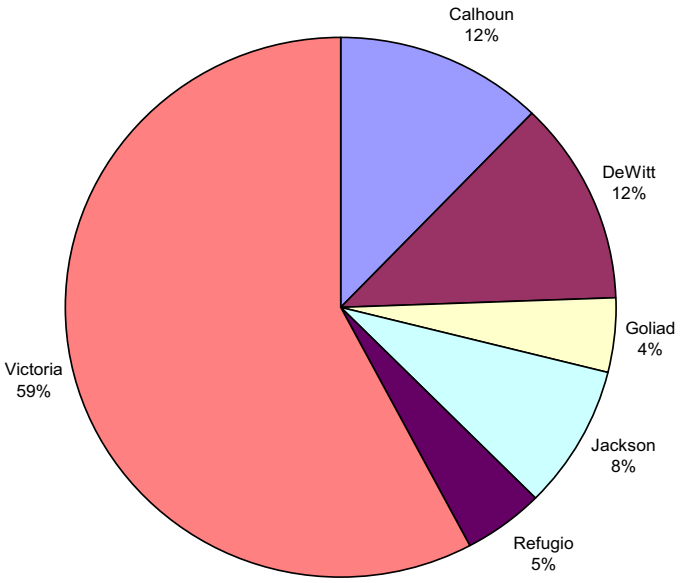
a. New school to replace existing school is scheduled to open for school year 2008/2009.
b. Additional classrooms in two existing buildings.
c. Middle school is combined with high school.
d. New school will replace existing school.
e. Numbers of campuses may not sum to the total.

Table 2.5.2-50
2007–2008 Enrollment and Capacities of Public Schools in the ROI

ISD	Current Enrollment/Percent of Capacity	Enrollment Capacity	Available Student Capacity
Calhoun County			
Calhoun County ISD	4290 (76%)	5,632	1342 (24%)
County-wide Total	4290 (76%)	5,632	1342 (24%)
DeWitt County			
Cuero ISD	1950 (72%)	2,700	750 (28%)
Meyersville ISD	125 (78%)	160	35 (22%)
Nordheim ISD	82 (47%)	175	93 (53%)
Westhoff ISD	48 (30%)	160	112 (70%)
Yoakum ISD	1550 (100%)	1,550	0 (0%)
Yorktown ISD	650 (72%)	900	250 (28%)
County-wide Total	4405 (78%)	5,645	1240 (22%)
Goliad County			
Goliad ISD	1312 (100%)	1,312	0 (0%)
County-wide Total	1312 (100%)	1,312	0 (0%)
Jackson County			
Edna ISD	1450 (81%)	1,800	350 (19%)
Ganado ISD	640 (91%)	700	60 (9%)
Hallettsville ISD	887 (85%)	1,050	163 (15%)
Industrial ISD	1060 (92%)	1,150	90 (8%)
Palacios ISD	1523 (85%)	1,800	277 (15%)
County-wide Total	5560 (86%)	6,500	940 (14%)
Refugio County			
Austwell-Tivoli ISD	155 (31%)	500	345 (69%)
Refugio ISD	735 (49%)	1,500	765 (51%)
Woodsboro ISD	546 (91%)	600	54 (9%)
County-wide Total	1436 (55%)	2,600	1164 (45%)
Victoria County			
Bloomington ISD	908 (86%)	1,050	142 (14%)
Nursery ISD	110 (52%)	210	100 (48%)
Victoria ISD[a]	13,550 (58%)	23,350	9800 (42%)
County-wide Total	14,568 (59%)	24,610	10,042 (41%)
Total for ROI	31,571 (68%)	46,299	14,728 (32%)

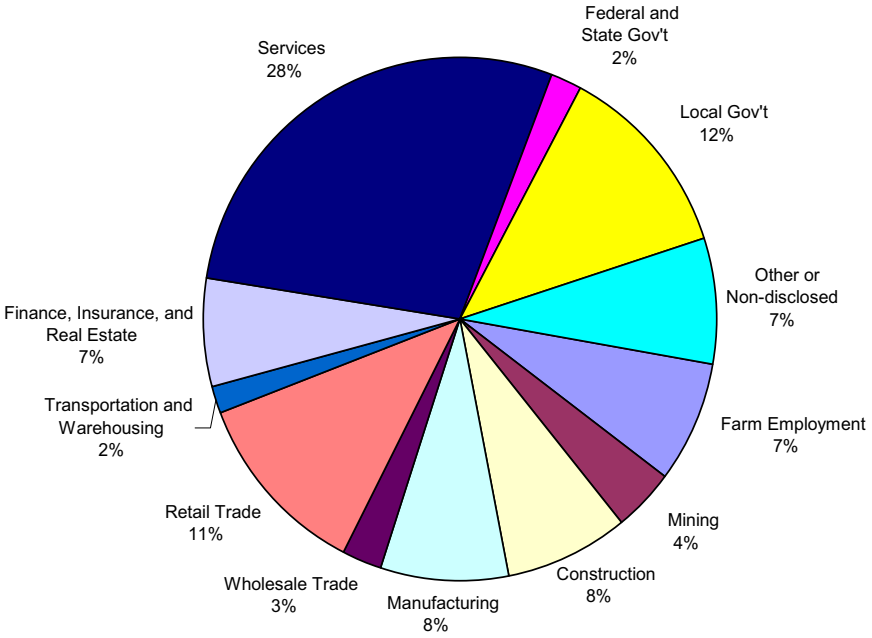
Note:If an ISD is located in more than one county, then the enrollment was only included in the primary county the ISD is located in with the exception of Hallettsville ISD and Palacios ISD. These ISDs were included in the county that is in the ROI since the primary county is outside the ROI.

a. Victoria ISD will decrease its current reliance on mobile classroom units when new schools are completed.



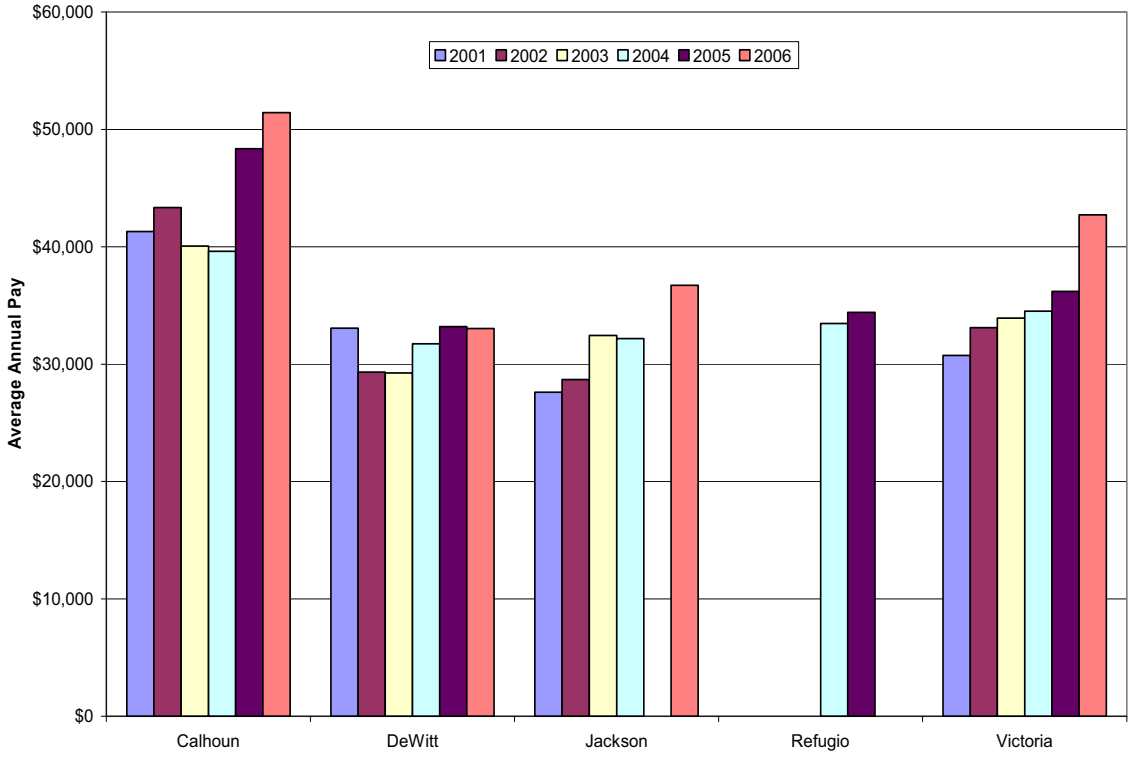
Source: BLS 2007a

Figure 2.5.2-1 ROI Labor Force Distribution, 2006



Source: BEA 2008

Figure 2.5.2-2 Major Employment Sectors, ROI, 2005



Source: BLS 2007b
Note: Data non-disclosed in all years for Goliad County, and in 2001–2003 and 2006 for Refugio County

Figure 2.5.2-3 Average Annual Earnings, NAICS Sector 237, Heavy and Civil Engineering Construction, 2001-2006

Figure 2.5.2-4 Transportation System in the 50-Mile Region

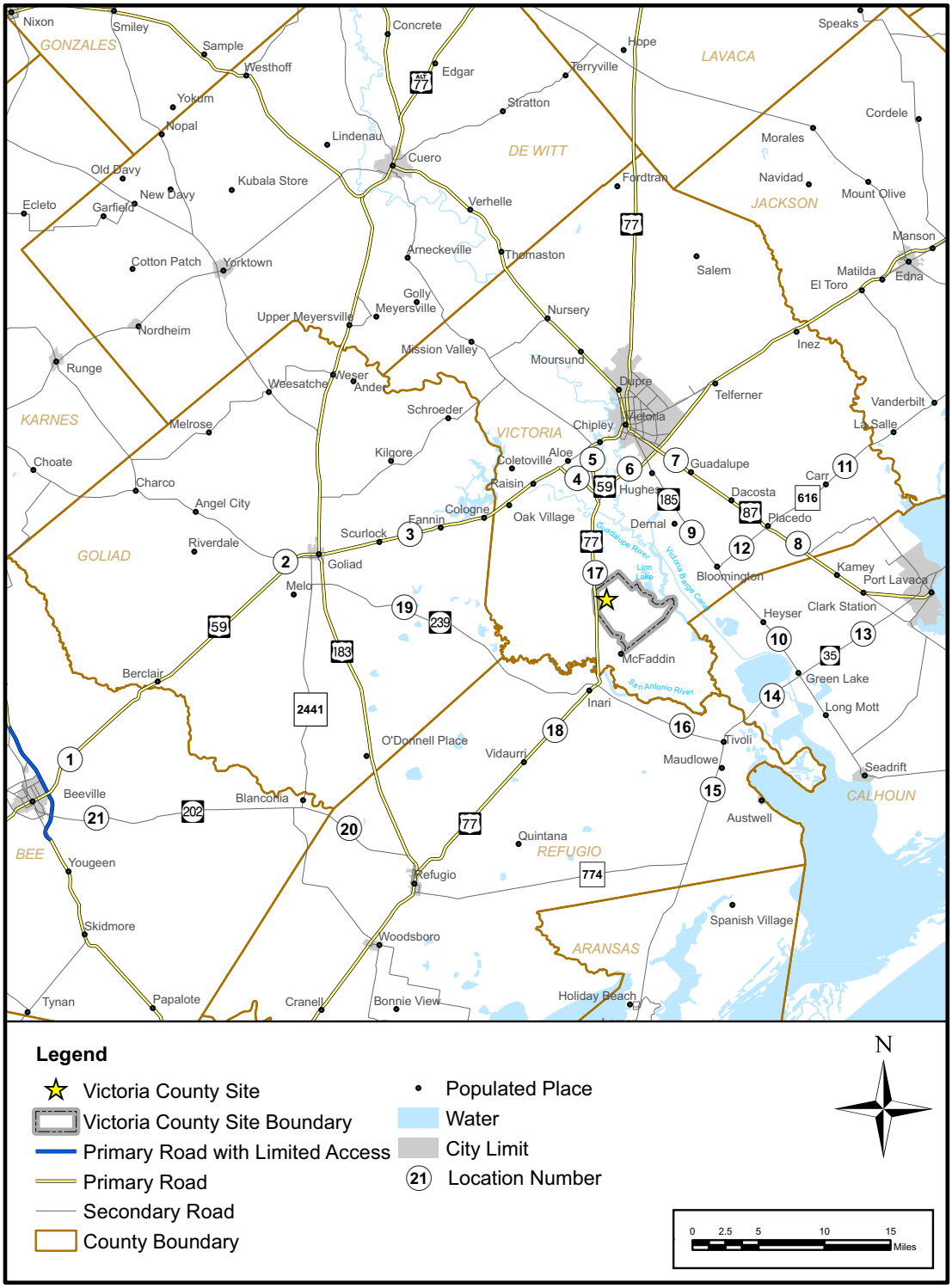


Figure 2.5.2-5 Transportation Routes to the Victoria County Station Site

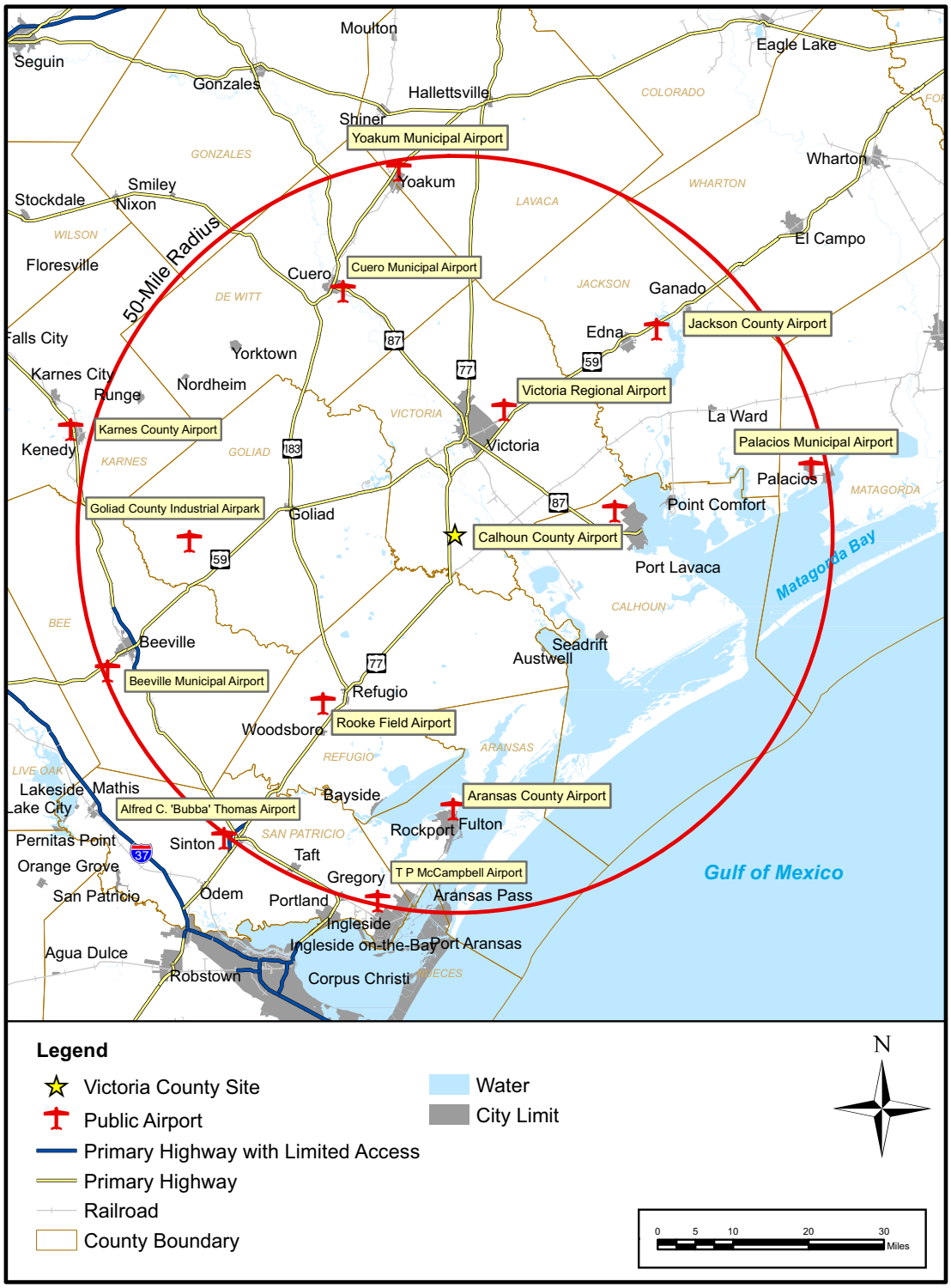
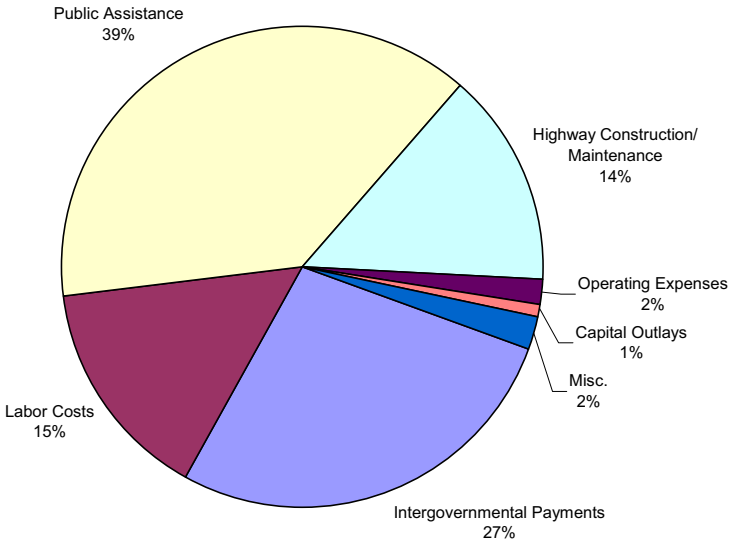
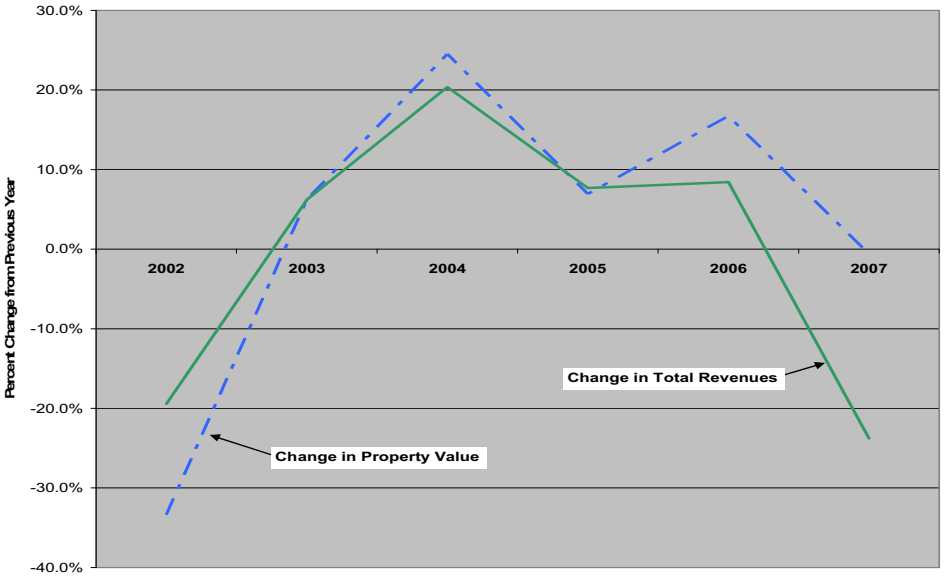


Figure 2.5.2-6 Airports in the 50-Mile Region



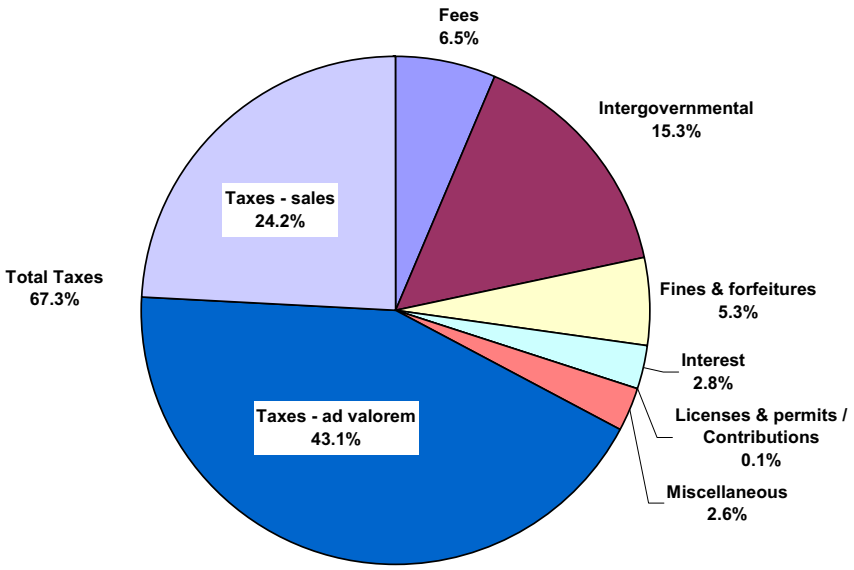
Source: TCPA 2007

Figure 2.5.2-7 State Expenditures by Category in ROI Counties, 2006



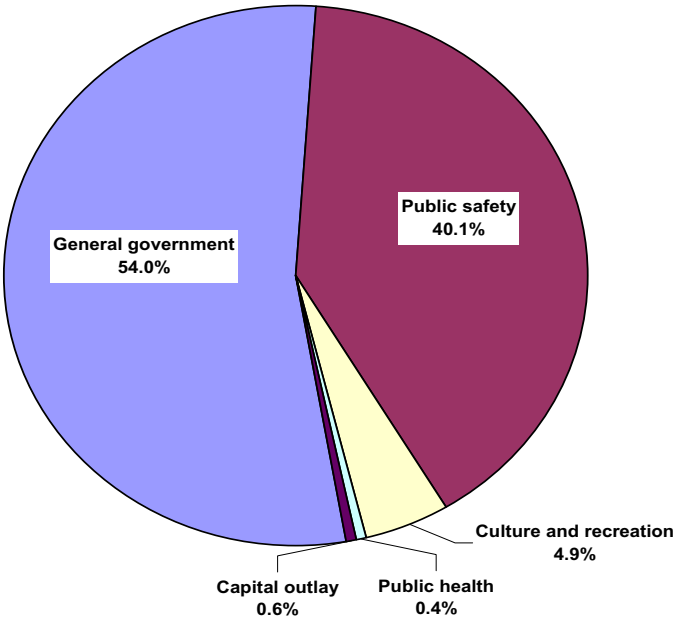
Source: RISD Feb 2008

Figure 2.5.2-8 Refugio ISD, Changes from Previous Year in Property Values and Revenues, 2001-2007



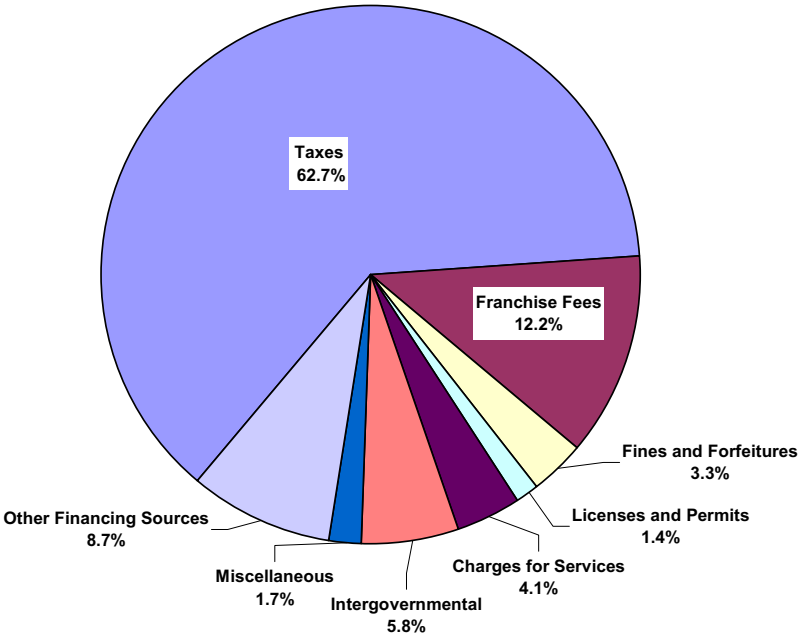
Source: VCA Jun 2007

Figure 2.5.2-9 Victoria County Revenues, 2006



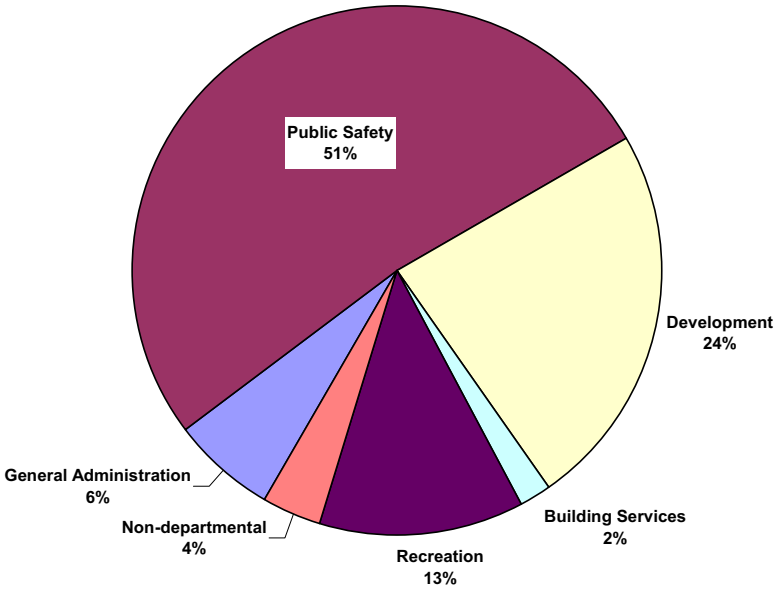
Source: VCA Jun 2007

Figure 2.5.2-10 Victoria County Expenditures, 2006



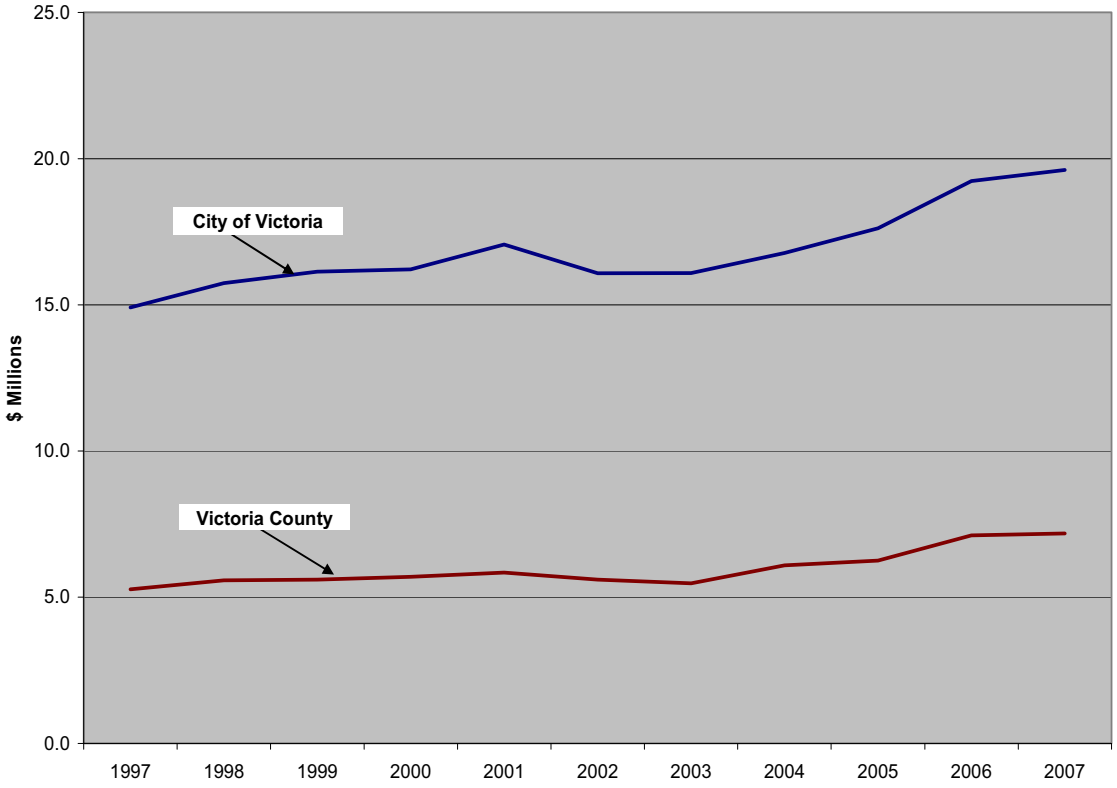
Source: Victoria 2007

Figure 2.5.2-11 City of Victoria Budgeted Revenues, 2006-2007



Source: Victoria 2007

Figure 2.5.2-12 City of Victoria Budgeted Expenditures, 2006-2007



Source: TCPA 2008g

Figure 2.5.2-13 Sales Taxes, Victoria County and City of Victoria, 1997–2007 (Adjusted for Inflation; Values are in 2007 Dollars)

Figure 2.5.2-14 Federal and State Recreational Areas within the 50-Mile Radius

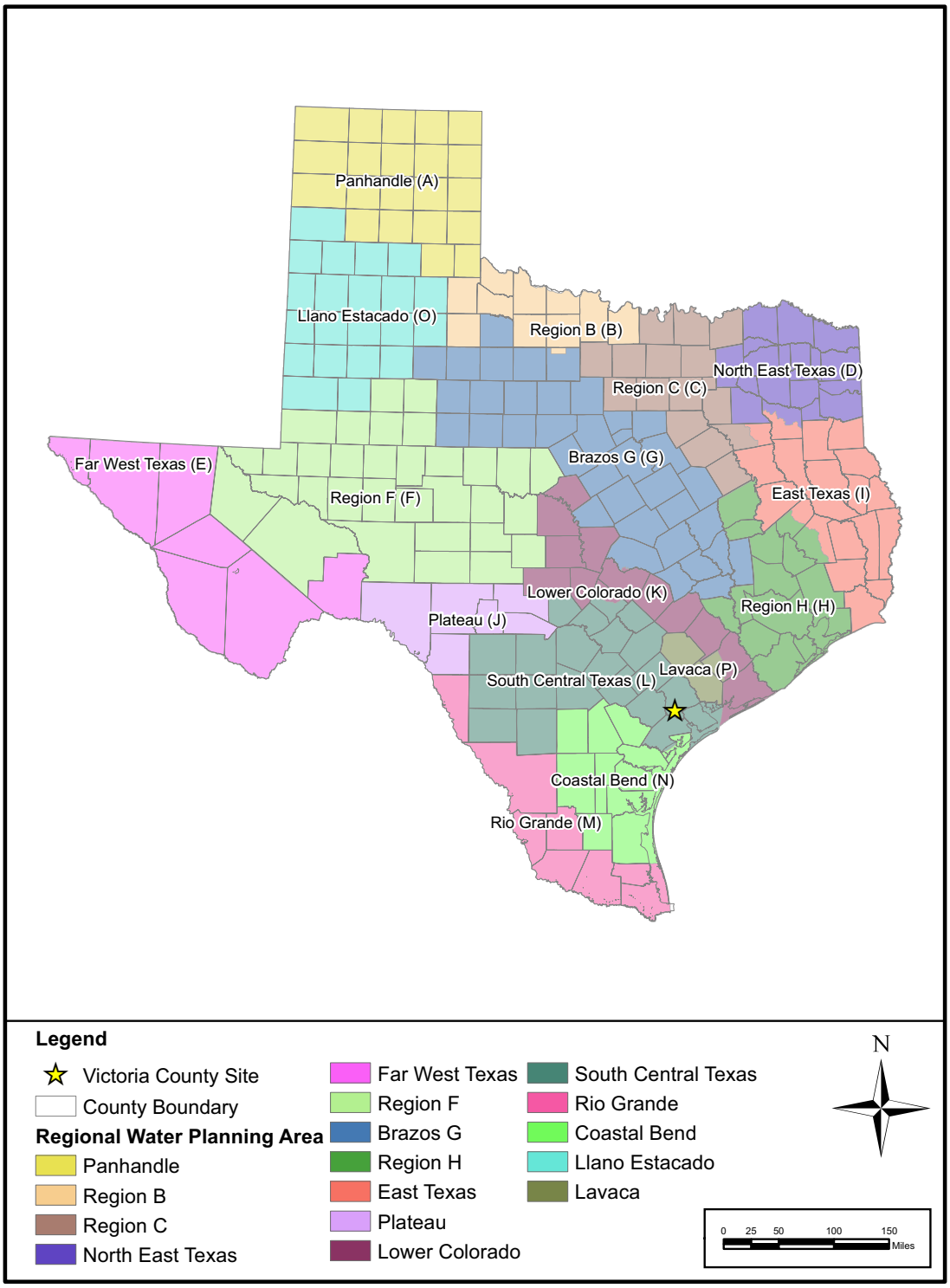


Figure 2.5.2-15 Regional Water Planning Areas

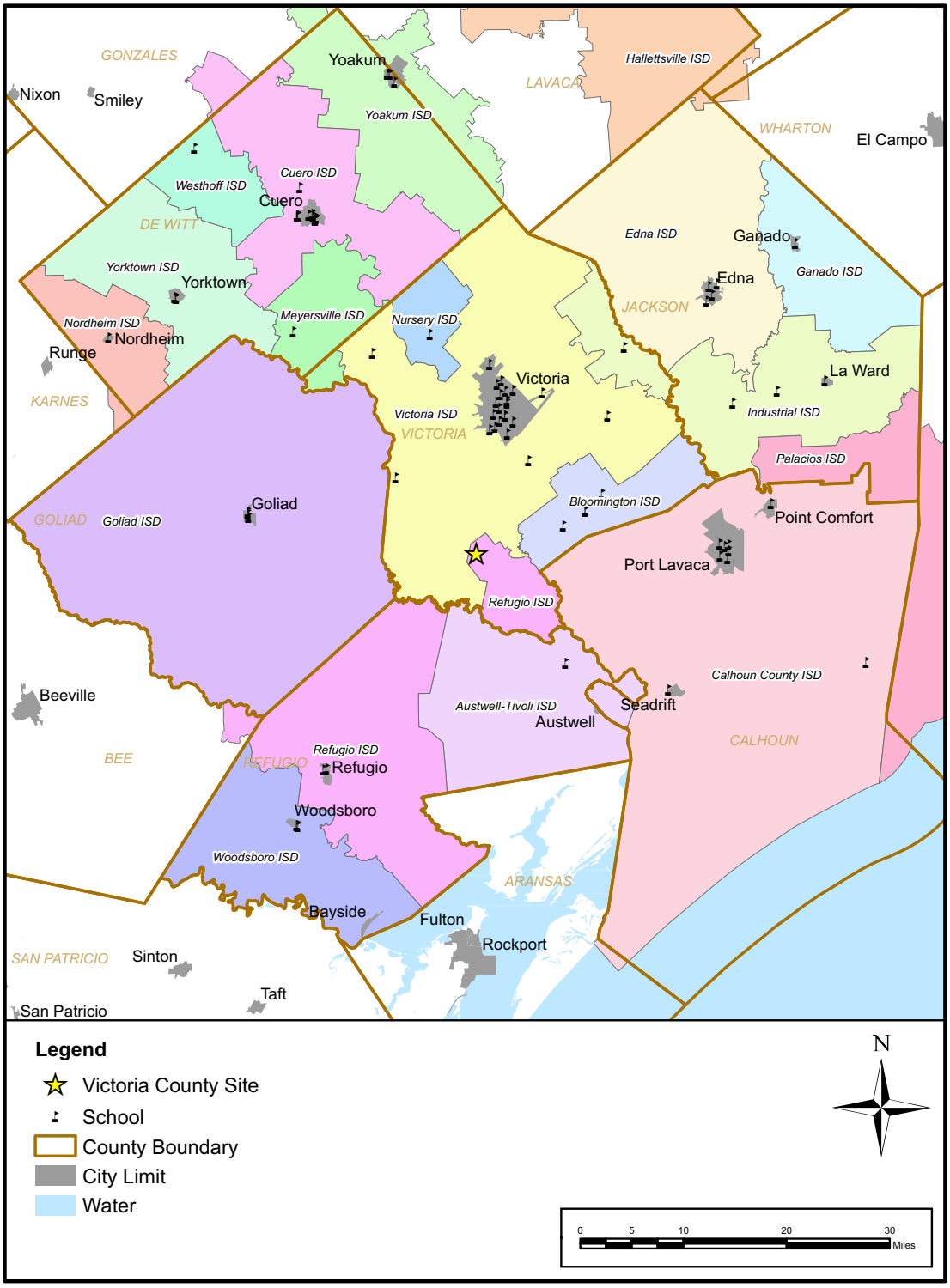


Figure 2.5.2-16 Public Schools and Independent School Districts

2.5.3 Historic Properties

2.5.3.1 Applicable Federal and State Historic Preservation Regulations

The NRC, a federal agency, would issue the combined construction and operating license for VCS Units 1 and 2; thus, the project is subject to review and consultation under the National Historic Preservation Act (16 U.S.C. § 470 et seq.). In particular, Section 106 of the Act applies, along with the section's implementing regulations, 36 CFR Part 800. These regulations apply to resources determined potentially eligible or eligible for listing on the National Register of Historic Places. The state of Texas' Government Code, Title 4, Chapter 442, Texas Historical Commission, Subsection 442.006(f) protects recorded Texas historic landmarks. State archeological landmarks are protected under the state of Texas' Natural Resources Code Title 9, Chapter 191, Antiquities Code. Historic Texas Cemeteries do not have specific protection. However, burials at any historic cemetery (dated post-1700) located on state, municipal, or private lands are protected by the Texas Health and Safety Code, Title 8, Chapters 694–715. Prehistoric burials located on state, municipal, or private lands do not have any additional protection, other than as an archaeological site, as addressed through the Antiquities Code.

The project currently does not include any federal land. If the transmission line corridor is designed in such a way that federal land is included in the right-of-way, then additional cultural resource regulations would pertain to cultural resources located on the federally owned land in the right-of-way. These regulations include the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 et seq.), Archaeological Resources Protection Act (16 U.S.C. 470aa - mm), American Indian Religious Freedom Act (42 U.S.C. 1996), and Archaeological and Historic Preservation Act (16 U.S.C. 469).

2.5.3.2 Consultation with the Texas Historical Commission

Exelon has consulted with the Texas Historical Commission (THC) and the Texas State Historic Preservation Officer regarding the project and cultural resource investigations associated with land selected for VCS and their results. Exelon held an initial meeting with the THC in December 2007 to introduce the site and to consult on planned Phase 1a investigations. The Phase 1a investigations would help define the areas of potential effect (APEs) for the project, and determine the follow-on Phase 1b (intensive inventory and initial evaluation) methodology for identifying historic properties (as defined in 36 CFR Part 800) and assessing the potential impact of the project on historic properties within the defined APEs. A copy of the Phase 1a report was provided to the THC in April 2008 for their review. Exelon then met with the THC to discuss the Phase 1a results and the proposed APEs and Phase 1b methodology. In May 2008, Exelon submitted a letter to the THC officially describing the proposed project APEs and Phase 1b investigation methodology (see Appendix 1B). The THC responded with a letter on May 8, 2008, concurring with the determination of the APEs and Phase 1b methodology (see Appendix 1B). The THC responded on May 29, 2008, with concurrence on the methodologies and findings presented in the Phase 1a report (see Appendix 1B). Once Phase 1b investigations are completed and a report of the results prepared, Exelon will submit the report and its determination of effects to historic properties to the THC for consultation. In July 2008, Exelon submitted a letter to the

THC describing the proposed APE and Phase 1a and 1b investigation methodologies for the makeup water pipeline.

2.5.3.3 Cultural Resource Investigations

2.5.3.3.1 Phase 1a Investigations for the VCS Site and the Definition of the Site APEs and Phase 1b Methodology

In consultation with the THC, Exelon conducted Phase 1a investigations to help define the APEs and determine Phase 1b methodologies to identify historic properties and assess potential impacts. The Phase 1a investigations were conducted by Geo-Marine, Inc. personnel who meet and exceed the professional qualifications stipulated in the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (36 CFR Part 61) (48 FR 44716 – 44742). The Phase 1a investigations were overseen by Tetra Tech, Inc. personnel who also meet and exceed the professional qualifications stipulated in the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation.*

The Phase 1a investigations addressed the 11,532-acre VCS site and the vicinity within 10 miles surrounding the site. The Phase 1a investigations included background research, geoarchaeological investigations, line-of-sight analysis, and a windshield survey. Background research was conducted to identify previously recorded cultural resources located on and near the VCS site, to develop prehistoric and historic cultural contexts, to define the cultural landscape initially, and to identify areas as having low, moderate, or high potential to contain prehistoric and historic archaeological resources. A review of pertinent archaeological and historical resources records was conducted, which included the Texas Archeological Sites Atlas and Texas Historic Sites Atlas. A review was also conducted of primary sources such as historic maps and historic pictorial publications, and secondary sources such as published archaeological and historic research concerning the region, county histories, research monographs, and previous cultural resource investigations. Geoarchaeological investigations were conducted through excavation of backhoe trenches located across the VCS site and analysis of exposed soil profiles to identify soil structures with the potential to contain archaeological resources, specifically with a focus on dynamic Holocene-aged depositional environments. The area surrounding the site, in which historic properties could have a view of the VCS structures, was determined by a line-of-sight analysis that was conducted using GIS and considered site topography, distance, and proposed structures. A windshield survey to locate historic structural resources was conducted in the area within 10 miles of the site to further clarify potential line-of-sight with regard to topography, vegetation, and orientation, and to perform initial identification of historic-age (i.e., greater than 50 years) properties.

Two APEs for historic properties were identified by the Phase 1a investigations that could potentially be affected by the construction of VCS: (1) the APE for physical disturbances and (2) the APE for visual effects (Figure 2.5-1). The APE for physical disturbances is estimated to be about 8386 acres on site based on the anticipated location and extent of areas required for all VCS construction activities within

the 11,532-acre site. A 100-foot-wide buffer area along the GBRA water storage reservoir's east side is included in this APE to capture additional area that could potentially receive indirect impacts during construction activities.

The Phase 1a report recommended a strategy for the Phase 1b archaeological survey of the APE for physical disturbances. The Phase 1a investigations determined that much of the site is located on a Pleistocene terrace, where the antiquity and relative geological stability of the formation tend to result in low potential for buried or intact surface archaeological resources. The strategy included a 10% sample survey of these uplands (806 acres), with one shovel test measuring approximately 1 foot in diameter and 2.6 feet deep excavated every 2 acres. A more intensive survey was recommended around a wetland area (248 acres) and along the lower, deeply incised portion of Dry Kuy Creek (248 acres), with shovel testing in a 30-meter grid. An intensive archaeological survey was also recommended for four valley margin locations (248 acres) where background research had indicated the presence of historic homesteads. These four locations would include shovel testing in a standard 30-meter grid and metal detector surveys over the areas. All of these areas (a total of 1550 acres) are in the APE for physical disturbances (Figure 2.5-2). Finally, the Guadalupe River valley margin along the eastern side of the site was identified in the Phase 1a investigations as an area with significant potential for buried cultural material. Based upon its designation as a high potential area, an intensive survey strategy, including shovel testing in a 30-meter grid and targeted backhoe trenching, was recommended for this area. Only the western portion of the valley margin area included in the Phase 1a investigations is included in the APE for physical disturbances.

The APE for visual effects to historic property settings extends 10 miles beyond the VCS facilities, including the power block structures and the dikes surrounding the cooling basin and GBRA water storage reservoir. This 10-mile radius APE was recommended in the Phase 1a report based on investigations using GIS line-of-sight analysis, complemented by field visits to identify topography, orientation, vegetation, and distance factors. It was found that beyond 10 miles, potential visibility of proposed VCS structures would rapidly diminish due to changes in elevation gradient, back slopes, and land cover. The Phase 1a report recommended a Phase 1b strategy of intensive windshield survey covering all accessible roads in the APE to identify potentially eligible architectural properties and to assess visual impact. The Phase 1a report also recommended recording and evaluating the rural historic landscape as a resource. The strategy recommended for this study included archival research, field survey, and ethnographic interviews.

Exelon provided the Phase 1a investigations report to the THC for review, and met with the THC in April 2008 to discuss the results and the proposed Phase 1b methodology. Exelon submitted a letter to the THC formally proposing the two APEs and the Phase 1b methodology. The THC responded with a letter on May 8, 2008, concurring with the determination of the APEs and Phase 1b methodology. The THC responded on May 29, 2008, with concurrence on the methodologies and findings included in the Phase 1a report.

2.5.3.3.2 Phase 1b Investigations for the VCS Site

Exelon conducted the Phase 1b investigations of the VCS site from May 12 to June 17 of 2008. The methodology implemented complied with the methodology proposed in the Phase 1a report, which was concurred with by the THC and is described in Subsection 2.5.3.3.1.

2.5.3.3.3 Definition of APEs and Phase 1a and 1b Methodologies for Offsite Areas

Exelon consulted with the THC regarding the heavy haul road and cooling basin blowdown pipeline. The APE for offsite physical disturbances measures 272 acres and was defined based on the anticipated location and extent of offsite areas required for all associated construction activities. The APE for visual effects to historic property settings is within the 10-mile radius defined for the onsite features because no structures taller than those in the power block would be built. The Phase 1a and 1b investigations will include site files research and an archaeological survey with 30-meter interval shovel testing for the entire APE for physical disturbances with targeted backhoe trenching in deep Holocene-aged depositional environments. This is due to the location of these project features within the Guadalupe River valley, which was identified during the VCS site Phase 1a investigations as an area with significant potential for buried cultural resources. A visual impact analysis will also be conducted. Exelon will submit a letter to the THC formally proposing the APE and methodology for Phase 1b survey of these offsite areas.

Exelon also consulted with the THC regarding the makeup water pipeline. The APE for offsite physical disturbances measures 242 acres and was defined based on the anticipated location and extent of offsite areas required for all associated construction activities. The Phase 1a and 1b investigations will include site files research and an archaeological survey with 30-meter-interval shovel testing of undisturbed portions of the entire APE for physical disturbances with targeted backhoe trenches excavated in the corridor near the crossing of the Victoria Barge Canal, the Guadalupe River, and other drainages. In July 2008, Exelon submitted a letter to the THC formally proposing the APE and methodology for Phase 1a and 1b survey of these offsite areas.

2.5.3.3.4 Transmission Line Study Area

Identification of cultural resources in the transmission line corridor is considered separately from other offsite areas described above in Subsection 2.5.3.3.3. The specific location of the transmission line right-of-way has not yet been determined. Once a location has been determined by the Public Utility Commission of Texas, and before initiation of construction activities, cultural resource investigations would be conducted by the transmission service provider to identify historic properties and assess the effects to these properties from constructing the transmission line in the vicinity.

A study was conducted for the transmission line area to identify known cultural resources. The study included research in the National Register of Historic Places, county architecture survey files, historic architecture reports on file at the THC, Texas Historic Sites Atlas, and Texas Archaeological Sites Atlas. Results are reported below in Subsection 2.5.3.9.

2.5.3.4 Cultural Resources in the Two VCS Site APEs

2.5.3.4.1 Resources in the APE for Physical Disturbances

The archaeological survey and shovel testing of the upland, wetland, and Dry Kuy Creek areas of the VCS site did not reveal prehistoric or historic cultural materials. All excavated shovel tests were able to reach subsoil, thus deep trenching via backhoe was not necessary.

The archaeological survey within the Guadalupe River valley margin and the four historic homestead areas of the VCS site resulted in discovery of three prehistoric sites, two historic sites, and three prehistoric localities. A site was defined when materials were recovered from two or more shovel tests or, for surface material, when five or more artifacts were found within a 20-meter square area. Artifact clusters not meeting the criteria for site were given the designation “locality.” All eight of the identified resources are recommended as not eligible for the National Register of Historic Places due to lack of integrity, lack of intact features, and/or low artifact density. The eight resources are listed in Table 2.5-1.

2.5.3.4.2 Resources in the APE for Visual Effects

The survey of the visual effects APE, which is a 10-mile radius surrounding the VCS site, recorded 455 historic resources, including individual buildings and structures, farmsteads, and homesteads. Of the 455 historic resources, 73 are recommended as eligible for listing on the National Register of Historic Places. These eligible historic properties are clustered in the locations of McFaddin, Tivoli, Guadalupe, and Victoria. They include 58 domestic dwellings, four agricultural outbuildings, two businesses, two industrial facilities, five churches, one post office, and one cemetery. Twenty-six of the 73 historic properties comprise a proposed Town of McFaddin Historic District. This district and the eligible resources that comprise it are also contributing properties to the McFaddin Ranch Rural Historic Landscape.

2.5.3.4.3 Rural Historic Landscape

The Phase 1b investigations included identifying, recording, and evaluating the McFaddin Ranch Rural Historic Landscape. This landscape includes areas both on the VCS site and areas in the vicinity of the site, thus this resource is located in both the physical disturbances APE and the visual effects APE. The McFaddin Ranch is recommended as eligible for listing on the National Register of Historic Places under Criteria A and B for its associations with the cattle ranching and petroleum industries and with James A. McFaddin and Claude K. McCan, Sr. The period of significance extends from 1878, when James McFaddin established the ranch, to 1968, when the Victoria cattle breed received official recognition. The resource is comprised of the natural landscape and many ranching and petroleum industry features located on the ranch, including the road network, windmills, cisterns, water troughs, water features, creeks, culverts, bridges, gates, fences, cattle guards, well heads, and pipelines. A total of 329 such features date to the period of significance and are considered contributing features to the historical significance of this rural historic landscape. The proposed Town of McFaddin Historic District and the 26 properties that comprise it are also contributing properties to this rural historic landscape.

The full results of the Phase 1b investigations will be provided for NRC review after the submission of this COL Application.

2.5.3.5 Cultural Resources in the Offsite Areas

The results of the Phase 1a and 1b investigations in the offsite areas will be incorporated into the COL Application when available. The full results of the Phase 1a and 1b investigations in the VCS offsite areas will be provided for NRC review after the submission of this COL Application.

2.5.3.6 Native American Consultation

Exelon consulted with the THC to identify Native American groups who consider themselves to be culturally affiliated with the area that encompasses the VCS site and offsite areas. The information provided by the THC led to the identification of six groups with potential cultural concerns within the VCS site and offsite project areas. These groups include the Alabama-Coushatta Tribe of Texas, Comanche Tribe of Oklahoma, Kiowa Tribe of Oklahoma, Mescalero Apache Tribe, Tonkawa Tribe of Oklahoma, and the Wichita and affiliated tribes.

2.5.3.7 Significant Cultural Resources within 10 Miles of the VCS Site

There are five types of designations in Texas to recognize and protect significant historic and prehistoric properties—two are federal and three are state designations. The National Park Service designates areas as National Historic Landmarks and properties listed on the National Register of Historic Places. The THC offers three designations: recorded Texas historic landmark, state archeological landmark, and historic Texas cemetery. Each of the four counties within 10 miles of the site (Victoria, Goliad, Refugio, and Calhoun) has a County Historical Commission, but they do not have their own designations, nor do they maintain a separate listing of important cultural properties.

A search of records maintained by the National Park Service, THC, and Texas Archeological Research Laboratory was conducted to identify significant cultural resources located within 10 miles of the site. Forty-six such resources were identified and are described below.

The National Register, which is maintained by the National Park Service, is the official list of national historic landmarks and National Register properties. There are no National Historic Landmarks or National Register-listed properties within 10 miles of the VCS site (NPS 2008a and 2008b).

The Texas Historic Sites Atlas, which is maintained by the THC, contains the lists of recorded Texas historic landmarks and historic Texas cemeteries located in Victoria, Refugio, Calhoun, and Goliad counties (THC 2008a, 2008b, 2008c, and 2008d). There are no designated Historic Texas Cemeteries within 10 miles of the VCS site. There are four landmarks within the 10 miles. These four properties are listed in Table 2.5-2.

The Texas Archeological Research Laboratory is located at the University of Texas at Austin. This facility maintains the records of state archeological landmarks and records of all previously recorded archaeological sites located in the state. There are no state archeological landmarks within 10 miles of

the VCS site. There are 42 previously recorded archaeological sites located within 10 miles of the site. These sites are listed in Table 2.5-3.

2.5.3.8 Significant Cultural Resources within 1.2 Miles of the Offsite Areas

A search of records maintained by the National Park Service, THC, and Texas Archeological Research Laboratory was conducted to identify significant cultural resources located within 1.2 miles of the offsite areas, including the heavy haul road, cooling basin blowdown pipeline, and makeup water pipeline. There are no national historic landmarks, National Register-listed properties, recorded Texas historic landmarks, historic Texas cemeteries, or state archeological landmarks within a 1.2-mile radius of the offsite areas (NPS 2008a and 2008b; THC 2008a, 2008b, 2008c, and 2008d).

There are 13 previously recorded archaeological sites located within 1.2 miles of the offsite areas. These sites are listed in Table 2.5-4.

2.5.3.9 Cultural Resources in the Transmission Line Study Area

The research of previously recorded cultural resources in the transmission line study area identified 121 historic architectural resources, 44 cemeteries, 45 recorded Texas historic landmarks, and 241 archaeological sites, of which 30 are state archaeological landmarks. This research did not include the more recently added transmission line to the Cholla substation, 20 miles north of VCS.

The 121 historic architectural resources were identified during a series of county-wide surveys conducted under the supervision of the THC. Generally, these county-wide building surveys represent a non-systematic attempt to document what were considered to be historically and architecturally significant structures. Thus, each of the architectural resources examined is listed on the National Register of Historic Places. The resources include mostly homes, but also courthouses, religious buildings (churches, temples), commercial buildings, a school, a windmill, and four historic districts. The resources are located in the towns of Victoria (111), Goliad (9), and Edna (1).

The 44 cemeteries are located in the counties of Victoria (9), Goliad (3), Jackson (26), Matagorda (5), and Wharton (1).

The 45 Recorded Texas Historic Landmarks include some of the historic architectural resources and cemeteries discussed above, plus others. The landmarks include homes, cemeteries, religious buildings, townsites, places of important events such as duels and battles, and community buildings.

The 241 archaeological sites come from both the historic and prehistoric periods. There are a total of 72 sites pertaining to the historic period, 16 to both the prehistoric and historic periods, and 153 to the prehistoric period. Of the 153 prehistoric sites identified, 43 were either potentially eligible for the National Register, already listed on the National Register, or recommended for further work to clarify their eligibility for the National Register. Seventy-nine sites have no recommendation at all. The remaining 31 sites were either recommended for no further work or not eligible for inclusion on the National Register. Many of the sites were identified and excavated in the 1960s and 1970s during the early days of compliance with the National Historic Preservation Act. Accordingly, the National Register

assessments for these sites are often problematic because they are rarely clearly defined, if defined at all. Prehistoric site types represented include occupation or campsites, shell middens, lithic or other artifact scatters, and quarries. These prehistoric archaeological sites are located in Victoria (36), Goliad (27), and Jackson (90) Counties.

Historic archaeological sites consist of artifact scatters, house sites, cemeteries, a kiln, a fort, a battlefield, a shipwreck, and a bridge. Of the 72 historic sites identified, 32 were either potentially eligible for the National Register, already listed on the National Register, or recommended for further work to clarify their eligibility for the National Register. Nineteen of the sites have no recommendation at all. The remaining 21 sites were either recommended for no further work or not eligible for inclusion on the National Register. These historic archaeological sites are located in the counties of Victoria (9), Goliad (1), and Jackson (62).

The 16 combination prehistoric/historic sites include prehistoric and historic artifact scatters, historic houses, and a historic cemetery. Eleven of the sites are either recommended for further work or potentially eligible for the National Register. Three had no recommendation at all, and two were recommended for no further work. These archaeological sites are located in the counties of Victoria (3), Goliad (1), and Jackson (12).

Of the 241 archaeological sites located in the transmission corridor study area, 30 were deemed to be sufficiently significant to be listed as state archeological landmarks. However, of these 30 landmarks, only two are listed on the National Register and only two others are recommended for further work to clarify their National Register status. Of the remaining 26, four have a recommendation of “no further work” while the remaining 22 have no National Register recommendation. The landmarks consist of 26 prehistoric sites, three historic sites, and a combination prehistoric/historic site. The landmarks include prehistoric lithic scatters, shell middens, campsites, historic houses, cemeteries, artifact scatters, a fort, and a steamboat. The state archeological landmarks are located in the counties of Goliad (19), Jackson (1) and Victoria (10).}

The distribution of sites within the transmission corridor study area is skewed because only a small portion of the study area has been surveyed, resulting in incomplete survey coverage and data. Approximately 12% fall in Goliad County, another 20% fall in Victoria County, and the remaining 68% fall in Jackson County. Although incomplete coverage may skew the site distribution, some general patterns have been observed in the distribution of sites. Prehistoric sites tend to cluster near water sources, such as river floodplains, and natural resources, like chert outcroppings, while historic archaeological sites will group around transportation centers, like railroads and bridges. However, agricultural sites associated with the historic period can be more widely spread. Sites from both the prehistoric and historic periods are prevalent on high, level land within a short distance to a reliable water source.

A smaller recommended corridor, approximately 3 miles wide, was delineated in the study area in response to environmental resource location data, including the locations of the cultural resources

described above for the study area. This smaller corridor avoids most of the known cultural resources described above by avoiding high resource concentration areas around Coleto Creek Reservoir and Lake Texana. This corridor also minimizes drainage crossings, which is important for cultural resources because, in this region, drainage crossings tend to have a high potential for archaeological sites. Finally, the smaller corridor also minimizes the proximity to developed areas such as towns. This is important for cultural resources because developed areas are where important architectural resources are likely to be located.

2.5.3.10 **References**

NPS 2008a. National Park Service, *National Historic Landmarks Survey, Listing of National Historic Landmarks by State, Texas (46)*, available at http://www.nps.gov/history/nhl/designations/listsofNHLs.htm, accessed April 9, 2008.

NPS 2008b. National Park Service, *National Register of Historic Places, Victoria County, Goliad County, Calhoun County, and Refugio County*, available at http://www.nr.nps.gov/iwisapi/explorer.dll/x2_3anr4_3aNRIS1/script/report.iws, accessed April 7, 2008.

THC 2008a. Texas Historical Commission, *Texas Historic Sites Atlas, Victoria County*, available at http://atlas.thc.state.tx.us, accessed April 7, 2008.

THC 2008b. Texas Historical Commission, *Texas Historic Sites Atlas, Refugio County*, available at http://atlas.thc.state.tx.us, accessed April 7, 2008.

THC 2008c. Texas Historical Commission, *Texas Historic Sites Atlas, Calhoun County*, available at http://atlas.thc.state.tx.us, accessed April 7, 2008.

THC 2008d. Texas Historical Commission, *Texas Historic Sites Atlas, Goliad County*, available at http://atlas.thc.state.tx.us, accessed April 7, 2008.

Table 2.5-1
Recorded Archaeological Resources on the VCS Site

Resource Identifier	Size (m^2)	Temporal Affiliation	NRHP Eligibility
VCS-001	7,225	Historic 19th century	Not eligible
VCS-002	2,700	Historic 19th century	Not eligible
VCS-003	10	Unspecified prehistoric	Not eligible
VCS-004	100	Unspecified prehistoric	Not eligible
VCS-005	200	Unspecified prehistoric	Not eligible
Locality 1	10	Unspecified prehistoric	Not eligible
Locality 2	10	Unspecified prehistoric	Not eligible
Locality 3	20	Unspecified prehistoric	Not eligible

Table 2.5-2
Recorded Texas Historic Landmarks Within 10 Miles of the VCS Site

Resource Name	Description	Location	Approximate Distance to Site
McFaddin Mercantile	1910 board-and-batten building	McFaddin	½ mile S
McFaddin Post Office	1913 board-and-batten building	McFaddin	½ mile S
Infant Jesus of Prague Catholic Church	1916 redwood church	McFaddin	½ mile S
T-C Ranch House	1874 ranch house	US 77, 25 miles north of Refugio	5 miles SW

Source: THC 2008a, 2008b

Table 2.5-3 (Sheet 1 of 2)
Previously Recorded Archaeological Sites within 10 Miles of the VCS Site

Site Number	Description	County
41CL59	Archaic shell midden, lithic scatter	Calhoun
41CL60	Archaic shell midden, artifact scatter	Calhoun
41CL61	Archaic shell midden	Calhoun
41CL62	Archaic shell midden, scatter of lithic, bone, and ceramic artifacts	Calhoun
41CL63	Archaic shell midden, lithic scatter	Calhoun
41CL75	prehistoric shell midden	Calhoun
41CL76	prehistoric shell midden	Calhoun
41CL77	prehistoric shell midden, scatter of lithic, ceramic, and historic artifacts	Calhoun
41CL80	prehistoric shell midden	Calhoun
41GD136	prehistoric camp, lithic and bone scatter	Goliad
41GD137	Early Archaic camp, lithic scatter	Goliad
41GD138	prehistoric camp, lithic and bone scatter	Goliad
41RF15	prehistoric lithic scatter, 19th century homestead	Refugio
41RF17	prehistoric lithic scatter	Refugio
41VT9	prehistoric burials, artifact scatter	Victoria
41VT12	unknown	Victoria
41VT65	de la Garza homestead	Victoria
41VT78	prehistoric burial	Victoria
41VT79	prehistoric camp, artifact scatter	Victoria
41VT80	Eagles Roost, prehistoric shell midden, lithic scatter	Victoria
41VT81	prehistoric habitation, artifact scatter	Victoria
41VT82	prehistoric bone and lithic scatter	Victoria
41VT83	prehistoric artifact scatter	Victoria
41VT84	prehistoric shell midden	Victoria
41VT85	prehistoric shell midden, Clovis point	Victoria
41VT86	prehistoric shell midden, artifact scatter	Victoria
41VT87	prehistoric shell midden	Victoria
41VT88	prehistoric lithic scatter	Victoria
41VT89	unknown	Victoria
41VT94	Blue Bayou, prehistoric cemetery, prehistoric to historic habitation	Victoria
41VT95	prehistoric quarry	Victoria
41VT98	Archaic cemetery and habitation	Victoria
41VT99	prehistoric camp, quarry	Victoria
41VT101	prehistoric lithic scatter	Victoria
41VT102	prehistoric lithic scatter	Victoria

Table 2.5-3 (Sheet 2 of 2)
Previously Recorded Archaeological Sites within 10 Miles of the VCS Site

Site Number	Description	County
41VT103	prehistoric lithic scatter	Victoria
41VT113	Dalton Bridge	Victoria
41VT115	prehistoric lithic scatter	Victoria
41VT116	unknown	Victoria
41VT117	prehistoric lithic scatter	Victoria
41VT118	Civil War-era homestead	Victoria
41VT119	prehistoric shell midden, lithic scatter	Victoria

Table 2.5-4
Previously Recorded Archaeologial Sites Within 1.2 Miles of the Offsite Areas

Site Number	Description	County
41CL59	Archaic shell midden, lithic scatter	Calhoun
41CL77	shell midden, scatter of lithic, ceramic, and historic artifacts	Calhoun
41CL78	prehistoric shell midden, lithic scatter	Calhoun
41CL79	prehistoric shell midden with lithic, ceramic, and historic artifacts	Calhoun
41VT9	Burials, artifact scatter	Victoria
41VT79	prehistoric camp, artifact scatter	Victoria
41VT94	Blue Bayou prehistoric cemetery	Victoria
41VT98	Archaic cemetery and habitation	Victoria
41VT99	prehistoric camp, quarry	Victoria
41VT101	prehistoric lithic scatter	Victoria
41VT102	prehistoric lithic scatter	Victoria
41VT103	prehistoric lithic scatter	Victoria
41VT113	Dalton Bridge	Victoria

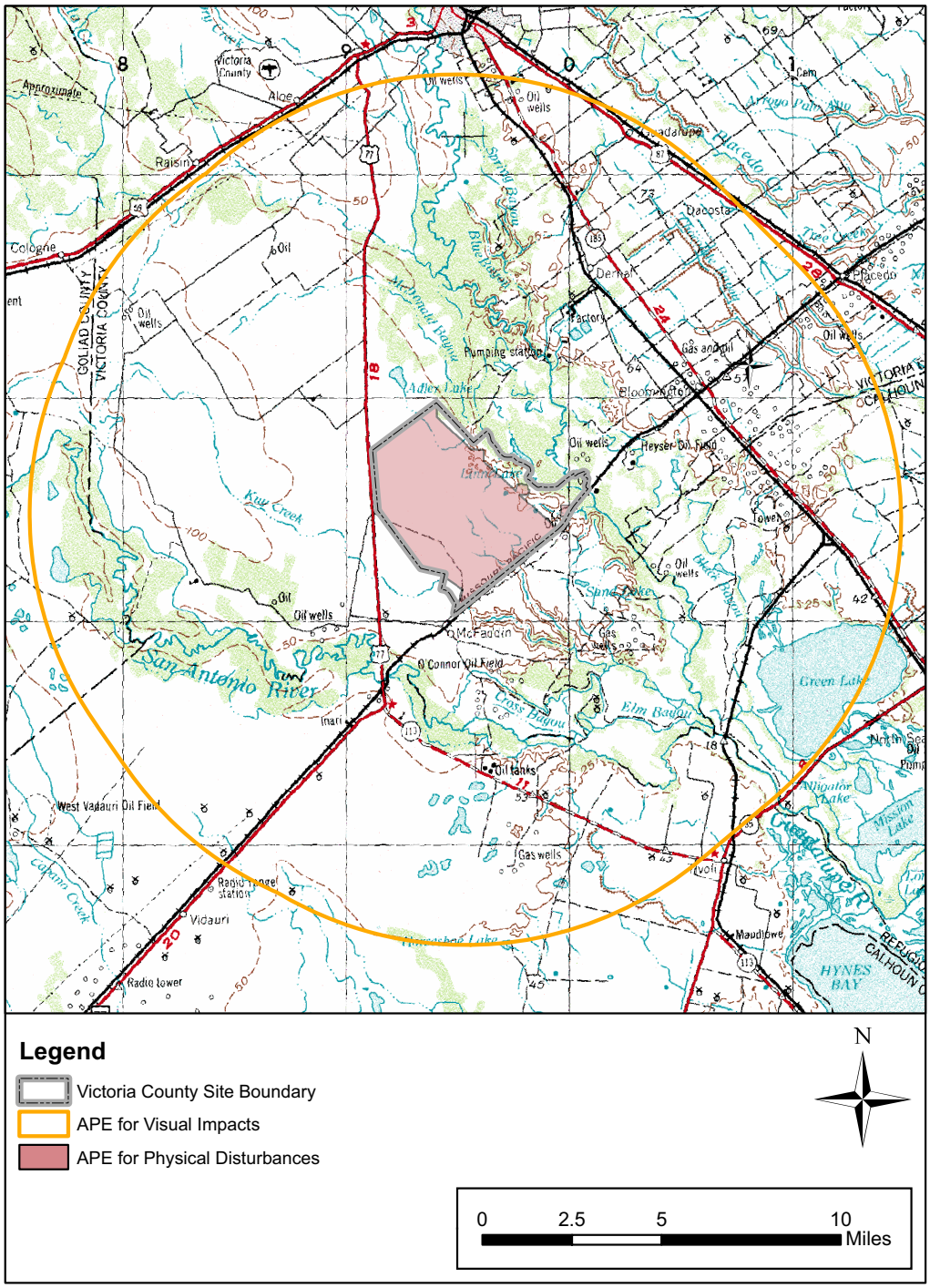


Figure 2.5-1 Areas of Potential Effect (APE)

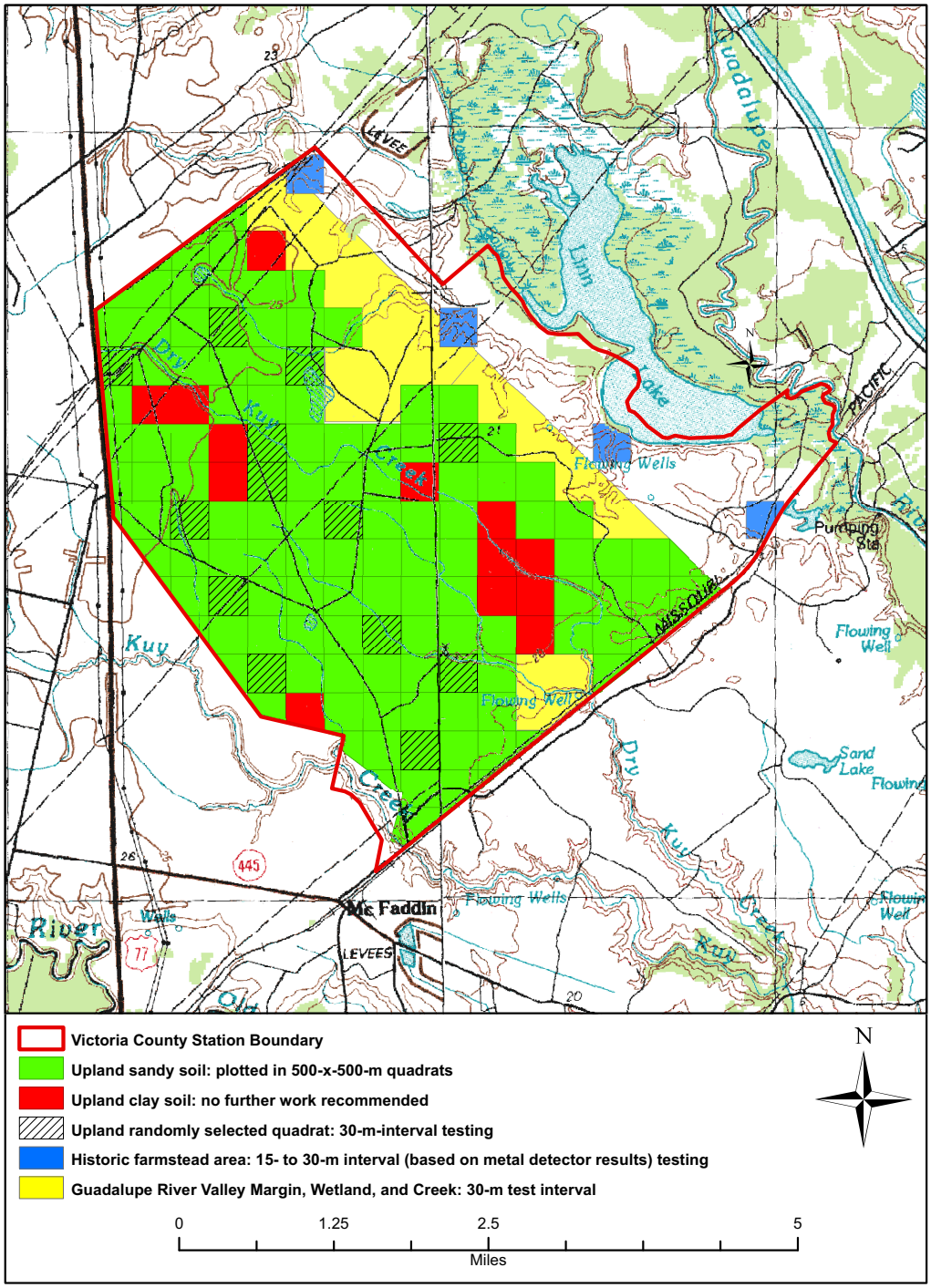


Figure 2.5-2 Location of Phase 1b Archaeological Survey Areas

2.5.4 Environmental Justice

2.5.4.1 Methodology

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (U.S. EPA Feb 2008). Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental impacts led President Clinton to issue Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." This order directs federal agencies to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Council on Environmental Quality has provided guidance for addressing environmental justice (CEQ Dec 1997). The NRC has also issued guidance on environmental justice analysis in "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" (U.S. NRC May 2004). Exelon used NRC guidance in determining the minority and low-income composition in the environmental impact area.

The NRC previously concluded that a 50-mile radius could reasonably be expected to contain the area of potential impact and that the state was appropriate as the geographic area for comparative analysis. The NRC's methodology identifies minority and low-income populations within the 50-mile region and then determines if these populations could receive disproportionately high adverse impacts from the proposed action. Exelon has adopted this approach for identifying the minority and low-income populations and associated impacts that could be caused by the proposed action. While this subsection identifies the locations of minority and low-income populations in the area surrounding the site, the potential adverse impacts to these groups from construction and operations are identified and discussed in Chapters 4 and 5, respectively.

Exelon used ArcGIS®[1] 9.2 software and U.S. Census Bureau (USCB) 2000 census data to determine minority and low-income characteristics by block group within 50 miles of the proposed VCS site (i.e., the environmental impact area). A census block group is a geographic unit used by the USCB, which is between the census tract and the census block. There are, on average, about 39 blocks in a block group. Exelon included a block group if any part of its occupied area fell within 50 miles of the proposed site. A total of 216 block groups were identified within the 50-mile area. Consistent with NRC guidance, Exelon defined the geographic area for comparative analysis as the state of Texas.

2.5.4.2 Minority Populations

The NRC's "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" defines minority categories as: American Indian or Alaskan Native, Asian, Native

1. ®ArcGIS is a trademark of Environmental Systems Research Institute, Inc.

Hawaiian or other Pacific Islander, Black races, and Hispanic ethnicity (U.S. NRC May 2004). Additionally, the guidance states that "other" may be considered a separate category and requires that the multiracial and aggregate minority categories be analyzed separately. The guidance also indicates that a significant minority population exists if either of these two conditions exists:

- The minority population of the block group or environmental impact area exceeds 50%.
- The minority population percentage of the environmental impact area is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

Exelon calculated the percentage of the block group's population represented by each minority category for each of the 216 block groups within the 50-mile radius (the environmental impact area), using the USCB 2000 census data, and calculated the percentage in each minority category for the state. If the percentage of any block group minority category exceeded 50% of the total block group population or exceeded its corresponding state percentage by more than 20%, it was identified as containing a significant minority population.

Census data for Texas characterizes 11.5% of the population as Black or African American, 0.6% as American Indian or Alaskan Native, 2.7% as Asian, 0.1% as Native Hawaiian or other Pacific Islander, 11.7% as Other, 2.5% as multiracial (two or more races), 29.0% as aggregate of minority races, and 32.0% as Hispanic ethnicity (USCB 2000a).

Table 2.5.4-1 and Figures 2.5.4-1 through 2.5.4-5 present the results of the analysis. Three census block groups within the 50-mile radius have significant Black or African American populations. However, as shown on Figure 2.5.4-1, none of these block groups are located in Victoria County. One block group, located in Matagorda County, has a significant Asian minority population (Figure 2.5.4-2). Twelve block groups have a significant "Other" race population. As shown on Figure 2.5.4-3, the closest block groups for this category are located directly east of the site in Victoria County and in the city of Victoria.

Nine block groups within the 50-mile radius have significant aggregate minority population percentages (Figure 2.5.4-4). The closest of these are located directly east of the site and in the city of Victoria. Sixty-eight census block groups within the 50-mile radius have significant Hispanic ethnicity populations. Figure 2.5.4-5 shows the location of these block groups, many of which are located in Victoria County. Based on the two criteria established previously, no significant American Indian or Alaskan Native, Native Hawaiian or other Pacific Islander, or multiracial minorities exist in the geographic area. In addition, there are no American Indian reservations within 50 miles of the Victoria County site.

Seasonal agricultural (migrant) workers may make up a portion of the minority population within the 50-mile radius. While migrant worker population counts are not available from USCB, the U.S. Department of Agriculture has collected information on farms that employ migrant labor. Farms in the following Texas counties, which fall wholly or partially within the 50-mile radius, employ migrant labor: Calhoun (2), Colorado (29), DeWitt (10), Goliad (1), Gonzales (7), Jackson (1), Lavaca (11), Matagorda

(72), Nueces (13), Refugio (6), San Patricio (21), and Wharton (40). Aransas, Bee, Karnes, and Victoria counties did not report any farms employing migrant labor (USDA Jun 2004).

2.5.4.3 Low-Income Populations

The NRC guidance defines low-income households based on statistical poverty thresholds (U.S. NRC May 2004). A block group is considered low-income if either of the following two conditions is met:

- The low-income population in the census block group or the environmental impact site exceeds 50%.
- The percentage of households below the poverty level in an environmental impact site is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

Exelon divided USCB low-income households in each census block group by the total number of households for that block group to obtain the percentage of low-income households per block group. Using the state of Texas as the geographical area for comparative analysis, Exelon determined that 14.0% of households are low-income in the state (USCB 2000b). Fourteen census block groups within the 50-mile radius have a significant percentage of low-income households. Table 2.5.4-1 identifies and Figure 2.5.4-6 locates the low-income block groups, none of which are in Victoria County.

2.5.4.4 Potential for Disproportionate Impacts

Exelon contacted local government officials and the staff of social welfare agencies concerning unusual resource dependencies or practices that could result in potentially disproportionate impacts to minority and low-income populations. Contact with multiple agencies in Calhoun, DeWitt, Jackson, Refugio, and Victoria counties was attempted. No appropriate agencies in Goliad County were identified. Many agencies had no information concerning activities and health issues of minority populations. Successful interviews were conducted with the Calhoun County Health Department, the U.S. Department of Agriculture in Calhoun County, the DeWitt County Commerce and Health Department, Family Promise of Victoria, the Health Department of Victoria County, the Neighborhood Services Program in Victoria County, and the United Way of Victoria County. No agency reported dependencies or practices, such as subsistence agriculture, hunting, or fishing, or preexisting health conditions through which the populations could be disproportionately adversely affected by the construction project.

As Figure 2.5.4-2 shows, the area surrounding Palacios has an unusually high percentage of Asian Americans because it is home to a large community of Vietnamese immigrants and their families. Tens of thousands of Vietnamese settled along the Gulf and Atlantic coasts around 1978 to shrimp, crab, fish, and work in seafood processing and wholesaling (Tang Aug 2003). While many in the Vietnamese community make their living by catching seafood, the seafood is generally sold commercially rather than for personal sustenance. No unique preexisting health conditions were identified for this particular community.

2.5.5 References

CEQ Dec 1997. Council on Environmental Quality, *Environmental Justice Guidance Under the National Environmental Policy Act*, December 1997, Executive Office of the President.

Tang Aug 2003. I. Tang, *Still Shrimping: Vietnamese American Shrimpers 25 Years After the Second Wave*, August 29, 2003, Asian Week.

USCB 2000a. U.S. Census Bureau, P3: Race [71] — *Universe: Total Population. Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data*, available at http://factfinder.census.gov, accessed March 15, 2007.

USCB 2000b. U.S. Census Bureau, *P92: Poverty Status in 1999 of Households by Household Type by Age of Householder [59] — Universe: Households. Data Set: Census 2000 Summary File 3 (SF 3) — Sample Data*, available at http://factfinder.census.gov, accessed March 15, 2007.

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U.S. EPA Feb 2008. U.S. Environmental Protection Agency, *Environmental Justice*, available at http://www.epa.gov/compliance/environmentaljustice/index.html, accessed March 4, 2008.

U.S. NRC May 2004. U.S. Nuclear Regulatory Commission, *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues*, NRR Office Instruction No. LIC-203, Revision 1, May 2004.

Table 2.5.4-1
Block Groups within 50 Miles of the Victoria County Site with Significant Minority or Low-Income Populations

County Name	Number of Block Groups	Black	American Indian or Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Some Other Race	Multiracial	Aggregate	Hispanic	Low-Income Households
Aransas	19	0	0	0	0	0	0	0	0	2
Bee	25	1	0	0	0	1	0	1	18	6
Calhoun	17	0	0	0	0	0	0	0	6	0
Colorado	1	0	0	0	0	0	0	0	0	0
De Witt	18	0	0	0	0	0	0	1	1	1
Goliad	6	0	0	0	0	0	0	0	2	0
Gonzales	2	0	0	0	0	0	0	0	0	0
Jackson	11	1	0	0	0	0	0	1	0	0
Karnes	6	1	0	0	0	0	0	1	3	0
Lavaca	7	0	0	0	0	0	0	0	0	0
Matagorda	8	0	0	1	0	2	0	1	2	0
Nueces	1	0	0	0	0	0	0	0	0	0
Refugio	9	0	0	0	0	0	0	0	2	1
San Patricio	21	0	0	0	0	2	0	0	11	4
Victoria	62	0	0	0	0	7	0	4	23	0
Wharton	3	0	0	0	0	0	0	0	0	0
TOTALS:	216	3	0	1	0	12	0	9	68	14

	Black	American Indian or Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Some Other Race	Multiracial	Aggregate	Hispanic	Low-Income Households
Texas Percentages	11.53	0.57	2.70	0.07	11.69	2.47	29.03	31.99	13.98

Note: Highlighted counties are completely contained within the 50-mile radius.

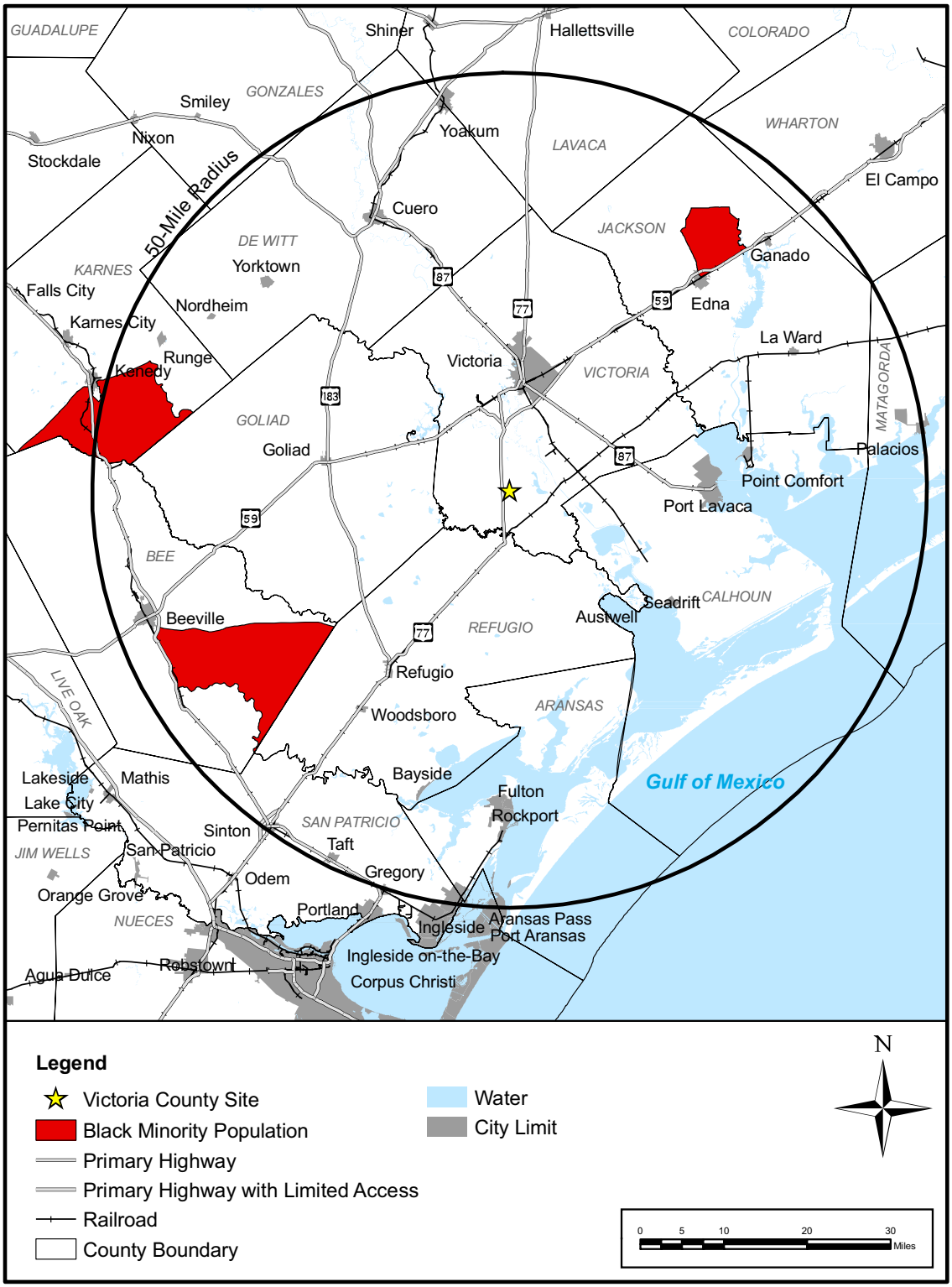

Figure 2.5.4-1 Black Population within the 50-Mile Region

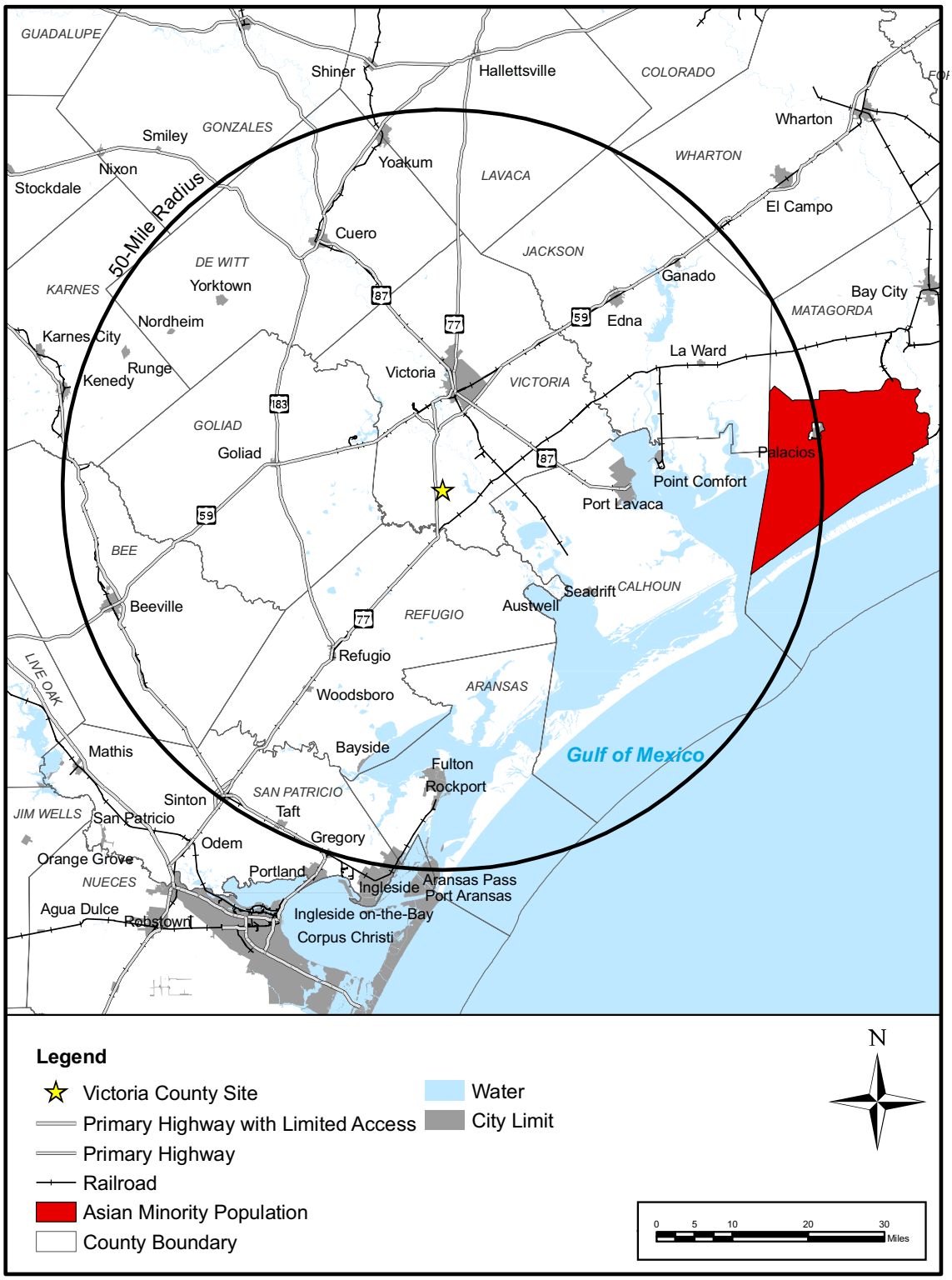

Figure 2.5.4-2 Asian Minority Population within the 50-Mile Region

Figure 2.5.4-3 Other Minority Population within the 50-Mile Region

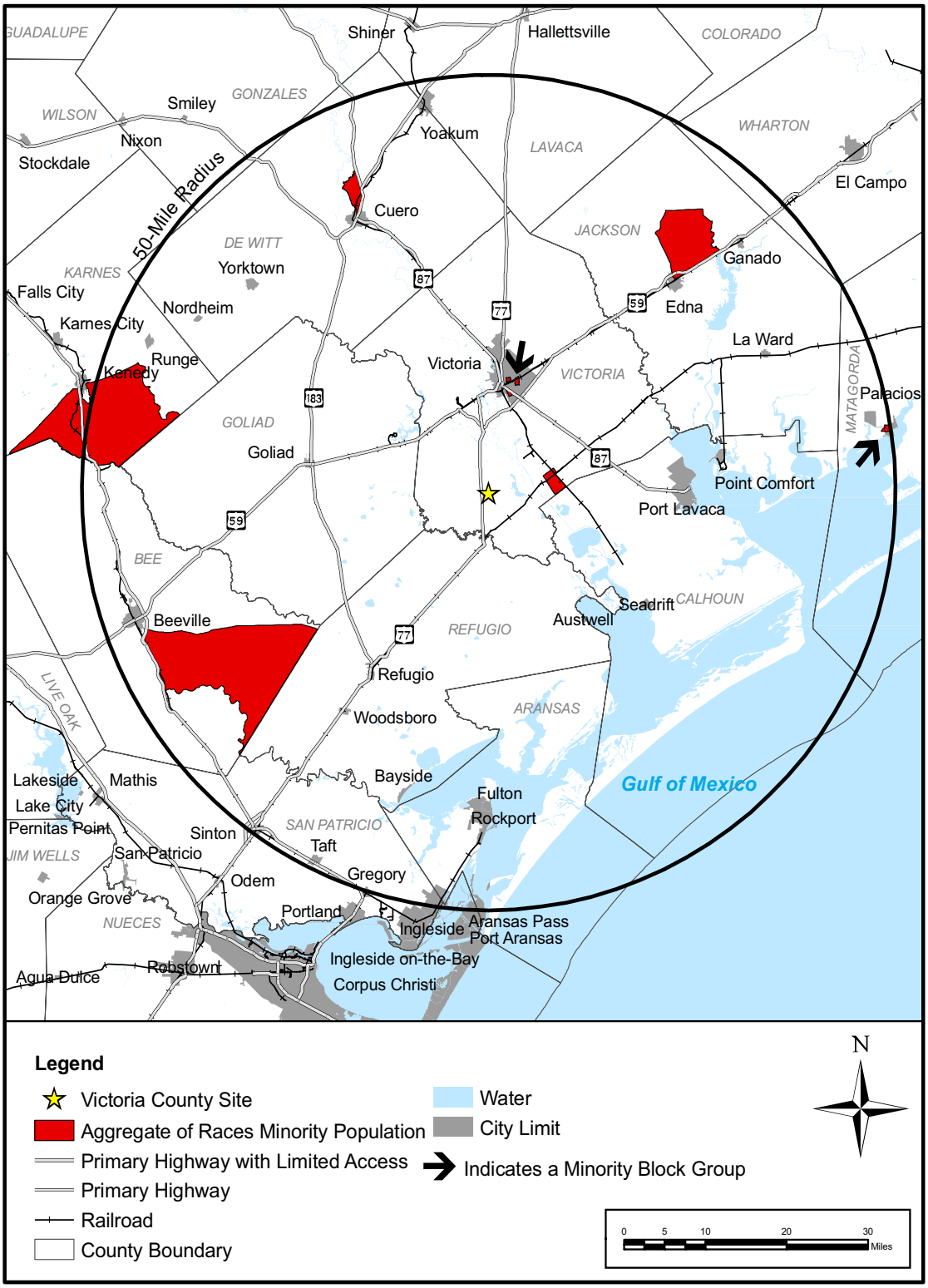

Figure 2.5.4-4 Aggregate of Races Minority Population within the 50-Mile Region

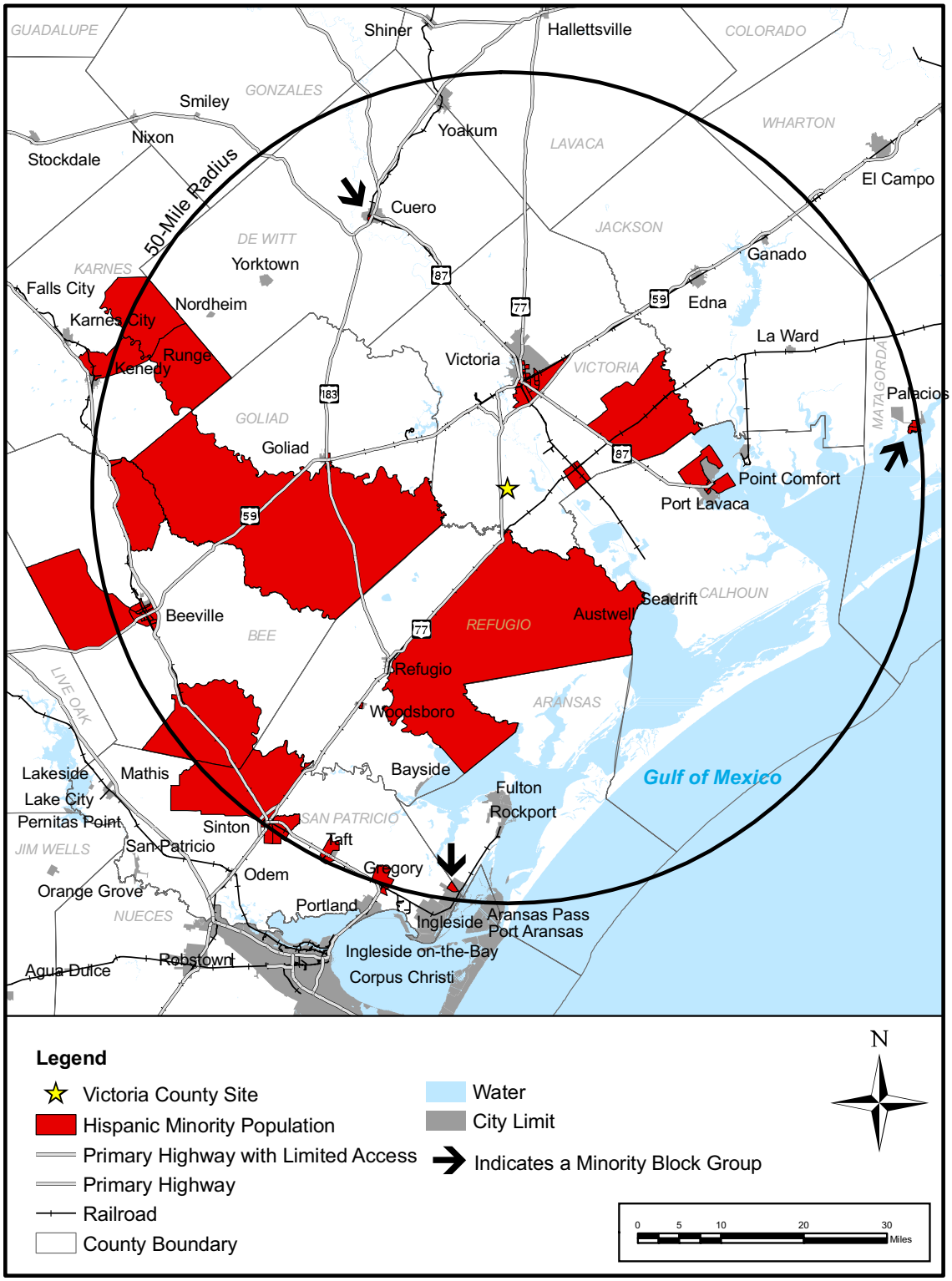

Figure 2.5.4-5 Hispanic Minority Population within the 50-Mile Region

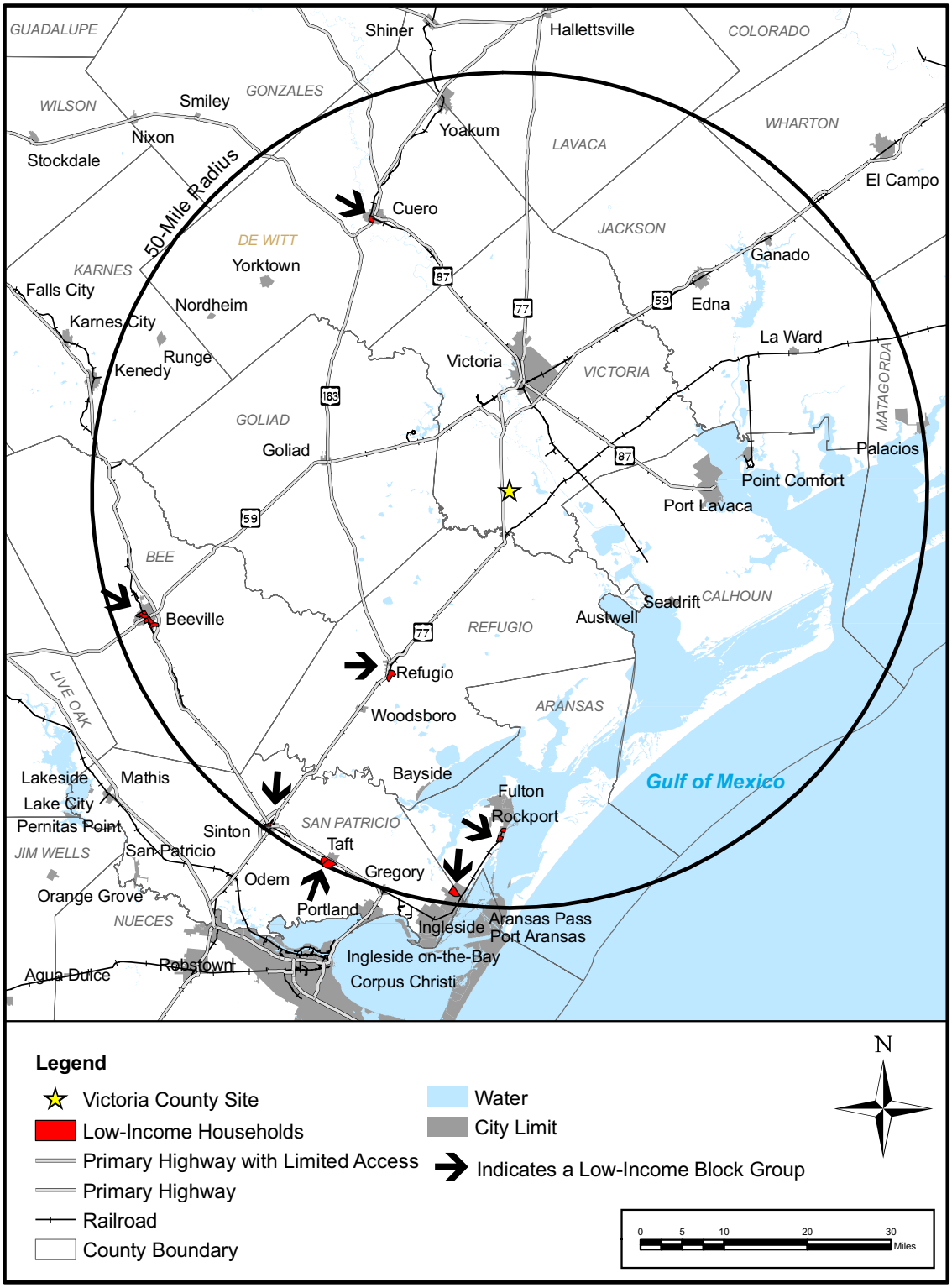

Figure 2.5.4-6 Low-Income Households within the 50-Mile Region

2.6 Geology

This section summarizes the geological conditions at the VCS Units 1 and 2 site. The site information is subdivided into two categories: physiography and stratigraphy. An evaluation of how plant construction and operations activities or infrastructure could interact with the geological features at the site to produce adverse environmental impacts is also provided. The information provided in these sections has been developed in accordance with the guidance provided in Regulatory Guide 4.2, *Preparation of Environmental Reports for Nuclear Power Stations.*

The geological information in this section is based on the information contained in FSAR Subsection 2.5.1, *Basic Geologic and Seismic Information*.

2.6.1 Geological Conditions

2.6.1.1 Physiography

The VCS site covers an area of approximately 11,500 acres (46.5 km^2) and is located in Victoria County in southern Texas. The site area is located within the Gulf Coastal Plains physiographic province (Figure 2.6-1) (Texas Bureau of Economic Geology 1996). Topography in the vicinity of the VCS site is characteristic of the Gulf Coastal Plains with gently rolling terrain. The ground elevations at the site, before preconstruction and construction activities, range from approximately 80 feet (24 meters) North American Vertical Datum of 1988 (NAVD 88) in the north to about 65 feet (20 meters NAVD 88) in the south to slightly above 15 feet (4.6 meters NAVD 88) in the southeast where it borders the Guadalupe River.

The site is drained by ephemeral streams that form a dendritic drainage pattern. The longest stream on the site is Dry Kuy Creek, which has headwaters near the northwest corner of the site. It flows for more than 5 miles (8 km) and joins Kuy Creek about a half-mile south of the site boundary. This creek is a tributary of the Guadalupe River; the Guadalupe River discharges into the San Antonio Bay about 7 miles (11 km) southeast of the confluence of the San Antonio and Guadalupe Rivers (Figure 2.6-2).

The eastern edge of the site is bounded by the Guadalupe River floodplain. The Union Pacific Railway right-of-way forms the southern boundary and Kuy Creek and U.S. Highway 77 forms the western boundary. The northern boundary is identified by a gravel ranch road about a half-mile north of the north gate to the VCS site. The VCS site is generally covered with grass, low-lying brush, or woodlands. The site is easily accessible by foot or standard vehicle.

VCS Units 1 and 2 will be constructed at a present grade elevation of approximately 85 feet (26 meters). Engineered fill will be used to raise the plant grade elevation to a final grade elevation of approximately 95 feet (29 meters NAVD 88).

2.6.1.2 Stratigraphy

The VCS site is underlain by Paleocene to Holocene age Coastal Plains sediments which are, in turn, underlain by about 21,000 feet (4 miles or 6.4 km) of Mesozoic age sediments above extended, thin

continental basement. The Cenozoic age sediments are estimated to be over 20,000 feet (3.8 miles or 6 km). The only borings that have been advanced into the Cenozoic and Mesozoic sediments in the area are those drilled for petroleum exploration purposes. These borings are generally limited to depths of around 6000 feet below the ground surface. Figures 2.6-3 and 2.6-4 are generalized stratigraphic columns for the site and vicinity taken from published data. The site stratigraphy is described in more detail in FSAR Subsection 2.5.1.

The long-term southward migration of the Gulf shoreline has been overprinted in late Cenozoic time with relatively minor marine regressions and transgressions associated with sea level changes during glacial and interglacial periods. Within the site vicinity, some of these glacial cycles are recorded in the deposition of the Beaumont and Lissie formations (the major Pleistocene formations). Both formations were deposited during interglacial transgressions as facies of alluvial fan-delta systems.

The near-surface sediments in the Victoria County region belong to the Beaumont Formation. From the Louisiana/Texas border to the Rio Grande, the Beaumont Formation is recognized as a series of multiple, cross-cutting and/or superimposed incised stream channel fills and over-bank deposits formed during glacio-eustatic cycles (Blum and Aslan 2006). The Beaumont Formation is composed of poorly bedded, marly, reddish-brown clay interbedded with lenses of sand (Barnes 1992); its thickness beneath the VCS site is between 100–200 feet (30–60 meters) (Blum and Price 1998).

The older Lissie Formation crops out in the site vicinity as levee deposits, distributary sands, and flood basin mud with a combined thickness of roughly 200 feet (61 meters) (Barnes 1987). The formation was deposited in low energy depositional environments, resulting in clay-rich surfaces. The sub-aerially exposed Lissie surface is morphologically subdued and has a relatively uniform seaward dip of 4.4–6.6 feet per mile (0.8–1.3 meters per km). Where exposed at the ground surface, the distinct gradient of the Lissie Formation surface allows it to be easily distinguished from stratigraphically higher and chronologically younger units like the Beaumont Formation. The age of the top of the Lissie Formation is estimated to be about 700 thousand years (kya) (Winker 1979).

2.6.2 Geological Impacts

Based on the geological conditions at the VCS site (FSAR Subsection 2.5.1 and 2.5.3), there are no known geological conditions that could result in plant construction or operation adversely impacting the environment. This conclusion is based on the following:

- The absence of capable tectonic sources (FSAR Subsections 2.5.1.2 and 2.5.3) at the VCS site eliminates the possibility of seismological impacts, namely design exceedence ground shaking and surface fault rupture. Non-tectonic growth faults may be present at the site within the Cenozoic and Mesozoic age sediments. Surface faulting is not expected to occur as a result of construction or operation of the proposed facility.
- Surface settlement, as a result of facility construction, is expected to be insignificant. If settlement does occur, it can be mitigated by regrading the site during construction.

- The geologic strata are not subject to dissolution.
- Permanent dewatering during operations will not be required at the VCS site because the static water table is deep enough that further reduction is not necessary.
- Water supply wells at the site will supply groundwater to the plant for other than process cooling purposes. The wells will be constructed at depths of between about 500–700 feet (150–210 meters) below the ground surface. This may result in subsidence of the sediments underlying the plant. The amount of potential subsidence is related to change in piezometric head and the amount of clay underlying the site. A 1992 study performed by Camp Dresser & McKee estimates that the land surface subsidence in Victoria County would be 0.3 feet using unit-compaction coefficients derived for the Chicot and Evangeline aquifers in the Houston area. This estimate is consistent with the Texas Water Development Board regional study of subsidence (Ratzlaff 1982) estimate of less than 6 inches based on 1973 data. The 1982 value is attributed to production of oil and gas rather than groundwater withdrawal.
- There are no natural slopes proximal to the VCS construction site that could be adversely impacted by foundation excavation, loading resulting from construction of the proposed structures, or infiltration of precipitation as a result of surface modifications. The slopes associated with construction of the cooling basin will be considered in the design and construction of the cooling basin.
- Potentially adverse impacts that could result from the placement of fill at the VCS construction site plant area will be mitigated by earthwork design.

Some short-term geological conditions that could impact the environment associated with construction and operation of the plant are described below.

- Disposal of excavated material will likely be required either on site or offsite. Generally accepted methods will be used to mitigate the potential for erosion of this material at the disposal site.
- Temporary dewatering of foundation excavations may impact groundwater levels in the water table aquifer. These impacts are described in FSAR Subsection 2.5.4.6 and ER Subsection 4.2.1.2.

2.6.3 References

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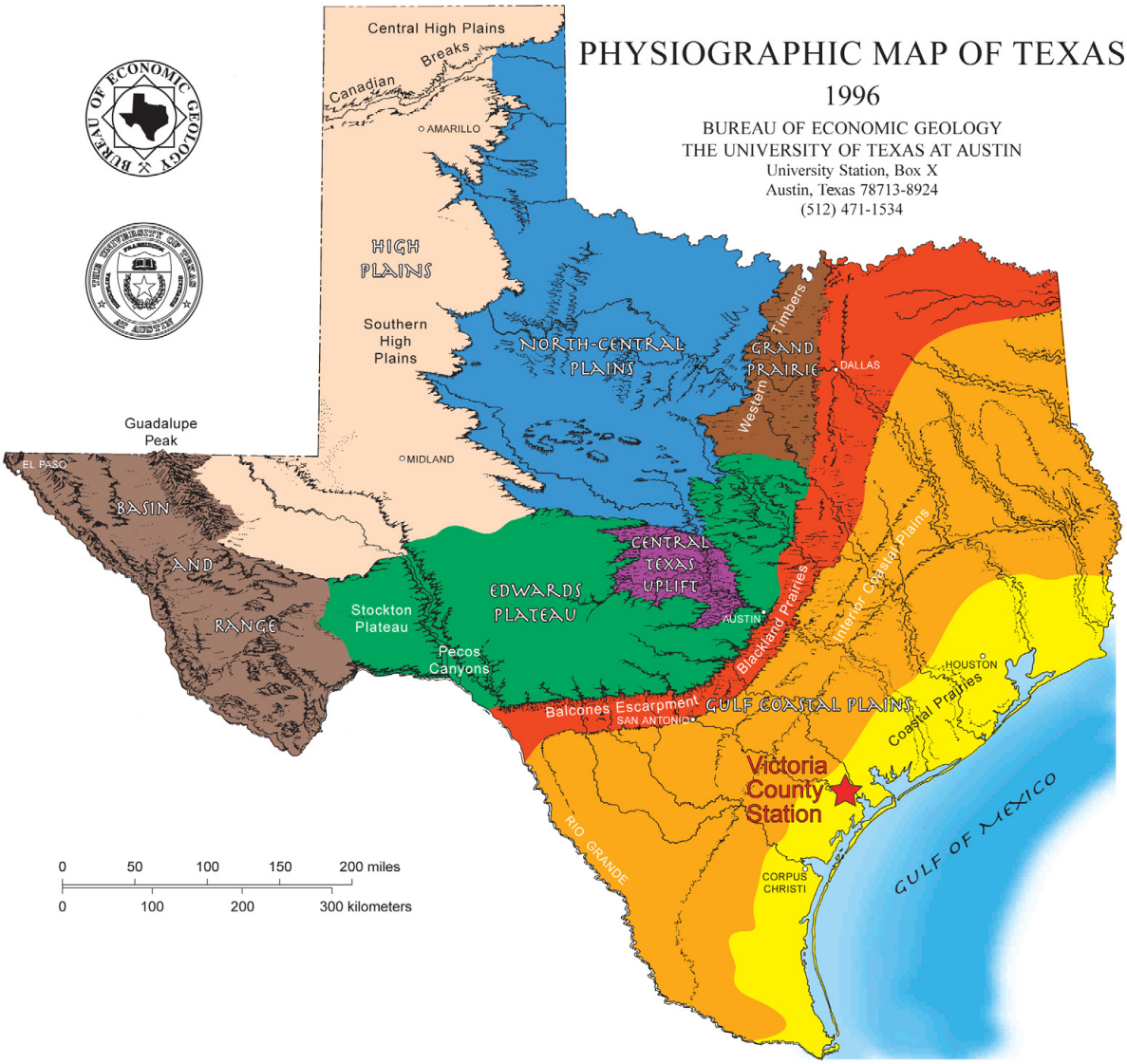

PROVINCE	MAX. ELEV. (ft)	MIN. ELEV. (ft)	TOPOGRAPHY	GEOLOGIC STRUCTURE	BEDROCK TYPES
Gulf Coastal Plains					
Coastal Prairies	300	0	Nearly flat prairie, <1 ft/mi to Gulf	Nearly flat strata	Deltaic sands and muds
Interior Coastal Plains	800	300	Parallel ridges (questas) and valleys	Beds tilted toward Gulf	Unconsolidated sands and muds
Blackland Prairies	1000	450	Low rolling terrain	Beds tilted south and east	Chalks and marls
Grand Prairie	1250	450	Low stairstep hills west; plains east	Strata dip east	Calcareous east; sandy west
Edwards Plateau					
Principal	3000	450	Flat upper surface with box canyons	Beds dip south; normal faulted	Limestones and dolomites
Pecos Canyons	2000	1200	Steep-walled canyons		Limestones and dolomites
Stockton Plateau	4200	1700	Mesa-formed terrain; highs to west	Unfaulted, near-horizontal beds	Carbonates and alluvial sediments
Central Texas Uplift	2000	800	Knobby plain; surrounded by questas	Centripetal dips, strongly faulted	Granites; metamorphics; sediments
North-Central Plains	3000	900	Low north-south ridges (questas)	West dip; minor faults	Limestones; sandstones; shales
High Plains					
Central	4750	2900	Flat prairies slope east and south	Slight dips east and south	Eolian silts and fine sands
Canadian Breaks	3800	2350	Highly dissected; local solution valleys		
Southern	3800	2200	Flat; many playas; local dune fields		
Basin and Range	8750	1700	North-south mountains and basins	Some complex folding and faulting	Igneous; metamorphics; sediments

Source: Texas Bureau of Economic Geology, 1996

Figure 2.6-1 Map of Physiographic Provinces

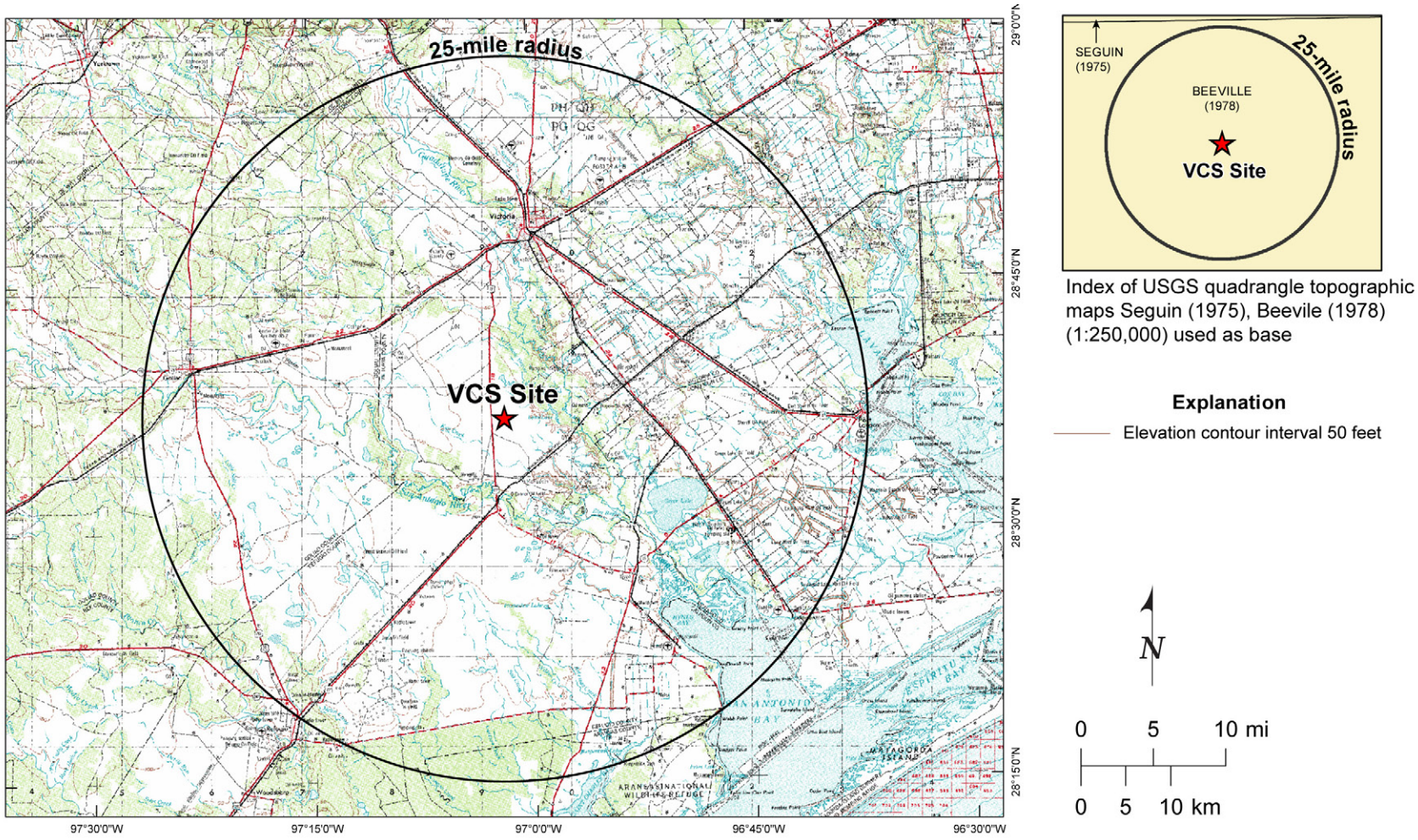

Figure 2.6-2 Site Vicinity Topographic Map (25-Mile Radius)

ERATHEM	SYSTEM	SERIES	STAGE	GROUP	AGE mya	FORMATION	MEMBER	LITHOLOGY	THICKNESS (ft)
MESOZOIC	CRETACEOUS	Upper Cretaceous		Navarro Gp.		Escondido Fm		claystone, marl	1050
						Olmos Fm		shale, sandstone	900
				Taylor Gp.		San Miguel Fm		sandstone & limestone	1150
						Anacacho Limestone		mudstone	500
						Upson Fm		limestone	800
				Austin Gp.				chalk	555
				Eagle Ford Group				shale w. limestone	40
				Woodine Group				shale	60
				Washita Gp.		Buda LS Fm		limestone	45
						Del Rio Fm		shale	45
						Georgetown Fm		limestone	25
				Fredricksburg Gp.		Edwards Fm	McKnight Evaporite	anhydrite	485
							McKnight Limestone	limestone	
							West Nueces Limestone	limestone	
						Glen Rose Formation		shale	
		Lower Cretaceous		Trinity Gp.				limestone	3250
								limestone	
						Pearsall Fm	Bexar Shale	shale & limestone	
							James (Cow Creek) Limestone		
							Pine Island Shale		
						Sligo Fm		limestone	
						Hosston		sandstone, shale, chert	
					144				
	JURASSIC	Upper Jurassic	Tithonian	Cotton Valley Gp.		Schuler Fm		sandstone, siltstone, shale	1600
						Bossier Fm		shale	
			Kimmeridgian	Louark Gp.		Haynesville Fm	Gilmer mbr	limestone, anhydrite	1600
							Buckner mbr		
			Oxfordian			Smackover Fm		limestone & shale	1600
		Middle Jurassic		Louann Gp		Norphlet Fm		sandstone	150
					208	Louann Salt		salt	3300
	TRIASSIC	Upper Triassic				Eagle Mills Fm		sandstone, shale, siltstone, salt	4100
		Lower Triassic			245				

Figure is not to scale.

Figure 2.6-3 Mesozoic Stratigraphic Column

ERATHEM	SYSTEM	SERIES	AGE m.y.		Victoria County Station	Approximate Thickness Undifferentiated (feet)	Approximate elevation of formation top (feet)	Hydrostratigraphy	
CENOZOIC	QUATERNARY	Holocene	0.10	Alluvium & Terrace Deposits	Undifferentiated Deweyville Terrace Deposits	0-50			
		Pleistocene	2		Beaumont Fm Lissie Fm Willis Formation	400 600-700	0± -400	Coastal Lowlands Aquifer System	Chicot aquifer
	TERTIARY	Pliocene	5		Goliad sand	800 to 1,000	-1,000 to -1,100		Evangeline aquifer
		Miocene	24		Fleming Formation Oakville Sandstone	3,400 to 4,500	-1,800 to -2,100		Burkeville Confining System Jasper aquifer
		Oligocene		Catahoula Tuff	Catahoula Sand Anahuac Formation Frio Formation	3,000	-5,200 to -6,600		Catahoula Confining System
			38		Frio Clay (Vicksburg Group)	200	-8,000 to -9,600	Coastal Uplands Aquifer System	Vicksburg - Jackson Confining System
		Eocene	58	Jackson Group	Whitsett Manning clay Welborn Caddell	500 to 1,100	-8,400 to -9,800		
				Claiborne Group	Yegua Cook Mountain Sparta Sand Weches Fm Queen City Snd Reklaw Fm Carrizo	1,400 to 4,500	-8,900 to -10,900		Upper Claiborne Aquifer Middle Claiborne Confining System Midddle Claiborne Aquifer Confining System Lower Claiborne-Upper Wilcox Aquifer
				Wilcox Group	Undifferentiated	2,000	-10,300 to -15,400		Middle Wilcox Aquifer Not Present
		Paleocene	66	Midway Grp	Wills Point Kincaid Fm	2,500	-12,300 to -17,400	Midway Confining System	

Figure 2.6-4 Cenozoic Stratigraphic Column

2.7 Meteorology, Air Quality, and Noise

This section describes the regional and local climatological, meteorological, and air quality as well as noise characteristics applicable to the site for VCS Units 1 and 2. This section also provides site-specific meteorological information for use in evaluating construction and operational impacts. This section concludes with a brief description of existing noise-generating sources at the site and expected noise levels relative to measured background conditions.

2.7.1 Regional Climatology

This subsection identifies sources of climatological data used to characterize various aspects of the climate representative of the site region and area around VCS Units 1 and 2 (as described in Subsections 2.7.1 through 2.7.4), describes large-scale general climatic features and their relationship to conditions in the site area and vicinity (Subsection 2.7.1.2), and summarizes normals, means, and extremes of several standard weather elements (Subsection 2.7.1.3).

2.7.1.1 Data Sources

Several data sources are used to characterize regional climatological conditions pertinent to the site for VCS Units 1 and 2. This includes data acquired by the National Weather Service (NWS) at its Victoria, Texas, first-order station and from 14 other nearby locations in its network of cooperative observer stations, as compiled and summarized by the National Climatic Data Center (NCDC).

These climatological observing stations are located in Aransas, Bee, Calhoun, DeWitt, Goliad, Jackson, Karnes, Lavaca, Matagorda, Refugio, San Patricio, and Victoria Counties. Table 2.7-1 identifies the specific stations and lists their approximate distance and direction from the midpoint between the proposed Units 1 and 2 reactor buildings at the site. Figure 2.7-1 illustrates these station locations relative to the site for VCS Units 1 and 2.

The objective of selecting nearby, offsite climatological monitoring stations is to demonstrate that the mean and extreme values measured at those locations are reasonably representative of conditions that might be observed at the VCS site. The 50-mile-radius circle shown in Figure 2.7-1 provides a relative indication of the distance between the climate-observing stations and the VCS site.

The identification of stations to be included was based on the following general considerations:

- Proximity to the site (i.e., within the nominal 50-mile radius indicated above, to the extent practicable)
- Coverage in all directions surrounding the site (to the extent possible)
- Where more than one station exists for a given direction relative to the site, a station was included if it contributed one or more extreme conditions (e.g., rainfall, snowfall, maximum or minimum temperatures) for that general direction or added context for variation of conditions over the site area

Nevertheless, if an overall extreme precipitation or temperature condition was identified for a station located within a reasonable distance beyond the nominal 50-mile radius and that event was considered to be reasonably representative for the site area, such stations were also included, regardless of directional coverage.

Normals (i.e., 30-year averages), means, and extremes of temperature, rainfall, and snowfall are based on the following references:

- *2007 Local Climatological Data, Annual Summary with Comparative Data for Victoria, Texas* (NCDC Jun 2008b)
- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* (NCDC Jul 2005)
- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* (NCDC Feb 2002)
- *Utah Climate Center, Utah State University, Climate Data Base for Texas* (USU Jun 2008)
- *Cooperative Summary of the Day, TD3200, Period of Record Through 2001, for the Central United States* (NCDC Nov 2002)
- *U.S. Summary of Day Climate Data (DS 3200/3210), Period of Record, 2002–2005* (NCDC Jul 2006)

First-order NWS stations also record measurements, typically on an hourly basis, of other weather elements, including winds, several indicators of atmospheric moisture content (i.e., relative humidity, dew point, and wet bulb temperatures), and barometric pressure, as well as other observations when those conditions occur (e.g., fog, thunderstorms). Table 2.7-2**,** excerpted from the 2007 local climatological data (LCD) summary for the Victoria, Texas, NWS station, presents the long-term characteristics of these parameters.

Additional data sources were also used in describing the climatological characteristics of the site area and region, including:

- *Minimum Design Loads for Buildings and Other* Structures (ASCE 2005)
- *Historical Hurricane Tracks Storm Query, 1851 through 2007* (NOAA-CSC Jun 2008)
- *The Climate Atlas of the United States* (NCDC Sep 2002)
- *Storm Events for Texas, Hail, Snow and Ice, Tornado, Hurricane and Tropical Storm, and Dust Storm Event Summaries* (NCDC Apr 2008, NCDC Jun 2008a, and NCDC Jun 2008c)
- *Storm Data (and Unusual Weather Phenomena with Late Reports and Corrections), January 1959 (Volume 1, Number 1) to January 2004 (Volume 46, Number 1)* (NCDC Jun 2004)
- *Air Stagnation Climatology for the United States (1948–1998)* (Wang and Angell Apr 1999)
- *Ventilation Climate Information System* (USDA Apr 2003, USDA Oct 2007)

- *Climatography of the United States, No. 85, Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days 1971–2000 (and previous normal periods)* (NCDC Jun 2002)

2.7.1.2 General Climate

The VCS site is located in the south-central Texas Coastal Plain, situated about 35 miles to the northwest of the Gulf of Mexico (see Figure 2.7-1). Topographic features within 5 miles and 50 miles of the site are addressed in Subsection 2.7.4.5. Terrain in the site area is generally flat to gently rolling. Elevations range from 0 feet above mean sea level (MSL) to the south to 550 feet above MSL to the west and northwest of the site.

The State of Texas is divided into 10 climate divisions. A climate division represents a region within a state that is as climatically homogeneous as possible. Division boundaries generally coincide with county boundaries except in the Western United States. The VCS site is located near the boundaries of two separate climate divisions within the State of Texas. It is physically situated in the western portion of Climate Division TX-08 (Upper Coast), but also lies directly adjacent to the eastern extent of the southern portion of Climate Division TX-07 (South Central) (NCDC Jun 2002).

The general climate in this region is classified as maritime subtropical (or humid subtropical) and is characterized by mild, short winters; long periods of mild sunny weather in the autumn; somewhat more windy but mild weather in the spring; and long, hot summers.

The regional climate is influenced by a semipermanent, subtropical high-pressure system over the North Atlantic Ocean – the Bermuda High (also known as the western extent of the Azores High). Because of the clockwise circulation around this high-pressure system, maritime tropical air mass characteristics prevail much of the year, especially during the summer when the Bermuda High is well developed. The Bermuda High can extend westward into the Gulf of Mexico at this time of year and, when it does, a synoptic weather type referred to as a Gulf High is said to be present (LOSC Sep 2002).

Collectively, these systems govern late spring and summer temperature and precipitation patterns. However, the influence of this macroscale circulation feature is also evident during the transitional seasons (spring and autumn), although relatively less so during the autumn months (in terms of the wind distribution turning more easterly) when it is disrupted by the passage of relatively smaller synoptic- and mesoscale weather systems from the north. Wind direction and speed conditions for the site and surrounding area are described in more detail in Subsections 2.7.1.3.4 and 2.7.4.2.

This macro-circulation feature also has an effect on the frequency of high air pollution potential in the VCS site region. These characteristics and their relationship to the Bermuda High, especially during the summer and early autumn, are addressed in Subsection 2.7.2.3.

During winter, cold air masses increasingly intrude into the region with the cyclonic (i.e., counterclockwise) northerly flow that follows the passage of low-pressure systems. These systems frequently originate in the continental interior, pick up moisture-laden air as the result of southeasterly

airflow in advance of the system, and result in a variety of precipitation events that include rain, sleet, freezing rain, or mixtures depending on the temperature characteristics of the weather system itself and the temperature of the underlying air (see Subsection 2.7.3.4).

Larger and relatively more persistent outbreaks of very cold, dry air, associated with massive high-pressure systems that move southward out of Canada, also occasionally affect the site region. However, these weather conditions are moderated significantly by the Gulf of Mexico immediately to the south and owing to surface heating (during the day) as the front passes over the land.

The Gulf High synoptic weather type can also occur during the winter and spring when continental polar high pressure areas push southward over eastern Texas and Louisiana (LOSC Sep 2002), bringing modified polar air with southerly to southeasterly wind flows in the VCS site area.

Monthly precipitation exhibits a cyclical pattern, with the predominant maximum period occurring from late spring into early summer, and a secondary maximum period from mid-summer into mid-autumn (Table 2.7-2). The late spring/early summer maximum is primarily a result of thunderstorm activity. The mid-summer to mid-autumn secondary maximum is associated with thunderstorms and very heavy rains that accompany tropical cyclones that occasionally move through the region (see Subsection 2.7.3.5). The VCS site is located close enough to the Gulf of Mexico that the strong winds associated with tropical cyclones can also have a significant effect on the site area.

2.7.1.3 Normal, Mean, and Extreme Climatological Conditions

This subsection describes normals and period-of-record means and extremes for several standard weather elements (i.e., temperature, atmospheric water vapor, precipitation, and wind conditions) representative of this climate setting.

As indicated previously, Table 2.7-2 presents the more extensive set of meteorological measurements and observations made at the Victoria, Texas, NWS station located about 17 miles north of the site for VCS Units 1 and 2. For comparison, Table 2.7-3 summarizes the annual normal daily maximum, minimum, and mean temperatures, as well as the normal annual rainfall and snowfall totals for Victoria, Texas, and 13 of the 14 other nearby cooperative observing stations (such data not being available for the Maurbro station).

With the exception of temperature measurements from Maurbro and Edna Highway 59 Bridge, and snowfall measurements at Refugio 2 NW and Karnes City 2N, long-term periods of record for temperature and precipitation for the other climatological observing stations, as well as summaries of the latest 30-year station normals from 1971 through 2000, are readily available from the NCDC (NCDC Jul 2005).

More detailed descriptions of these and other climatological characteristics, including measured extremes, are addressed in Subsection 2.7.4.1.

2.7.1.3.1 Temperature

Daily mean temperatures are based on the average of the daily mean maximum and minimum temperature values. Annual daily normal temperatures vary over the site area by only about 3 °F, ranging from 68.2°F at the Yoakum station (about 46 miles north of the site for VCS Units 1 and 2) to 71.3 °F at the Goliad station (about 22 miles to the west) (Table 2.7-3).

Likewise, the diurnal (day-to-night) temperature ranges, as indicated by the differences between the daily mean maximum and minimum temperatures, are fairly comparable, ranging from 11.4 °F at Port O'Connor (about 39 miles east-southeast of the VCS site) to 24.2°F at the Cuero station (about 37 miles to the north-northwest) (USU Jun 2008). The breadth of this range reflects each station's proximity to the Gulf Coast—Port O'Connor is located directly on the coast (less temperature variability due to maritime influence), whereas Cuero is located much farther inland. Similar variations in diurnal temperature range are noted among the other observing stations in the site area.

On a monthly basis, the LCD summary for the Victoria, Texas, NWS station indicates that the daily normal temperature is highest during July and August (84.2 °F) and reaches a minimum in January (53.2 °F) (NCDC Jun 2008b).

The highest temperature observed in the site area (113 °F) was recorded on September 5, 2000, at the Cuero cooperative station. The lowest temperature observed in the site area (6 °F) was recorded on December 23, 1989, at the Yoakum cooperative station, located about 46 miles north of the site (NCDC Jul 2005; USU Jun 2008).

2.7.1.3.2 Atmospheric Water Vapor

Based on a 24-year period of record, the LCD summary for the Victoria, Texas, NWS station (Table 2.7-2) indicates that the mean annual wet bulb temperature is 64.2°F, with a seasonal maximum during the summer months (June through August) and a seasonal minimum during the winter months (December through February). The highest monthly mean wet bulb temperature is 76.1°F in July (only slightly less during August); the lowest monthly mean value (49.7°F) occurs during January (NCDC Jun 2008b).

The LCD summary shows a mean annual dew point temperature of 61.2°F, also reaching its seasonal maximum and minimum during the summer and winter, respectively. The highest monthly mean dew point temperature is 73.6°F in July (again, only slightly less during August). The lowest monthly mean dew point temperature (46.4°F) occurs during January (NCDC Jun 2008b).

The 30-year normal daily relative humidity averages 76% on an annual basis, typically reaching its diurnal maximum in the early morning hours (around 0600 Local Standard Time [LST]) and its diurnal minimum during the early afternoon hours (around 1200 LST). There would be less variability in this daily pattern with the passage of weather systems, persistent cloud cover, and precipitation. Nevertheless, this diurnal pattern is evident throughout the year. The LCD summary indicates that average early morning relative humidity levels are greater than or equal to 93% during the months of June, July, August, and September (NCDC Jun 2008b).

2.7.1.3.3 Precipitation

As Table 2.7-3 indicates, normal annual rainfall totals for the 15 nearby observing stations listed in Table 2.7-1 (i.e., within approximately 50 miles of the VCS site) vary noticeably, ranging from 28.35 inches at the Karnes City 2N observing station (about 55 miles to the west-northwest of the site for VCS Units 1 and 2) to 45.40 inches at the Palacios Municipal Airport station (about 48 miles to the east) (NCDC Feb 2002). This data, in conjunction with Figure 2.7-1, also indicates that total annual rainfall tends to decrease more from east to west than as a function of distance inland from the Gulf of Mexico and adjacent bay waters.

However, when the four climatological observing stations closest to, and surrounding, the VCS site are considered (i.e., Victoria Regional Airport, Goliad, Refugio 2 NW, and Aransas Wildlife Refuge), all within 25 miles, normal annual rainfall totals are quite similar, ranging from 38.58 inches at Goliad to 40.83 inches at Aransas Wildlife Refuge (NCDC Feb 2002). Therefore, long-term average annual total rainfall at the VCS site could reasonably be expected to be within this range.

The LCD summary of normal rainfall totals for the Victoria, Texas, NWS station indicates two seasonal maximums, the highest (13.05 inches) during late spring into early summer (April through June) and the second (12.31 inches) during mid-summer into mid-autumn (August through October). Together, these periods account for about 63% of the annual total for the Victoria NWS station, although rainfall is greater than 2.0 inches during every month of the year. The overall maximum monthly total rainfall occurs during May (5.12 inches) (NCDC Jun 2008b).

The overall highest 24-hour rainfall total in the site area, 17.58 inches, was recorded on October 18, 1994 at the Edna Highway 59 Bridge cooperative observing station (USU Jun 2008), located approximately 32 miles northeast of the VCS site. The overall highest monthly rainfall total in the site area, 34.44 inches during July 2006, was recorded at the Port O'Connor cooperative observing station (USU Jun 2008; NCDC Jun 2008d), located approximately 39 miles to the east-southeast of the VCS site.

Snow in the VCS site area is an unusual event and occurs, on average, less than 1 day per year as indicated by the LCD summary for the Victoria, Texas, NWS station in Table 2.7-2 (NCDC Jun 2008b). Table 2.7-3 indicates that normal annual snowfall totals at the listed observing stations average 0.5 inch per year or less. Heavy snowfall events rarely occur in the VCS site area, as described in Subsection 2.7.3.4. The greatest snowfall totals on record among the observing stations listed in Table 2.7-4 were measured at the Goliad station, located 22 miles west of the VCS site, as a result of the Christmas storm of 2004 (December 25, 2004). The 24-hour and cumulative monthly totals at Goliad were 12.0 inches in both cases (NCDC Jul 2006; USU Jun 2008; NCDC Jun 2008d).

See Subsection 2.7.4.1.3 for more details regarding these events and a description of other station precipitation records.

2.7.1.3.4 Wind Conditions

Based on a 28-year period of record, the LCD summary for the Victoria, Texas, NWS station (Table 2.7-2) indicates that the annual prevailing wind direction (i.e., the direction from which the wind blows most often) is from 170 degrees (i.e., south-southeasterly). Monthly prevailing winds are from the south-southeast or south-southwest during the spring and summer (March through August), while from the north during mid-autumn through the winter (October through February) (NCDC Jun 2008b). These characteristics are further enhanced by the establishment of the Bermuda High in the summer and the passage of northerly cold fronts beginning in mid-autumn and continuing through the winter (see Subsection 2.7.1.2).

Based on a 24-year period of record, the LCD summary shows an annual mean wind speed of 9.5 miles per hour. On a seasonal basis, the highest average wind speeds occur during the spring (about 10.8 mph) and are lowest during the summer and autumn months (8.6 and 8.7 mph, respectively). On average, the LCD indicates that the highest monthly average wind speed (11.0 mph) occurs during April (NCDC Jun 2008b).

Characteristics of extreme wind conditions for design basis purposes are described in Subsection 2.7.3.2. Wind data summaries, based on measurements from the onsite pre-application phase meteorological monitoring program are described in Subsections 2.7.4.2 and 2.7.4.3.

2.7.2 Air Quality

This subsection addresses current ambient air quality conditions in the VCS site area and region (e.g., the compliance status of various air pollutants) that have a bearing on plant design, construction, and operating basis considerations (Subsection 2.7.2.1). It also cross-references other subsections of the ER that address the types and characteristics of nonradiological emission sources associated with plant construction and operation and the expected impacts associated with those activities (Subsection 2.7.2.2), and characterizes conditions (from a climatological standpoint) in the site area and region that may be restrictive to atmospheric dispersion (Subsection 2.7.2.3).

2.7.2.1 Regional Air Quality Conditions

The site for VCS Units 1 and 2 is located within the Corpus Christi-Victoria Intrastate Air Quality Control Region (AQCR) and includes Aransas, Bee, Brooks, Calhoun, DeWitt, Duval, Goliad, Gonzales, Jackson, Jim Wells, Kenedy, Kleberg, Lavaca, Live Oak, McMullen, Nueces, Refugio, San Patricio, and Victoria Counties (40 CFR 81.136). Attainment areas are areas where the ambient levels of criteria air pollutants are designated as being “better than,” “unclassifiable/attainment,” or “cannot be classified or better than” the EPA-promulgated National Ambient Air Quality Standards (NAAQS). Criteria pollutants are those for which NAAQS have been established: sulfur dioxide, particulate matter (i.e., PM_{10} and $PM_{2.5}$, which are particles with nominal aerodynamic diameters less than or equal to 10.0 and 2.5 microns, respectively), carbon monoxide, nitrogen dioxide, ozone, and lead (40 CFR Part 50).

The Corpus Christi-Victoria Intrastate AQCR is in attainment for all criteria air pollutants except lead, which is undesignated (40 CFR 81.344).

There are no pristine areas designated as “Mandatory Class I Federal Areas Where Visibility is an Important Value” that are located within 100 miles of the VCS site. The Big Bend National Park is the closest Class I area (40 CFR 81.429) located about 355 miles west of the VCS site.

2.7.2.2 Projected Air Quality Conditions

The Units 1 and 2 nuclear steam supply systems and other related radiological systems are not sources of criteria pollutants or other toxic air emissions. Supporting equipment (e.g., diesel generators, auxiliary boilers, fire pump engines), and other nonradiological emission-generating sources (e.g., storage tanks and related equipment) or activities will not be expected to be a significant source of criteria pollutant emissions.

Emergency equipment will only be operated on an intermittent test or emergency-use basis. Therefore, these emission sources will not be expected to affect ambient air quality levels in the vicinity of the VCS site, nor will they be anticipated to be a significant factor in the design and operating bases of VCS Units 1 and 2. Likewise, because of the relatively long distance of separation from the VCS site, visibility at any Class I Federal Areas will not be expected to be significantly affected by project construction and facility operations.

Emission-generating sources and activities related to construction of VCS Units 1 and 2, potential impacts, and mitigation measures are addressed in Subsection 4.4.1.3. Nonradiological emission-generating sources associated with routine facility operations are described further in Subsection 3.6.3.1. Characteristics of these emission sources and the potential effects on air quality and visibility associated with their operation are addressed under Subsections 5.8.1 and 5.3.3, respectively.

2.7.2.3 Restrictive Dispersion Conditions

Atmospheric dispersion can be described as the horizontal and vertical transport and diffusion of effluents released into the atmosphere. Horizontal and along-wind dispersion is controlled primarily by wind direction variation, wind speed, and atmospheric stability. Subsection 2.7.4.2 addresses wind characteristics for the VCS site vicinity based on measurements from the pre-application phase, onsite meteorological monitoring program. The persistence of those wind conditions is described in Subsection 2.7.4.3.

In general, lower wind speeds represent less turbulent air flow, which is restrictive to both horizontal and vertical dispersion. And although wind direction tends to be more variable under lower wind speed conditions (which increases horizontal transport), air parcels containing pollutants often recirculate within a limited area, thereby increasing cumulative exposure.

Major air pollution episodes are usually related to the presence of stagnating high-pressure weather systems (or anti-cyclones) that influence a region with light and variable wind conditions for 4

consecutive days or more. An updated air stagnation climatology has been published with data for the continental United States based on more than 50 years of observations, from 1948 through 1998 (Wang and Angell Apr 1999). In this study, stagnation conditions were defined as 4 or more consecutive days when meteorological conditions were conducive to poor dispersion. Although interannual frequency varies, the data in Figures 1 and 2 of that report indicates that on average, the VCS site region can expect about 30 days per year with stagnation conditions, or about five to six cases per year, with a mean duration of about 5 days for each case (Wang and Angell Apr 1999).

Air stagnation conditions primarily occur during an “extended” summer season (May through October). This is a result of the weaker pressure and temperature gradients, and therefore weaker wind circulations, during this period (as opposed to the winter season). Based on Wang and Angell (Apr 1999), Figures 17 to 67, the highest incidence of air stagnation is recorded between July and September, typically reaching its peak during August, when the Bermuda High pressure system has become established. As the LCD summary for Victoria, Texas, in Table 2.7-2 indicates, this 3-month period coincides with the lowest monthly mean wind speeds during the year. Air stagnation is at a relative minimum within this “extended” summer season during May and June (Wang and Angell Apr 1999).

The dispersion of air pollutants is also a function of the mixing height. The mixing height (or depth) is defined as the height above the surface through which relatively vigorous vertical mixing takes place. Lower mixing heights (and wind speeds), therefore, are a relative indicator of more restrictive dispersion conditions. Holzworth (Jan 1972) reported mean seasonal and annual morning and afternoon mixing heights and wind speeds for the contiguous United States based on observations over the 5-year period from 1960 to 1964 from a network of 62 NWS stations at which daily surface and upper air sounding measurements were routinely made.

However, an interactive, spatial database developed by the U.S. Department of Agriculture Forest Service, referred to as the Ventilation Climate Information System, is readily available and provides both monthly and annual graphical and tabular summaries of relevant dispersion-related characteristics (e.g., morning and afternoon modeled mixing heights, modeled surface wind speeds, and resultant ventilation indices) (USDA Oct 2007). The system, although developed primarily for fire management and related air quality purposes, extends the period of record to climatologically representative durations of 30 to 40 years, depending on the parameter.

Table 2.7-5 summarizes minimum, maximum, and mean morning and afternoon mixing heights, surface wind speeds, and ventilation indices on a monthly, seasonal, and annual basis for the VCS site area. As atmospheric sounding measurements are still only made from a relatively small number of observation stations, these statistics represent model-derived values within the interactive database for a specific location (USDA Apr 2003) – in this case, the VCS site. The seasonal and annual values listed in Table 2.7-5 were derived as weighted means based on the corresponding monthly values.

From a climatological standpoint, the lowest mean morning mixing heights occur in the autumn, and the highest mean morning mixing heights occur during the spring. As might be expected, mean afternoon mixing heights reach a seasonal minimum in the winter and a maximum during the summer as the result of more intense summertime heating.

The wind speeds listed in Table 2.7-4, representing the VCS site area, are reasonably consistent with the LCD summary for Victoria, Texas (Table 2.7-2) although about 1 meter per second (m/sec) lower. Relatively lower daily mean wind speeds (i.e., the average of the morning and afternoon mean values in Table 2.7-5) are shown to generally occur during the summer and autumn as in the LCD (USDA Oct 2007 and NCDC Jun 2008b). This period of minimum wind speeds also coincides with the “extended” summer season described by Wang and Angell (Apr 1999) that is characterized by relatively higher air stagnation conditions.

The ventilation index is based on the product of the wind speed and the mixing height. Because it uses surface winds instead of higher trajectory winds, the index values represent conservative estimates of ventilation potential. This is more indicative of the dispersion potential near the ground and, therefore, directly relevant to the release heights of the sources evaluated in Subsections 2.7.5 and 2.7.6.

Based on the classification system for ventilation indices (USDA Apr 2003), the morning ventilation indices for the VCS site area indicate “marginal” ventilation potential on an annual average basis with conditions rated as “fair” during the spring and “marginal” for the other three seasons (USDA Oct 2007); again, consistent with the characteristics reported by Wang and Angell (Apr 1999).

Ventilation indices markedly improve during the afternoon with conditions rated as “good” on an annual average basis and for all seasons except the winter which is classified as “fair” (USDA Oct 2007). Mean wind speeds do not vary significantly in the site area over the course of the year. As a result, the relatively better ventilation index classifications are attributable to the higher mixing height values, which, for the summer and autumn seasons, tend to mask the general potential for more restrictive dispersion conditions during the “extended” summer referred to by Wang and Angell (Apr 1999). Nevertheless, the decrease in the ventilation index values between the summer and autumn is still evident and consistent with the monthly variations for air stagnation potential described previously.

2.7.3 Severe Weather

This subsection addresses severe weather phenomena that affect the VCS site area and region and that are considered in the design and operating bases for the plant. These include:

- The frequencies of thunderstorms and lightning (Subsection 2.7.3.1)
- Observed and probabilistic extreme wind conditions (Subsection 2.7.3.2)
- Tornadoes and related wind and pressure characteristics (Subsection 2.7.3.3)
- The frequency and magnitude of hail, snowstorms, and ice storms (Subsection 2.7.3.4)
- Tropical cyclones and related effects (Subsection 2.7.3.5)

- Droughts and dust (sand) storms (Subsection 2.7.3.6)

2.7.3.1 Thunderstorms and Lightning

Thunderstorms can occur in the VCS site area at any time during the year. Based on a 48-year period of record, Victoria, Texas, averages about 56 thunderstorm-days (i.e., days on which thunder is heard at an observing station) per year. On average, August has the highest monthly frequency of occurrence, about 10 days. Annually, more than half (about 57%) of thunderstorm-days are recorded between early summer and early autumn (i.e., from June through September). From November through February, a thunderstorm might be expected to occur about 2 days per month (NCDC Jun 2008b).

The mean frequency of lightning strokes to earth can be estimated using a method attributed to the Electric Power Research Institute, as reported by the U.S. Department of Agriculture Rural Utilities Service in the publication titled *Summary of Items of Engineering Interest* (USDA Aug 1998). This methodology assumes a relationship between the average number of thunderstorm-days per year (***T***) and the number of lightning strokes to earth per square mile per year (***N***), where:

$$\boldsymbol{N} = 0.31\boldsymbol{T}$$

Based on the average number of thunderstorm-days per year at Victoria, Texas (i.e., 56, see Table 2.7-2), the frequency of lightning strokes to earth per square mile is about 17 per year for the VCS site area. This frequency is essentially equivalent to the mean of the 10-year (1989 to 1999) lightning flash density for the area that includes the VCS site, as reported by the NWS (6 to 8 flashes per square kilometer per year [NSSL 2006]) and, therefore, is considered to be a reasonable indicator.

The VCS power block area is a rectangular area that encompasses both units and covers approximately 41 acres, or 0.064 square mile (mi^2). Given the estimated annual average frequency of lightning strokes to earth in the VCS site area, the frequency of lightning strokes in the power block area can be estimated as follows:

$$(17 \text{ lightning strokes/mi}^2\text{/year}) \times (0.064 \text{ mi}^2) = 1.09 \text{ lightning strokes/year, or about once each year.}$$

2.7.3.2 Extreme Winds

From a climatological standpoint, the frequency of peak wind speed gusts can be characterized from information in the *Climate Atlas of the United States* (NCDC Sep 2002), which is based on observations made over the 30-year period of record from 1961 to 1990. Frequencies of occurrence were developed from values reported as the 5-second peak gust for the day. Mean annual occurrences of peak gusts greater than or equal to 50 mph, 40 mph, and 30 mph in the VCS site area range between 1.5 and 2.4 days per year, 9.5 and 20.4 days per year, and 60.5 and 80.4 days per year, respectively.

Estimating the wind loading on plant structures for design and operating bases considers the “basic” wind speed, which is the “3-second gust speed at 33 feet (10 meters) above the ground in Exposure Category C,” as defined in Sections 6.2 and 6.3 of the ASCE-SEI design standard, *Minimum Design Loads for Buildings and Other Structures* (ASCE 2005).

The “basic” wind speed is approximately 110 mph, as estimated by linear interpolation from the plot of basic wind speeds in Figure 6-1A of ASCE 7-05 (ASCE 2005) for that portion of the United States that includes the VCS site. The site is located in a hurricane prone region as defined in Section 6.2 of the ASCE-SEI design standard; that is, along the U.S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 mph (ASCE 2005).

From a probabilistic standpoint, this value is associated with a mean recurrence interval of 50 years. Section C6.0 (Table C6-3) of the ASCE-SEI design standard provides conversion factors for estimating 3-second-gust wind speeds for other recurrence intervals (ASCE 2005). Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period value by a scaling factor of 1.07, which yields a 100-year return period 3-second-gust wind speed for the site of approximately 118 mph.

Subsection 2.7.3.5 addresses rainfall extremes associated with tropical cyclones that have passed within 100 nautical miles of the VCS site. It concludes with a description of observed or estimated sustained wind speeds and wind gusts accompanying several of the more intense hurricanes that have made landfall and tracked through this radial area.

2.7.3.3 Tornadoes

The design-basis tornado characteristics applicable to structures, systems, and components important to safety include the following parameters as identified in Regulatory Guide 1.76 (U.S. NRC Mar 2007a):

- Maximum wind speed
- Translational speed
- Maximum rotational speed
- Radius of maximum rotational speed
- Pressure drop
- Rate of pressure drop

Based on Figure 1 of Regulatory Guide 1.76 and the coordinates for the midpoint between the VCS Units 1 and 2 reactors, the VCS site is located within Tornado Intensity Region II, about 25 miles south of the southern boundary of Tornado Intensity Region I (at 29 degrees North Latitude). Because of the site’s proximity to this boundary, the design basis tornado characteristics for Tornado Intensity Region I (U.S. NRC Mar 2007a) have been conservatively assumed to apply to the VCS site and are:

- Maximum wind speed = 230 mph
- Translational speed = 46 mph
- Maximum rotational speed = 184 mph
- Radius of maximum rotational speed = 150 feet

- Pressure drop = 1.2 pounds per square inch (psi)
- Rate of pressure drop = 0.5 psi per second

Revision 1 of Regulatory Guide 1.76 retains the 10^{-7} exceedance probability for tornado wind speeds, the same as the original version of that regulatory guide. Revision 2 of NUREG/CR-4461 (U.S. NRC Feb 2007) describes the relationship between and previous use of the original Fujita scale of wind speed ranges for different tornado intensity classifications and the enhanced Fujita scale wind speed ranges in the revised analysis of tornado characteristics. That document was the basis for most of the technical revisions to Regulatory Guide 1.76.

Tornadoes observed within a 2° latitude and longitude square, centered on the VCS site, are used to characterize their frequency of occurrence from a climatological standpoint. Data was obtained from the NCDC *Storm Events* database of tornado occurrences by location, date, and time; starting and ending coordinates; Fujita-scale wind speed classification (or F-scale); Pearson-scale path length and path-width dimensions (or P-scale); and other storm-related statistics (NCDC Jun 2008a).

The 2° square area for this evaluation includes all or portions of 25 counties in Texas. All tornado occurrences for a given county were included, even if some portion of the county was not within the 2° latitude/longitude square. Through the nearly 58-year period from 1950 through September 2007, the records in the database indicate that a total of 784 tornadoes occurred in one of these counties (NCDC Jun 2008a).

Tornado F-scale classifications (with corresponding wind speed range based on the original Fujita scale of wind speeds) and respective frequencies of occurrence are as follows:

- F5 (wind speed > 117 mps) = 0
- F4 (wind speed 93–116 mps) = 1
- F3 (wind speed 70–92 mps) = 23
- F2 (wind speed 50–69 mps) = 81
- F1 (wind speed 33–49 mps) = 230
- F0 (wind speed 18–32 mps) = 372

An additional 77 tornadoes were not assigned an F-scale in the *Storm Events* database (NCDC Jun 2008a) and are therefore assumed to be comparable to an F0 classification.

Tornadoes have occurred in the VCS site area during all months of the year, with nearly identical peak frequencies in the autumn and spring (about 36% and 33%, respectively). On a monthly basis, the greatest number of events has been recorded in September (160), followed by the second-highest count during the month of May (146). Together, they comprise nearly 40% of the tornadoes that occur annually in the site area. Fewer than 10% of all tornadoes have occurred during the winter months (NCDC Jun 2008a).

2.7.3.4 Hail, Snowstorms, and Ice Storms

Frozen precipitation in the VCS site area typically occurs in the form of hail, snow, sleet, and freezing rain. The frequency and characteristics of these types of weather events are based on the following two references: the latest version of *The Climate Atlas of the United States* (NCDC Sep 2002), which has been developed from observations made over the 30-year period of record from 1961 to 1990, and the NCDC *Storm Events* database for Texas (NCDC Apr 2008) based on observations for the period of January 1950 to March 2007.

Although hail can occur at any time of the year in the site area and is associated with well-developed thunderstorms, it is observed primarily during the late winter through early summer months (February through June), reaching a peak during May and April, and occurring least often from mid-summer into early autumn (July through September) (NCDC Apr 2008).

The *Climate Atlas* (NCDC Sep 2002) indicates that the northern two-thirds of Victoria County and most of DeWitt County to the northwest can expect, on average, hail with diameters 0.75 inch or greater approximately 1 to 2 days per year. The *Climate Atlas* also shows a similar frequency in smaller portions of the adjacent or nearby Goliad, Karnes, Jackson, Bee, and San Patricio Counties. However, a relatively lower frequency is indicated for most of the area in these counties; that is, about 1 day per year for hail 0.75 inch or larger in diameter. Other nearby counties of Matagorda, Calhoun, Refugio, and Aransas, which are directly adjacent to the Gulf of Mexico, can expect 0.75-inch or greater hail about 1 day or fewer per year. The *Climate Atlas* indicates that the occurrence of hail with diameters greater than or equal to 1.0 inch is relatively less frequent over the site area (NCDC Sep 2002).

The NCDC cautions that hailstorms are point observations and somewhat dependent on population density. This may explain the areal extent of higher frequencies around Victoria and the eastern half of DeWitt County and what could be interpreted as generally lower frequencies of occurrence in other nearby counties not directly adjacent to the Gulf of Mexico. A decrease in frequency toward the coast appears to be reasonable. The slightly higher annual mean frequency of approximately 1 to 2 days per year with hail larger than or equal to 0.75 inch in diameter is considered to be a representative indicator for the VCS site.

Hailstorms within Victoria and surrounding counties have generally reported maximum hailstone diameters ranging between 2.0 and 4.5 inches. Golfball-sized hail (about 1.75 inches in diameter) is not a rare occurrence and has been observed numerous times in the site area (NCDC Apr 2008). However, in terms of extreme hailstorms, the NCDC *Storm Events* database indicates that grapefruit- to softball-sized hail (approximately 4.0 to 4.5 inches in diameter, respectively) was observed on three occasions within 50 miles of the VCS site:

- April 11, 1995 (4.5 inches), Calhoun County, approximately 30 miles to the southeast of the VCS site
- February 19, 1991 (4.5 inches), DeWitt County, approximately 45 miles to the north-northwest
- May 25, 1961 (4.0 inches), Lavaca County, approximately 40 miles to the north-northwest

From central Texas southward, most winters bring no accumulation of snow. Snowstorms occur only once every few decades, but no corner of the state is immune (USU Jun 2008). Any accumulation of snow is a rare occurrence in the Upper Coast climate division where the VCS site is located, with normal annual totals at all listed nearby observing stations averaging less than 0.5 inch (see Table 2.7-3). Historical records for the site area indicate that maximum 24-hour and monthly snowfalls have occurred during the months of November through February (see Table 2.7-5). The *Climate Atlas* (NCDC Sep 2002) indicates that the occurrence of snowfalls 0.1 inch or greater in the VCS site area average less than 1 day per year (see also Table 2.7-2). Additional details regarding maximum 24-hour and cumulative monthly record snowfall totals are given in Subsection 2.7.4.1.3.

Depending on the temperature characteristics of the air mass, snow events are often accompanied by, or alternate between, sleet and freezing rain as the weather system traverses the VCS site region. In most cases, freezing rain results from the process of warm moist air "overrunning" colder air and is caused by rain falling into a relatively shallow layer of cold air with temperatures either at or just below the freezing point. Arctic air masses that reach the Upper Coast climate division in the winter season are typically very shallow and have been known to produce ice storms. The *Climate Atlas* (NCDC Sep 2002) indicates that, on average, freezing precipitation occurs about 3 to 5 days per year in the area that includes the VCS site.

From an operational standpoint, ice storm effects often include hazardous driving conditions, and occasionally downed trees and power lines as the result of ice buildup on these surfaces. The NCDC *Storm Data* and *Storm Events* summaries (NCDC Jun 2004 and NCDC Apr 2008, respectively) for the VCS site area frequently do not include statements of ice accumulation, which suggests that the amounts are light.

2.7.3.5 Tropical Cyclones

Tropical cyclones include not only hurricanes and tropical storms, but systems classified as tropical depressions, subtropical storms, subtropical depressions, and extratropical storms. This characterization considers all "tropical cyclones" (rather than systems classified only as hurricanes and tropical storms) because storm classifications are generally downgraded once landfall occurs and the system weakens, although they may still result in significant rainfall and extreme wind events as they travel through the site region.

The National Oceanic and Atmospheric Administration's Coastal Services Center provides a comprehensive historical database, extending from 1851 through 2007, of tropical cyclone tracks based on information compiled by the National Hurricane Center. This database indicates that 60 tropical cyclone centers or storm tracks have passed within a 100-nautical-mile radius of the VCS site during this historical period (NOAA-CSC Jun 2008). Storm classifications and respective frequencies of occurrence over this 157-year period of record are as follows:

- Hurricanes: Category 5 (1), Category 4 (4), Category 3 (5), Category 2 (6), Category 1 (14)
- Tropical storms: 24

- Tropical depressions: 6
- Subtropical storms: 0
- Subtropical depressions: 0
- Extratropical storms: 0

Wind speeds (1-minute average) corresponding to each of the Saffir-Simpson Hurricane Categories are listed below:

Hurricane Classification	Wind Speed (mph)
Category 1	74–95
Category 2	96–110
Category 3	111–130
Category 4	131–155
Category 5	>155

Tropical cyclones within this 100-nautical-mile radius have occurred as early as June and as late as October, with the highest frequency (18 out of 60 events) recorded during September, including all classifications at and above Tropical Depression status. June, July, and August account for 13, 12, and 13 events, respectively. Tropical storms have occurred in all months from June to October.

During the months of June through September, hurricanes occur with similar frequency (7, 5, 7, and 8, respectively). The only Category 5 hurricane to track within 100 nautical miles of the VCS site was Hurricane Carla in September 1961. Of the four Category 4 hurricanes that have occurred within this radial distance, three were recorded in August, and one was recorded in September. Two Category 3 hurricanes have occurred in September and one each in July, August, and October. Most major hurricanes in the site area have occurred from mid- to late-summer (NOAA-CSC Jun 2008).

Tropical cyclones are responsible for at least 16 separate rainfall records among the 15 NWS and cooperative observer network stations listed in Table 2.7-1: four 24-hour (daily) rainfall totals and 12 monthly rainfall totals (see Table 2.7-4). In late June 1960, two 24-hour records were set at the Maurbro and Point Comfort cooperative observing stations as the result of an unnamed tropical storm (14.80 inches and 14.65 inches, respectively). Rainfall associated with Hurricane Beulah in late September 1967, whose track did not pass within 100 nautical miles of the VCS site, nevertheless, resulted in historical 24-hour maximum totals of 10.61 inches at the Beeville 5 NE station and 9.16 inches at the Goliad observing station (NCDC Jul 2005, USU Jun 2008, NCDC Nov 2002, and NOAA-CSC Jun 2008).

Monthly station records were established because of partial contributions from the following tropical cyclones (NCDC Jun 2008b, NCDC Jul 2005, USU Jun 2008, NCDC Nov 2002, NOAA-CSC Jun 2008, and NCDC Jun 2008d):

- Hurricane Fern in September 1971 (26.30 inches at Refugio)
- Hurricane Beulah in September 1967 (25.59 inches at Sinton, 22.62 inches at Beeville 5 NE, 22.60 inches at Karnes City 2N, 22.19 inches at Goliad, 21.27 inches at Cuero, and 20.85 inches at Rockport)
- An unnamed tropical storm in June 1960 (25.24 inches at Point Comfort and 22.47 inches at Maurbro)
- An unnamed hurricane in October 1949 (24.28 inches at Palacios Municipal Airport)
- Tropical Storm Erin in July 2007 (22.65 inches at Aransas Wildlife Refuge and 20.35 inches at the Victoria Regional Airport)

As indicated above, significant amounts of rainfall can still be associated with a tropical cyclone once the system moves inland. Wind speed intensity, however, noticeably decreases as the system passes over terrain and is subjected to increased frictional forces. Examples of such effects, associated with some of the more intense tropical cyclones that have passed within 100 nautical miles of the VCS site, are:

- Hurricane Carla (September 1961). Carla was one of the most violent storms in Texas history. The storm remained at hurricane strength as it crossed the area within 100 nautical miles of the VCS site. Carla rapidly decreased in intensity after moving onshore (having reached Category 5 status while offshore, but decreasing to a Category 3 hurricane at landfall). The storm was downgraded to Tropical Storm status just northeast of Austin, Texas.

  The eye of the hurricane (30 miles in diameter) moved into the Port O'Connor area about 40 miles east-southeast of the VCS site and the city of Victoria. Peak wind gusts estimated at the following locations include: 175 mph at Port Lavaca (about 25 miles from the site); 150 mph at Victoria, Austwell, Edna, Aransas Pass, and Port Aransas (at distances ranging from about 20 to 70 miles away); and 160 mph at Matagorda (about 65 miles distant) (NOAA-CSC Jun 2008; NCDC Jun 2004; U.S. Weather Bureau Sep 1961).

- Hurricane Celia (August 1970). Celia crossed the Texas coastline about 50 miles south-southwest of the VCS site, between Corpus Christi and Aransas Pass. It remained a Category 3 hurricane for about 40 miles inland, decreasing to a Category 1 storm as it traversed the remainder of the area within 100 nautical miles of the site. Celia was downgraded to Tropical Storm status about 135 miles inland from the coast.

  Celia's damage was primarily from high intensity winds. Unlike other tropical cyclone events, flooding occurred relatively less with this storm. Sustained wind speeds of 130 mph were measured at Aransas Pass about 50 miles south-southwest of the VCS site. Peak wind gusts of 180 mph were estimated at both Aransas Pass (along the coast) and at Robstown, west of Corpus Christi, about 70 miles southwest of the site (NOAA-CSC Jun 2008; NCDC Jun 2004).

- Hurricane Claudette (July 2003). Hurricane Claudette (Category 1) struck the middle Texas coast near Port O'Connor with sustained winds estimated around 90 mph. At Point Comfort, the Formosa Plant measured sustained winds of 80 mph with a gust to 100 mph. Estimates of sustained winds between 70 and 80 mph with gusts to near 100 mph were also reported for DeWitt County, to the northwest of Victoria County. Claudette continued moving inland across Victoria, Goliad, and Bee Counties, eventually weakening to a tropical storm. Maximum rainfall measurements were recorded in Bee, Goliad, and Refugio Counties (NOAA-CSC Jun 2008, NCDC Jun 2008d).

2.7.3.6 Droughts and Dust (Sand) Storms

Droughts are prolonged periods of very dry weather, which cause serious water imbalances in the affected area. The Upper Coast climate division where the VCS site is located (see Subsection 2.7.1.2) is commonly affected by drought conditions. However, the most severe droughts occur in west and northwestern Texas where the southwestern desert of the United States extends (Bomar 1983). Subsection 2.3.1.1.1 describes the effect of droughts on the VCS cooling system (water sources such as the Guadalupe River) and describes historical low water conditions from droughts and their frequencies.

Dust storms predominantly originate in normally arable regions during periods of drought where dust and sand layers are loosened. Dust storms in the upper coastal region of Texas are very rare because of the lush grasslands and small interspersed pine and oak thickets. Severely reduced visibilities because of large-scale dust storms in Texas occur on average only once every 3 to 5 years (Bomar 1983). The NCDC *Storm Events* database indicates no occurrences of dust storms near the VCS site since 1993 (NCDC Jun 2008c).

2.7.4 Local Meteorology

Data acquired by the NWS at its Victoria, Texas, first-order station and from 14 other nearby locations in its network of cooperative observer stations, as compiled and summarized by the NCDC and the Utah State GIS Climate Search (USU Jun 2008; NCDC Nov 2002, NCDC Jul 2006, NCDC Jun 2008b), are used to characterize normals, and period-of-record means and extremes of temperature, rainfall, and snowfall in the vicinity of the site for VCS Units 1 and 2. Subsection 2.7.1.1 identifies the sources of these climatological summaries and other data resources. The approximate distances and directions of these climatological observing stations relative to the site are listed in Table 2.7-1; their locations are shown in Figure 2.7-1.

As indicated in Subsection 2.7.1.1, first-order NWS stations also record measurements, typically on an hourly basis, of other weather elements, including winds, relative humidity, dew point and wet bulb temperatures, barometric pressure, and other observations when those conditions occur (e.g., fog, thunderstorms).

Besides using data from these nearby climatological observing stations, measurements from the tower-mounted meteorological monitoring system that currently supports VCS Units 1 and 2 are also used to characterize dispersion conditions in support of this COL Application. Refer to Subsections 6.4.2 and 6.4.3 for a description of relevant details about this pre-application monitoring program, including: tower location; terrain features and elevations in the vicinity of proposed Units 1 and 2; instrumentation and measurement levels; data recording and processing; and system operation, maintenance, and calibration activities.

2.7.4.1 Normal, Mean, and Extreme Values

Subsection 2.7.1.3 summarizes normals, and period-of-record means and extremes for several standard weather elements (temperature, atmospheric water vapor, precipitation, and wind conditions).

To substantiate that mean and extreme values at these stations (based on their long-term records of observations) are representative of conditions that might be expected at the site for VCS Units 1 and 2, this subsection provides additional details regarding the individual station records from which the values presented in Subsection 2.7.1.3 were obtained.

Historical extremes of temperature, rainfall, and snowfall are listed in Table 2.7-4 for the 15 NWS and cooperative observing stations in the VCS site area.

2.7.4.1.1 Temperature

Characteristics of the normal daily maximum and minimum temperatures, the daily mean temperatures, and the diurnal temperature ranges for 14 of the 15 nearby climatological observing stations that make such measurements are described in Subsection 2.7.1.3.1 and presented in Table 2.7-3. The overall maximum and minimum temperature extremes observed in the VCS site area are summarized in Subsection 2.7.1.3.1 as well.

Extreme maximum temperatures recorded in the vicinity of the site for VCS Units 1 and 2 have ranged from 103°F to 113°F, with the highest reading observed at the Cuero cooperative station on September 5, 2000. As Table 2.7-4 and the accompanying notes show, individual station extreme maximum temperature records were set at multiple locations on the same or adjacent dates (e.g., Palacios Municipal Airport, Port O'Connor, Point Comfort, Yoakum, Rockport, Sinton, Victoria Regional Airport, Refugio 2 NW, and Karnes City 2N on September 5 and 6, 2000) (NCDC Jul 2005; NCDC Nov 2002; NCDC Jul 2006; USU Jun 2008).

Extreme minimum temperatures in the vicinity of the VCS site have ranged from 6°F to 12°F, with the lowest reading on record observed at the Yoakum cooperative station (about 46 miles to the north) on December 23, 1989. More noteworthy, though, Table 2.7-4 and the accompanying notes indicate that record low temperatures were also set at Palacios Municipal Airport, Port O'Connor, Point Comfort, Cuero, Sinton, Aransas Wildlife Refuge, Victoria Regional Airport, and Karnes City 2N on the same date (NCDC Jul 2005; NCDC Nov 2002; NCDC Jul 2006; USU Jun 2008).

The extreme maximum and minimum temperature data indicates that synoptic-scale conditions responsible for periods of record-setting excessive heat, as well as significant cold air outbreaks, tend to affect the overall VCS site area. The similarity of the respective extremes and their dates of occurrence suggest that these statistics are reasonably representative of the temperature extremes that might be expected to be observed at the site for VCS Units 1 and 2.

2.7.4.1.2 Atmospheric Water Vapor

Annual, seasonal, and monthly characteristics of the wet bulb and dew point temperatures, along with relative humidity (including diurnal variations), based on measurements at the nearby Victoria, Texas, NWS station, are described in Subsection 2.7.1.3.2.

2.7.4.1.3 Precipitation

Characteristics of the normal (30-year average) annual rainfall and snowfall totals are described in Subsection 2.7.1.3.3 and presented in Table 2.7-3. The overall maximum daily and monthly totals observed in the VCS site area for these forms of precipitation are summarized in Subsection 2.7.1.3.3 as well.

Because precipitation is a point measurement, mean and extreme statistics, such as individual storm event, or daily or cumulative monthly totals vary from station to station. Assessing the variability of precipitation extremes over the VCS site area to evaluate whether the available long-term data is representative of conditions at the site depends greatly on station coverage.

Historical precipitation extremes (rainfall and snowfall) are presented in Table 2.7-4 for the 15 nearby climatological observing stations listed in Table 2.7-1. Maximum recorded 24-hour rainfall totals range from 8.15 inches at the Rockport station, about 40 miles south of the VCS site, to 17.58 inches at the Edna Highway 59 Bridge observing station, about 32 miles to the northeast (NCDC Jul 2005; NCDC Nov 2002; NCDC Jul 2006; USU Jun 2008). Maximum monthly rainfall totals range from 18.33 inches at Yoakum, about 46 miles to the north, to 34.44 inches at the Port O'Connor observing station, about 39 miles to the east-southeast (NCDC Jul 2005; NCDC Nov 2002; NCDC Jul 2006; USU Jun 2008; NCDC Jun 2008d).

Most of the individual station monthly rainfall records (and to a lesser extent the 24-hour record totals) were established as a result of precipitation associated with tropical cyclones. Of those records, half were because of tropical cyclones that passed within a 100-nautical-mile radius of the VCS site. The other half (i.e., six monthly totals and two 24-hour totals) were attributable to the expansive influence of Hurricane Beulah, which did not pass within that radial distance of the site.

However, the overall highest 24-hour rainfall total in the site area, 17.58 inches, on October 18, 1994, at the Edna Highway 59 Bridge cooperative observing station (USU Jun 2008) was not directly associated with a tropical cyclone. Rather, this extreme rainfall event was one of many over southeast Texas caused by a synoptic situation that included a steady stream of tropical moisture into the region in the wake of former Pacific Hurricane Rosa. The remnants of that storm crossed into Mexico, moved

through Texas, and slowed after entering the Mississippi Valley. This system coupled with a quasi-stationary frontal boundary along the Texas Coast that provided a source of instability and supported widespread and continual thunderstorm development (NCDC Jun 2004).

Similarly, the highest monthly rainfall total in the site area, 34.44 inches during July 2006, was recorded at the Port O'Connor cooperative observing station (USU Jun 2008; NCDC Jun 2008d). This total represents the accumulation of 14 days of measurable precipitation during that month, with less than 20% being recorded from July 1 to 7, and the period from July 23 to 29 accounting for approximately 80% of the total. More than 24 inches fell within a four–day period between July 23 and July 26 (USU Jun 2008; NCDC Jun 2008d).

In general, when monthly rainfall records were established at a given observing station, regardless of their cause(s), significant amounts of precipitation were usually measured at most of the other stations in the site area, particularly when associated with the passage of tropical cyclones. This is usually not the case for maximum 24-hour rainfall records because of the occurrence of more local-scale events such as thunderstorms and because of the intense nature of these storms in this coastal area. However, there does not appear to be any clear relationship between the rainfall recorded during such extreme events, whether on a 24-hour or monthly basis, and the distance inland within the area considered around the VCS site (Figure 2.7-1). Therefore, based on the range of the maximum recorded 24-hour and monthly rainfall totals among these stations, the areal distribution of these climatological observing stations around the site, and their proximity to the site, data suggests that rainfall extremes close to the upper limits of the respective maxima can reasonably be expected to occur at the VCS site.

From central Texas southward, most winters bring no accumulation of snowfall. Major snowstorms occur only once every few decades, but no corner of the state is immune (USU Jun 2008). Among the 15 nearby observing stations listed in Table 2.7-4, 7 of the 24-hour maximum snowfall records were established as a result of the Christmas storm of 2004 occurring on December 24-25. The highest, 12.0 inches, was measured at the Goliad observing station about 22 miles to the west of the VCS site. Other station records on this date range from 4.5 inches at Beeville 5 NE, about 42 miles west-southwest, to 9.5 inches at the Refugio 2 NW observing station, about 25 miles to the southwest (Table 2.7-4). Because of the rarity of such events in the site area, any of the record snowfall amounts listed in Table 2.7-4 can reasonably be expected to occur at the VCS site when such events do take place.

2.7.4.1.4 **Fog**

The closest station to the VCS site at which observations of fog are made and routinely recorded is the Victoria, Texas, NWS station about 17 miles to the north-northeast. The 2007 LCD summary for this station (Table 2.7-2) indicates an average of about 44 days per year of heavy fog conditions, based on a 43-year period of record. The NWS defines heavy fog as fog that reduces visibility to 1/4 mile or less (NCDC Jun 2008b).

On a seasonal basis, heavy fog conditions occur most often during the winter months (December through February), reaching peak frequency in January, averaging 7.2 days per month. Heavy fog

conditions occur least often in the summer (i.e., June to August), averaging less than 1 day per month (NCDC Jun 2008b).

The frequency of heavy fog conditions at the site for VCS Units 1 and 2 would be expected to be very similar to the observations made at the Victoria, Texas, NWS station because of their close proximity to each other (about 17 miles). This is consistent with the higher frequency of occurrence reported in *The Climate Atlas of the United States* (NCDC Sep 2002), which indicates an annual average frequency of 35.5 to 40 days per year in the area that includes both Victoria, Texas, and the VCS site. The seasonal variation in *The Climate Atlas* is very similar to that in the 2007 LCD for the Victoria NWS station (NCDC Jun 2008b; NCDC Sep 2002).

Enhancement of naturally occurring fog conditions as the result of the cooling basin and plant service water system cooling towers associated with VCS Units 1 and 2 is addressed in Subsection 5.3.3.1.

2.7.4.2 Average Wind Direction and Wind Speed Conditions

The distribution of wind direction and wind speed is an important consideration when characterizing the dispersion climatology of a site. Long-term average wind motions at the macro- and synoptic scales (on the order of several thousand down to several hundred kilometers) are influenced by the general circulation patterns of the atmosphere at the macroscale and by large-scale topographic features (e.g., land-water interfaces such as coastal areas). These characteristics are addressed in Subsection 2.7.1.2.

Although they may reflect these larger-scale circulation effects, site-specific or microscale (on the order of 2 kilometers or less) wind conditions are influenced primarily by local and, to a lesser extent (in general), by meso- or regional-scale (up to about 200 kilometers) topographic features. Wind measurements at these smaller scales are currently available from the onsite, pre-application phase meteorological monitoring program operated in support of proposed VCS Units 1 and 2 and, for comparison, from data recorded at the nearby Victoria, Texas, NWS station.

Subsections 6.4.2 and 6.4.3 describe the pre-application phase monitoring program. Wind direction and wind speed measurements were made at two levels on a 60-meter instrumented tower (the lower level at 10 meters and the upper level at 60 meters). The monitoring program began operation on June 28, 2007.

Figures 2.7-2 through 2.7-7 present annual and seasonal wind rose plots (i.e., graphical distributions of the direction from which the wind is blowing and wind speeds for each of 16, 22.5° compass sectors centered on north, north-northeast, northeast, etc.), for the 10-meter level based on measurements over the 1-year period of record from July 1, 2007, through June 30, 2008.

The wind direction distribution at the 10-meter level indicates a prevailing wind (the direction from which the wind blows most often) from the south-southeast on an annual basis with about 50% of the winds blowing from the southeast quadrant (see Figure 2.7-2). Winds from the north and north-northeast sectors combined occur about 18% of the time annually.

On a seasonal basis, winds from the southeast quadrant appear to predominate throughout the year, but especially during the spring and summer (see Figures 2.7-4 and 2.7-5). During the winter, winds from the north sector prevail (see Figure 2.7-3). Autumn represents a transitional season in that winds from the northeast and southeast quadrants occur with about the same frequency as north to northeasterly flow increases as the result of increased cold frontal passages (Figure 2.7-6); winds from the north sector prevail during this season as well. Plots of individual monthly wind roses at the 10-meter measurement level are presented in Figure 2.7-7, Sheets 1 to 12.

Wind rose plots based on measurements at the 60-meter level are shown in Figures 2.7-8 through 2.7-13. By comparison, wind direction distributions for the 60-meter level are fairly similar to the 10-meter level wind roses on an annual basis, and for the winter, spring, and summer seasons in terms of the predominant directional quadrants and variation over the course of the year. However, autumn differs in terms of the predominant directional quadrant; that is, winds from the southeast quadrant clearly occur more often at the 60-meter level than at the 10-meter level where, as indicated above, the aggregate frequencies from the northeast and southeast quadrants appear to be similar. Plots of individual monthly wind roses at the 60-meter measurement level are presented in Figure 2.7-13, Sheets 1 to 12.

Wind information summarized in the LCD for the Victoria, Texas, NWS station (Table 2.7-2) indicates a prevailing south-southeasterly wind direction on an annual basis, as well as seasonal variations (NCDC Jun 2008b), that appear to be reasonably similar to the 10-meter-level wind flow at the VCS site. Differences between the two wind direction distributions are attributable to many factors: topographic setting, sensor exposure, instrument threshold and accuracy, and length of record.

Table 2.7-6 summarizes seasonal and annual mean wind speeds based on measurements from the upper and lower levels of the onsite meteorological tower over the 1-year period from July 1, 2007 through June 30, 2008, and from wind instrumentation at the Victoria, Texas, NWS station based on a 24-year period of record (NCDC Jun 2008b). The elevation of the wind instruments at the Victoria NWS station is reasonably comparable to the lower (10-meter) level measurements at the VCS site.}

On an annual basis, mean wind speeds at the 10- and 60-meter levels are 4.0 and 5.9 meters per second, respectively, at the VCS site. The annual mean wind speed at Victoria (4.2 meters per second) is similar to the 10-meter level at the VCS site, differing by only 0.2 meters per second. Seasonal average wind speeds are similar throughout the year, except during autumn when speeds average about 0.8 meters per second lower at the VCS site than at Victoria. Seasonal mean wind speeds for both locations follow the same pattern, described in Subsection 2.7.2.3, in relation to the seasonal variation of relatively higher air stagnation and restrictive dispersion conditions in the site region.

Only 13 occurrences of calm wind conditions were recorded by the onsite meteorological monitoring system at the 10-meter level, and only two occurrences at the 60-meter level, over the 1-year period from July 1, 2007 through June 30, 2008.

2.7.4.3 Wind Direction Persistence

Wind direction persistence is a relative indicator of the duration of atmospheric transport from a specific sector-width to a corresponding downwind sector-width that is 180 degrees opposite. Atmospheric dilution is directly proportional to the wind speed (other factors remaining constant). When combined with wind speed, a wind direction persistence/wind speed distribution further indicates the downwind sectors with relatively more or less dilution potential (higher or lower wind speeds, respectively) associated with a given transport wind direction.

Tables 2.7-7 and 2.7-8 present wind direction persistence/wind speed distributions based on measurements from the VCS pre-application phase monitoring program for the 1-year period of record from July 1, 2007 through June 30, 2008. The distributions account for discrete durations ranging between 1 and 48 hours for wind directions from 22.5-degree upwind sectors centered on each of the 16 standard compass radials (i.e., north, north-northeast, northeast, etc.) and for wind speed groups greater than or equal to 5, 10, 15, 20, 25, and 30 mph. Distributions are provided for wind measurements made at the lower (10-meter) and the upper (60-meter) tower levels, respectively, identified in the preceding subsection.

At the 10-meter level, the longest persistence period is at least 30 hours for winds from the north. This duration appears in the broadest wind speed group summarized (i.e., for speeds greater than or equal to 5 mph). For the north direction sector, the longest persistence period decreases to at least 18 hours for wind speeds greater than or equal to 10 mph. Maximum persistence periods of at least 18 hours' duration occurred for speeds greater than or equal to 15 mph and south-southeast winds. For wind speeds greater than or equal to 25 mph, maximum persistence is limited to at least 4 hours and was recorded for south-southeast and northwest winds.

At the 60-meter level, the longest persistence period is at least 36 hours and occurred for winds from the south-southeast (see Table 2.7-8) for wind speeds greater than or equal to 15 mph. For this direction sector, the longest persistence period decreases to at least 18 hours for wind speeds greater than or equal to 20 mph. For wind speeds greater than or equal to 30 mph, maximum persistence is limited to at least 4 hours and was recorded for winds from the south-southeast and northwest sectors.

2.7.4.4 Atmospheric Stability

Atmospheric stability is a relative indicator for the potential diffusion of pollutants released into the ambient air. Atmospheric stability, as addressed in this ER, was based on the delta-temperature ($\Delta\mathbf{T}$) method described in Section 2.2 of Revision 1 to RG 1.23 (U.S. NRC Mar 2007b).

The approach classifies stability based on the temperature change with height (i.e., the difference in °C per 100 meters or $\Delta\mathbf{T}$). Stability classifications are assigned according to the following criteria from Table 1 of RG 1.23:

- Extremely Unstable (Class A): $\Delta\mathbf{T} \leq -1.9°C$
- Moderately Unstable (Class B): $-1.9°C < \Delta\mathbf{T} \leq -1.7°C$

- Slightly Unstable (Class C): -1.7°C < Δ**T** ≤ –1.5°C
- Neutral Stability (Class D): -1.5°C < Δ**T** ≤ –0.5°C
- Slightly Stable (Class E): -0.5°C < Δ**T** ≤ +1.5°C
- Moderately Stable (Class F): +1.5°C < Δ**T** ≤ +4.0°C
- Extremely Stable (Class G): +4.0°C < Δ**T**

The diffusion capacity is greatest for extremely unstable conditions and decreases progressively through the remaining unstable, neutral stability, and stable classifications.

During the 1-year period from July 1, 2007 through June 30, 2008, Δ**T** was determined from the difference between temperature measurements made at the 60- and 10-meter tower levels. Seasonal and annual frequencies of atmospheric stability class and associated 10-meter level mean wind speeds for this period of record are presented in Table 2.7-9.

The data indicates a predominance of neutral stability (Class D) and slightly stable (Class E) conditions throughout most of the year. These stability classes combined were recorded about 52% of the time on an annual basis, ranging seasonally from about 42% during autumn to about 58% during both the winter and spring. Extremely unstable conditions (Class A) were recorded slightly more than 5% of the time on an annual basis, occurring more frequently during the summer (about 8% of the time) as the result of relatively greater solar insolation, and least often during the autumn (only about 2.5% of the time). Moderately and extremely stable conditions (Classes F and G, respectively) were recorded about 29% of the time on an annual basis, occurring most often during the autumn (about 42% of the time), owing in part to increased radiational cooling at night, and least often during the spring (about 20% of the time).

Joint frequency distributions (JFDs) of wind speed and wind direction by atmospheric stability class and for all stability classes combined for the 10- and 60-meter wind measurement levels are presented in Tables 2.7-10 and 2.7-11, respectively, based on the 1-year period of record from July 1, 2007 through June 30, 2008. The 10-meter level JFDs are used to evaluate short-term dispersion estimates for accidental atmospheric releases (see Subsection 2.7.5) and long-term diffusion estimates of routine releases to the atmosphere (see Subsection 2.7.6).

The pre-application phase onsite meteorological monitoring program will continue until two complete annual cycles of measurement data are available. A supplement to the COL Application, including the subsequently measured data and a reanalysis of the atmospheric dispersion estimates in Subsections 2.7.5 and 2.7.6, based on the complete 2-year data set, will be submitted. See Subsection 6.4.6 for additional details.

2.7.4.5 Topographic Description and Potential Modifications to Meteorological Conditions

The VCS site is located in Victoria County, Texas approximately 13 miles from the city of Victoria. The site is approximately 125 miles southwest of Houston and 60 miles north-northeast of Corpus Christi.

The VCS site property encompasses approximately 11,500 acres. The power block area for Units 1 and 2 covers about 41 acres.

Terrain features within a 50-mile radius of the site for VCS Units 1 and 2, based on digital map elevations, are illustrated in Figure 2.7-1. Terrain elevation profiles along each of the 16 standard 22.5° compass radials out to a distance of 50 miles from the site are shown in Figure 2.7-14 (Sheets 1 through 6). Because Units 1 and 2 are located relatively close to one another and because of the distance covered by these profiles, the locus of these radial lines is the center point between the Units 1 and 2 reactor buildings.

The nominal plant grade elevation for Units 1 and 2 is around 95 feet above MSL. Located within the south-central Texas Coastal Plain, terrain within 50 miles of the site for VCS Units 1 and 2 is generally flat to gently rolling with elevations decreasing to the east-northeast clockwise through the south-southwest. Terrain elevations tend to increase to the west-southwest through the north-northeast with increasing distance from the site, with relief of up to about 450 feet relative to nominal plant grade. Figure 2.7-1 indicates that the highest elevation within 50 miles of the site is 550 feet above MSL (this spot elevation does not fall along one of the 16 standard direction radials presented in Figure 2.7-14). The lowest elevation within 50 miles of the site, 0 feet MSL (Gulf of Mexico and adjacent bay waters), occurs to the east through the south (see Figures 2.7-1 and 2.7-14).

More detailed topographic features within a 5-mile radius of the site for VCS Units 1 and 2, also based on digital map elevations, are shown in Figure 2.7-15. Terrain within this radial distance of the site primarily consists of flat plains with very little elevation change, relative to nominal plant grade.

Construction of the site for VCS Units 1 and 2 will include clearing, grubbing, excavation, leveling, and landscaping activities typical of large-scale projects (see Section 3.9 for a listing of activities and their estimated durations). The most prominent feature, however, in terms of land alteration associated with this facility, will be the excavation and construction of an approximately 4900-acre cooling water basin. Nevertheless, alterations to the existing terrain would not represent a significant change to the flat to gently rolling topographic character of the site vicinity or the surrounding site area (see Figure 2.7-15).

Subsection 6.4.2 provides additional details regarding the considerations made in siting and equipping the meteorological tower installed for the pre-application phase monitoring program in relation to the construction of, and/or major structures associated with, those units.

The dimensions and operating characteristics of the facilities associated with VCS Units 1 and 2, including paved, concrete, or other improved surfaces, are considered to be insufficient to generate discernible, long-term effects to local- or microscale meteorological conditions, or to the mean and extreme climatological characteristics of the site area described previously under Subsections 2.7.1.3 and 2.7.4.1.

Wind flow will be altered in areas immediately adjacent to and downwind of larger site structures. However, these effects will likely dissipate within 10 structure heights downwind of the intervening structure(s). Similarly, although ambient temperatures immediately above any improved surfaces could

increase, these temperature effects will be too limited in their vertical profile and horizontal extent to alter local-, area-, or regional-scale mean or extreme ambient temperature patterns. See Subsections 6.4.2.4 and 6.4.2.5 for additional details.

VCS Units 1 and 2 use a cooling basin and plant service water system cooling towers as a means of heat dissipation during normal operation. Potential meteorological effects resulting from the cooling basin and plant service water system cooling towers could include enhanced ground-level fogging and icing, cloud shadowing and precipitation enhancement, and increased ground-level humidity. These effects are addressed in detail in Subsections 5.3.3.1 and 5.3.3.2.

2.7.5 Short-Term Diffusion Estimates

2.7.5.1 Regulatory Basis and Technical Approach

To evaluate potential health effects for General Electric-Hitachi ESBWR design basis accidents, Section 7.1 of NUREG-1555 (U.S. NRC Mar 2000) specifically requires the applicant to account for the 50-percentile X/Q (relative concentration) values at appropriate distances from the release points of effluents to the atmosphere. These 50-percentile X/Q values are to be determined using onsite meteorological data and represent more realistic dispersion conditions for the VCS Units 1 and 2 site vicinity. The NRC-sponsored PAVAN model (NUREG/CR-2858) (U.S. NRC Nov 1982) has been used to generate these 50-percentile X/Q values.

Recent (July 1, 2007 through June 30, 2008) data from the VCS Units 1 and 2 pre-application phase meteorological monitoring program has been used for the quantitative evaluation of a design basis accident and atmospheric dispersion estimates at the proposed VCS site. The pre-application phase monitoring program will continue until two complete annual cycles of measurement data are available. A supplement to the COL Application, including the subsequently measured data and a reanalysis of the atmospheric dispersion estimates in Subsections 2.7.5 and 2.7.6, based on the complete 2-year data set, will be submitted to NRC. See Subsection 6.4.6.5 for more details.

The PAVAN program implements the guidance provided in Regulatory Guide 1.145 (U.S. NRC Feb 1983). Mainly, the code computes X/Q values at the exclusion area boundary (EAB) and the boundary of the low population zone (LPZ) for each combination of wind speed and atmospheric stability class for each of 16 downwind direction sectors (i.e., north, north-northeast, northeast, etc.). The X/Q values calculated for each direction sector are then ranked in descending order, and an associated cumulative frequency distribution is derived based on the frequency distribution of wind speeds and stabilities for the complementary upwind direction sector (i.e., 180 degrees opposite). The X/Q values are also ranked independently of wind direction into a cumulative frequency distribution for the entire site.

The following input data and assumptions were used in the PAVAN modeling analysis:

- Meteorological data: 1 year (July 1, 2007 to June 30, 2008) onsite JFD of wind speed, wind direction, and atmospheric stability
- Wind sensor height: 10 meters

- Vertical temperature difference: (60 meters–10 meters)
- Number of wind speed categories: 12 (including calm and the 11 wind speed categories listed in Table 2.7-10)
- Type of release: Ground-level
- Release height: 10 meters (default height)
- Minimum building cross-sectional area: 2352 square meters
- Effective reactor building height: 48 meters above grade
- Shortest distance from source boundary to EAB: 1036 meters, used for all sectors
- Shortest distance from source boundary to LPZ: 7710 meters, used for all sectors

The 1-year composite joint frequency distributions of wind speed, wind direction, and atmospheric stability class, input to the PAVAN dispersion modeling analysis, are presented in Table 2.7-10 (see also Subsection 2.7.4.4 for additional information).

The EAB for VCS Units 1 and 2 is entirely contained within the site property line and is represented in Figure 2.7-17. No residential areas are located within this overall EAB.

As shown in Figure 2.7-17, VCS Units 1 and 2 are conservatively treated as one unit when estimating the shortest distance to each boundary receptor in each direction. To represent both Units 1 and 2, a source boundary was created. Because the PAVAN model cannot produce 5% overall site limit X/Q values unless the distances from the release point to the EAB or LPZ are identical, the shortest distance from the source boundary to the LPZ was used for all 16 direction sectors. For purposes of determining X/Qs and subsequent radiation doses with respect to VCS Units 1 and 2, the EAB is represented by two 4000-foot-radius circle EABs combined into one oval EAB centered on the midpoint between the two reactors (Figure 2.7-17). This dose calculation EAB will be 3399 feet (1036 meters) from the source boundary. The LPZ boundary for VCS Units 1 and 2 consists of one 5-mile-radius circle, centered at the midpoint between the two reactors (see Figure 2.7-18).

As NUREG/CR-2858 (U.S. NRC Nov 1982) indicates, ground-level releases include all release points or areas that are lower than two and one-half times the height of adjacent solid structures. The tallest structures within the source boundary are the Unit 1 and Unit 2 turbine buildings with an elevation of 162 feet (49.4 meters) above grade. Because the ESBWR reactor building plant stack is below the threshold height, all accidental releases were assumed to be at ground level and were assigned the default release height of 10 meters. Compared with an elevated release, a ground-level release usually results in higher ground-level concentrations at downwind receptors as the result of less dilution from shorter traveling distances.

The PAVAN model was also configured to calculate X/Q values assuming both wake credit allowed and wake credit not allowed. Obstructions to air flow have a wake region that extends 10 times the obstruction height downwind. For a reactor building, its physical height is 162 feet and the structural wake extends about 1620 feet (494 meters) downwind. The EAB is 3399 feet (1036 meters) away from

the source boundary in all directions. As a result, the entire EAB is located beyond the wake influence zone induced by either of the reactor buildings. Furthermore, the LPZ is a circle with a 5-mile (8047-meter)-radius centered at the midpoint between the two reactor buildings. Because the LPZ is located beyond the EAB, the "wake credit not allowed" scenario of the PAVAN modeling results was used for the X/Q analyses at both the EAB and the LPZ.

The distance between the EAB and the source boundary (i.e., 1036 meters) for VCS Units 1 and 2 was entered as the receptor distance for each downwind sector in calculating the X/Q values at the EAB. On the other hand, because the LPZ is a circle, the shortest distance between the source boundary for Units 1 and 2 and the LPZ was determined for all direction sectors; these distances are shown in Table 2.7-12. The shortest distance (i.e., 4.792 miles or 7710 meters to the southwest of Unit 1 and to the northeast of Unit 2) was input to the PAVAN model for all direction sectors to calculate X/Q values applicable to the LPZ.

2.7.5.2 PAVAN Modeling Results

Based on the methodology provided in Subsection 2.7.5.1, the resulting 5% overall site limit X/Q percentiles based on the upper envelope of the ordered X/Q-frequency values for the EAB and LPZ are shown in Tables 2.7-13 and 2.7-14, respectively. From these tables, the 50-percenticle X/Q values for the EAB and LPZ are 4.57×10^{-5} and 2.69×10^{-6} sec/m^3, respectively.

These model-predicted X/Q values represent a 0-to-2-hour time interval with no credit taken for building wake effects as indicated previously. To estimate X/Qs for longer time intervals, the program calculates sector-dependent and overall site limit annual average X/Q values using the procedure described in NUREG/CR-2858 (U.S. NRC Nov 1982). The values for intermediate time periods at the LPZ (i.e., 8 hours, 16 hours, 72 hours, and 624 hours) were determined by logarithmic interpolation between the 50-percentile, 0-to-2-hour X/Q and the corresponding annual average X/Qs.

The highest annual average X/Q value was chosen as the end point for the interpolation; the highest annual average X/Q at the LPZ was the overall site limit values rather than the sector-dependant value. These results, along with the 50-percentile, 0-to-2-hour X/Q value at the EAB are summarized below.

Summary of Interpolated X/Q Values (sec/m^3) for Intermediate Time Periods

Source Location	Receptor Distance	50-Percentile 0–2 hr	0–8 hours (8 hours)	8–24 hour (16 hours)	1–4 days (72 hours)	4–30 days (624 hours)	Annual Average
Source Boundary	EAB	4.57×10^{-5}	—	—	—	—	—
Source Boundary	LPZ	—	1.84×10^{-6}	1.52×10^{-6}	1.01×10^{-6}	5.61×10^{-7}	2.73×10^{-7}

2.7.6 Long-Term (Routine) Diffusion Estimates

2.7.6.1 Regulatory Basis and Technical Approach

The NRC-sponsored XOQDOQ computer program (NUREG/CR-2919) (U.S. NRC Sep 1982) was used to estimate X/Q values due to routine releases of gaseous effluents to the atmosphere. The XOQDOQ computer code has the primary function of calculating annual average X/Q values and annual average relative deposition (D/Q) values at receptors of interest (e.g., the EAB; the nearest milk cow/goat, residence, garden, meat animal). X/Q and D/Q values owing to intermittent releases, which occur during routine operation, may also be evaluated using the XOQDOQ model.

The XOQDOQ dispersion model implements the assumptions outlined in Regulatory Guide 1.111 (U.S. NRC Jul 1977). The program assumes that the material released to the atmosphere follows a Gaussian distribution around the plume centerline. In estimating concentrations for longer time periods, the Gaussian distribution is assumed to be evenly distributed within a given directional sector. A straight-line trajectory is assumed between the release point and all receptors.

The following input data and assumptions were used in the XOQDOQ modeling analysis:

- Meteorological data: 1 year (July 1, 2007, to June 30, 2008) onsite JFD of wind speed, wind direction, and atmospheric stability
- Wind sensor height: 10 meters
- Vertical temperature difference: (60 meters–10 meters)
- Number of wind speed categories: 12 (including calm and the 11 wind speed categories listed in Table 2.7-10)
- Type of release: Ground-level
- Release height: 10 meters (default height)
- Minimum building cross-sectional area: 2352 square meters
- Effective reactor building height: 48 meters above grade
- Distances from the release point to the nearest residence, nearest property boundaries, vegetable garden, meat animal, and the Unit 2 reactor (see Table 2.7-15)

No milk cows/goats are identified within 5 miles of the VCS site, and no dairies are identified within 50 milesThe XOQDOQ and PAVAN dispersion models used the same meteorological data set (1 year; July 1, 2007, to June 30, 2008) previously indicated. As mentioned in Subsection 2.7.5.1, a reanalysis of the atmospheric dispersion estimates in Subsections 2.7.5 and 2.7.6, based on a complete 2-year data set, when available, will be submitted to NRC as a supplement to the COL Application.

The ESBWR reactor design has been used to calculate the minimum building cross-sectional area, a required input to the model, as called for in NUREG/CR-2919 (U.S. NRC Sep 1982). Although the turbine building is larger, using the reactor building is more conservative because a smaller area results in higher X/Q values. The effective height of the reactor buildings for modeling purposes is 158 feet or

48 meters. The resulting cross-sectional area was determined by multiplying the height by the width (161 feet or 49 meters) of the reactor building. The area used is 2352 square meters.

Compared to an elevated release, a ground-level release usually results in higher concentrations at downwind receptors located at ground level because of less dilution from shorter traveling distances. Consequently, as a conservative approach and for the reasons described in Subsection 2.7.5.1, only ground-level releases were assumed in the XOQDOQ modeling analysis.

Potential releases were assumed to occur at any point on the source boundary as a conservative approach to minimizing the travel distance of any release to all receptors of interest. Source to receptor distances associated with the property boundary were calculated for the 16 standard direction radials (i.e., north, north-northeast, northeast, etc.). Values represent the shortest distance from the source boundary to the property boundary in each sector (see Table 2.7-15 [Sheet 2 of 2]). Distances from a potential release point to the nearest residence, meat animal, and vegetable garden in each of the 16, 22.5° compass sectors (i.e., north, north-northeast, northeast, etc.) are also listed in Table 2.7-15 (Sheet 1 of 2). Directional sectors without a receptor within 5 miles were not modeled. A total of 10 sectors were considered for analysis as residential, meat animal and vegetation receptors. Nine of these sectors contained all three receptors in the same location (at the same distance). The north-northwest sector contained a vegetable garden at a greater distance than the residential and meat animal receptors. No milk cow or goat receptors are located within 5 miles of the site and were not analyzed.

One other set of receptors of interest was identified to estimate X/Q and D/Q values at VCS Unit 2 with the primary release point being located at VCS Unit 1. This scenario was considered to evaluate the impact on Unit 2 when Unit 1 is operational and VCS Unit 2 is still under construction. Because of the relative orientation of the two units, only three sectors were considered (i.e., north-northeast, northeast, and east-northeast) (see Table 2.7-15 [Sheet 1 of 2]).

2.7.6.2 XOQDOQ Modeling Results

Among all of the modeled receptors of interest, the overall maximum annual average X/Q value, 2.3 x 10^{-5} sec/m^3 (no decay and 2.26 day decay, undepleted), occurred at proposed Unit 2 as the result of an assumed routine release from proposed Unit 1, as previously described. The maximum annual average X/Q values (along with the downwind sectors and corresponding receptor distances relative to the source boundary) for the other sensitive receptor types are:

- 7.4 x 10^{-6} sec/m^3 at the property boundary in the west sector at a receptor distance of 0.66 mile (1063 meters)
- 2.2 x 10^{-6} sec/m^3 for the nearest residence/meat animal in the north-northwest sector at receptor distances of 1.53 miles (2462 meters)
- 1.6 x 10^{-6} sec/m^3 for the nearest vegetable garden receptor in the northwest sector at a receptor distance of 1.79 miles (2881 meters)

Table 2.7-16 summarizes the maximum X/Q and D/Q values estimated by the XOQDOQ dispersion model for various radioactive decay and plume depletion scenarios at sensitive receptors of interest around the VCS site. Table 2.7-17 presents annual average X/Q and D/Q values for the northwest and north-northwest sector, respectively, at the 22 standard radial distances between 0.25 and 50 miles downwind and for the model's 10 standard distance-segment boundaries between 0.5 and 50 miles downwind. Among the 16, 22.5° compass sectors (centered on north, north-northeast, northeast, etc.) evaluated by the model, the results for the northwest and north-northwest are provided in Table 2.7-17 because the highest relative concentrations and relative deposition values occur within these two sectors at all downwind distances.

Detailed annual average X/Q and D/Q estimates generated by the XOQDOQ model for the receptors of interest, at the 22 standard radial distances and for the 10 standard distance-segment boundaries, are also provided in Table 2.7-18 through 2.7-26.

Table 2.7-18 presents X/Q and D/Q estimates at all of the modeled receptors of interest identified in Table 2.7-15. Tables 2.7-19 and 2.7-20 list X/Q estimates with no radioactive decay and no plume depletion for each of the 16, 22.5° compass sectors at the 22 standard radial distances and for the 10 standard distance-segment boundaries, respectively. Tables 2.7-21 and 2.7-22 contain X/Q estimates that include radioactive decay with a half-life of 2.26 days for short-lived noble gases and no plume depletion. Tables 2.7-23 and 2.7-24 show X/Q estimates that include radioactive decay with a half-life of 8 days for all iodines released to the atmosphere, as well as incorporation of plume depletion. Finally, Tables 2.7-25 and 2.7-26 list modeled estimates of long-term average relative deposition at the 22 standard radial distances and for the 10 standard distance-segment boundaries, respectively.

2.7.7 Noise

The VCS site is located on an approximately 11,500-acre greenfield site approximately 13 miles south of the city of Victoria. The site is surrounded by farmlands, with the western border next to U.S. Highway 77 and the southern border running parallel to a railroad line. The site and surrounding area is rural in nature with pasture and shrub land.

The dominating preexisting sources of man-made noise at the site are the result of gas wells, a compressor station, and heavy equipment associated with a cattle ranch. Background noise measurements were conducted between February 26 and February 29, 2008, at selected locations around the VCS site boundary (Figure 2.7-16).

The hourly measurements made at location NSR-1 were primarily affected by the traffic on U.S. Highway 77, natural sounds, and wind-induced noise. The hourly energy equivalent sound pressure level was typically between 50 and 52 dBA, but did get as low as 40 dBA with the noise monitor location upwind from U.S. Highway 77.

Measurement location NSR-2 was selected primarily because of the presence of a residential structure located west of U.S. Highway 77. The monitor was positioned at approximately the same distance from Highway 77, but on the east side of the road. The house was found to be abandoned, but

measurements at this location were continued as a reference point for the western boundary. At NSR-2 the primary noise source was traffic noise from U.S. Highway 77, and the hourly energy equivalent sound pressure levels were approximately 60dBA.

Location NSR-3 is located in the southwestern corner of the site. The dominating noise source at this location is a nearby compressor station; NSR-3 is approximately 200 yards from the compressor station. The noise level at this location was within a constant range between 50-55dBA.

Location NSR-4 was situated on the eastern side of the property boundary. The primary man-made source of noise at this location was from railroad traffic, occurring south of the measurement location. At those times when there was no rail traffic, the sound in this area was mainly caused by birds, insects, and wind-generated noise. The hourly energy equivalent noise level at this location fluctuated between 30 and 50dBA.

At location NSR-5, which was adjacent to a residential home, the noise level was very low without wind-generated noise. The hourly energy equivalent sound pressure level was approximately 30 dBA at times, with no wind-generated noise.

Location NSR-6 was situated near the meteorological tower and the sound levels at this location were primarily from U.S. Highway 77. The hourly energy equivalent sound pressure level was approximately 55 dBA at this location.

Noise sources during the operational phase of the proposed new units will include transformers and other electrical equipment, circulating water pumps, and the public address system. However, the effects of noises generated by unit operation are mitigated by the undeveloped land surrounding the plant. Also, most equipment will be located within the plant buildings which serves to dampen noises.

The center of proposed Units 1 and 2 lies approximately 4400 feet from the nearest site boundary. The nearest full-time residence is approximately 6800 feet away from the center of proposed Units 1 and 2.

During the construction phase of the new units, noise will be generated from construction equipment and site traffic. The construction noise will be associated with building the two units, the site infrastructure, and the construction of the cooling basin. Based on a comprehensive construction noise study conducted for the Empire State Electric Energy Research Corporation by Bolt Beranek and Newman (Bolt Beranek and Newman May 1977), in a report titled *Power Plant Construction Noise Guide*, the noise associated with construction is divided into six different phases: excavation; concrete pouring; steel erection; mechanical; cleanup; and steam-blow. The last phase may not be applicable to the construction and startup of nuclear units. The long-term average A-weighted equivalent sound pressure levels, LAeq, are listed in the table that follows as a function of distance for each of these phases.

The nearest occupied residences are located north of and approximately 6800 feet from the center of the proposed units; residences towards the east are located approximately 10,000 feet from the proposed units. Mobile construction equipment will be used to construct the cooling basin. Residences

near the construction site will experience short-term higher noise levels when construction equipment is working nearby.

	Estimated Long-Term Equivalent Sound Pressure Level, LAeq		
Phase	**Northern Residences (~6800 feet away)**	**West Boundary (~3900 feet away)**	**East Residences (~10,000 feet away)**
Excavation	40	50	35
Concrete Pouring	36	46	31
Steel Erection	40	50	35
Mechanical	35	45	30
Cleanup	30	40	25
Steam (or Air) Blows for Pipe Cleaning	80	90	75

2.7.8 References

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Table 2.7-1
NWS and Cooperative Observing Stations Near the VCS Site

Station [a]	County	Approximate Distance (Miles)	Direction Relative to Site	Elevation (feet)
Palacios Municipal Airport	Matagorda	48	E	12
Beeville 5 NE	Bee	42	WSW	255
Port O'Connor	Calhoun	39	ESE	5
Point Comfort	Calhoun	29	E	20
Cuero	DeWitt	37	NNW	178
Maurbro	Jackson	40	ENE	30
Yoakum	Lavaca	46	N	295
Edna Highway 59 Bridge	Jackson	32	NE	68
Rockport	Aransas	40	S	9
Goliad	Goliad	22	W	142
Sinton	San Patricio	50	SW	53
Aransas Wildlife Refuge	Aransas	25	SE	15
Victoria Regional Airport [b]	Victoria	17	NNE	104
Refugio 2 NW	Refugio	25	SW	54
Karnes City 2N	Karnes	55	WNW	450

[a]Numeric and letter designators following a station name (e.g., Beeville 5 NE) indicate the station's approximate distance in miles (e.g., 5) and direction (e.g., northeast) relative to the place name (e.g., Beeville).

[b]National Weather Service First-Order Station

Table 2.7-2
Local Climatological Data Summary for Victoria, Texas

NORMALS, MEANS, AND EXTREMES
VICTORIA (KVCT)

LATITUDE: 28 ° 51'N LONGITUDE: -96 ° 55'W ELEVATION (FT): GRND: 113 BARO: 106 TIME ZONE: CENTRAL (UTC -6) WBAN: 12912

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	62.8	66.6	73.4	79.2	85.1	90.3	93.4	93.7	89.9	83.0	73.0	65.2	79.6
	MEAN DAILY MAXIMUM	51	63.9	67.4	74.0	80.4	85.9	90.8	93.6	94.1	89.8	83.0	73.6	66.5	80.3
	HIGHEST DAILY MAXIMUM	47	88	95	97	98	101	106	104	107	111	99	93	88	111
	YEAR OF OCCURRENCE		1971	1986	1989	1963	1964	1998	1964	1962	2000	1991	1988	1964	SEP 2000
	MEAN OF EXTREME MAXS.	51	79.4	82.2	86.3	89.6	92.8	96.0	98.3	99.5	96.5	92.1	86.2	81.2	90.0
	NORMAL DAILY MINIMUM	30	43.6	46.7	53.9	60.1	68.1	73.3	75.0	74.6	70.3	61.6	52.3	45.2	60.4
	MEAN DAILY MINIMUM	51	43.7	46.7	53.4	61.1	68.0	73.1	75.0	74.6	70.5	61.6	52.4	45.5	60.5
	LOWEST DAILY MINIMUM	47	14	19	21	33	45	59	62	62	48	31	24	9	9
	YEAR OF OCCURRENCE		1982	1985	2002	1987	2005	1984	1967	2004	2000	1993	1976	1989	DEC 1989
	MEAN OF EXTREME MINS.	51	26.2	30.0	34.9	44.6	56.1	65.3	70.5	69.8	57.8	45.1	35.1	28.3	47.0
	NORMAL DRY BULB	30	53.2	56.7	63.7	69.7	76.6	81.8	84.2	84.2	80.1	72.3	62.7	55.2	70.0
	MEAN DRY BULB	51	53.8	57.0	63.7	70.8	77.0	82.1	84.3	84.4	80.2	72.3	63.0	56.0	70.4
	MEAN WET BULB	24	49.7	52.7	58.0	64.0	70.8	75.0	76.1	76.0	72.6	65.9	57.8	51.2	64.2
	MEAN DEW POINT	24	46.4	49.4	54.6	60.7	68.5	72.8	73.6	73.5	69.9	63.1	54.6	47.8	61.2
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.1	0.4	0.8	6.3	20.2	28.0	27.9	18.5	4.9	0.1	0.0	107.2
	MAXIMUM <= 32	30	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4
	MINIMUM <= 32	30	4.1	2.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	*	0.6	3.1	10.5
	MINIMUM <= 0	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	372	249	113	28	1	0	0	0	1	22	145	317	1248
	NORMAL COOLING DEG. DAYS	30	18	26	84	181	368	514	601	597	454	248	83	29	3203
RH	NORMAL (PERCENT)	30	77	76	75	74	78	77	74	75	76	76	77	77	76
	HOUR 00 LST	30	85	85	84	85	89	90	89	88	88	88	87	85	87
	HOUR 06 LST	30	88	88	88	89	92	93	93	94	93	91	90	88	91
	HOUR 12 LST	30	65	63	60	59	62	60	55	56	59	58	61	64	60
	HOUR 18 LST	30	69	64	63	62	67	66	60	62	65	67	71	71	66
S	PERCENT POSSIBLE SUNSHINE														
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG (VISBY <= 1/4 MI)	43	7.2	5.5	5.3	4.1	2.5	0.8	0.5	0.6	1.4	3.7	6.3	6.4	44.3
	THUNDERSTORMS	48	1.6	1.7	3.2	3.7	6.2	6.8	7.6	9.7	7.9	3.9	2.1	1.5	55.9
CLOUDNESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)				6.4			4.0							
	MIDNIGHT-MIDNIGHT (OKTAS)														
	MEAN NO. DAYS WITH:														
	CLEAR	1	3.0	5.0	8.0		5.0	9.0							
	PARTLY CLOUDY			1.0	3.0		9.0	6.0							
	CLOUDY	1	1.0	3.0	10.0		3.0	5.0							
PR	MEAN STATION PRESSURE (IN)	24	30.02	29.96	29.90	29.84	29.81	29.81	29.87	29.86	29.84	29.90	29.97	30.01	29.90
	MEAN SEA-LEVEL PRES. (IN)	24	30.14	30.08	30.02	29.96	29.93	29.93	29.99	29.98	29.96	30.02	30.09	30.14	30.02
WINDS	MEAN SPEED (MPH)	24	9.9	10.4	10.9	11.0	10.5	9.3	8.5	8.0	8.2	8.7	9.2	9.4	9.5
	PREVAIL.DIR (TENS OF DEGS)	28	36	36	17	17	17	17	19	19	14	36	36	36	17
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	12	43	43	45	47	41	43	62	43	41	43	41	40	62
	DIR. (TENS OF DEGS)		17	15	03	11	07	32	05	26	04	35	31	33	05
	YEAR OF OCCURRENCE		1996	2001	2006	2004	1999	2005	2003	1996	1998	1998	2006	1997	JUL 2003
	MAXIMUM 5-SECOND														
	SPEED (MPH)	12	52	52	55	64	59	51	83	45	53	52	51	47	83
	DIR. (TENS OF DEGS)		30	15	03	11	22	32	04	27	12	35	30	33	04
	YEAR OF OCCURRENCE		1998	2001	2006	2004	2004	2005	2003	1996	2001	1998	2003	1997	JUL 2003
PRECIPITATION	NORMAL (IN)	30	2.44	2.04	2.25	2.97	5.12	4.96	2.90	3.05	5.00	4.26	2.64	2.47	40.10
	MAXIMUM MONTHLY (IN)	47	7.76	9.08	11.61	11.70	14.66	13.50	20.34	8.97	19.05	12.44	16.14	6.97	20.34
	YEAR OF OCCURRENCE		1991	1992	1997	1997	1993	2004	2007	2001	1978	1997	2004	1975	JUL 2007
	MINIMUM MONTHLY (IN)	47	0.02	0.23	0.18	T	0.01	T	0.05	0.34	1.11	0.34	0.02	0.34	T
	YEAR OF OCCURRENCE		1971	1988	1971	1987	1998	1980	1997	2006	1982	1987	1981	2007	APR 1987
	MAXIMUM IN 24 HOURS (IN)	47	4.70	3.21	5.04	9.87	8.45	9.30	8.41	6.14	8.51	8.15	9.20	6.12	9.87
	YEAR OF OCCURRENCE		1991	1992	1997	1991	1972	1977	1990	1964	1967	1994	2004	1975	APR 1991
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	8.8	7.3	6.9	6.4	7.4	8.4	7.2	8.8	9.9	7.3	7.5	8.1	94.0
	PRECIPITATION >= 1.00	30	0.6	0.6	0.7	0.8	1.7	1.7	0.9	0.9	1.5	1.3	0.6	0.6	11.9
SNOWFALL	NORMAL (IN)	30	0.1	0.*	0.*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.*	0.1
	MAXIMUM MONTHLY (IN)	36	2.1	1.0	T	0.0	T	0.0	0.0	T	0.0	0.0	0.2	T	2.1
	YEAR OF OCCURRENCE		1985	1973	1990		1993			1994			1976	1990	JAN 1985
	MAXIMUM IN 24 HOURS (IN)	36	2.1	1.0	T	0.0	T	0.0	0.0	T	0.0	0.0	0.2	T	2.1
	YEAR OF OCCURRENCE'		1985	1973	1990		1993			1994			1976	1990	JAN 1985
	MAXIMUM SNOW DEPTH (IN)	39	2	3	0	0	0	0	0	0	0	0	0	0	3
	YEAR OF OCCURRENCE		1985	1958											FEB 1958
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2

Table 2.7-3
Climatological Normals at Selected NWS and Cooperative Observing Stations in the VCS Area

Station	Normal Annual Temperatures (°F) [a]				Normal Annual Precipitation	
	Daily Maximum	Daily Minimum	Daily[b] Range	Daily Mean	Rainfall[a] (inches)	Snowfall[c] (inches)
Palacios Municipal Airport	77.2	61.1	16.1	69.2	45.40	0.1
Beeville 5 NE	80.8	59.6	21.2	70.2	33.48	0.1
Port O' Connor	76.4	65.0	11.4	70.7	34.78	0.1
Point Comfort	79.7	62.4	17.3	71.1	43.87	Trace
Cuero	81.7	57.5	24.2	69.6	36.08	0.1
Yoakum	79.7	56.7	23.0	68.2	40.96	Trace
Edna Highway 59 Bridge	NA[d]	NA[d]	NA[d]	NA[d]	42.17	NA[d]
Rockport	77.9	62.9	15.0	70.4	35.96	Trace
Goliad	83.1	59.4	23.7	71.3	38.58	0.5
Sinton	79.4	60.7	18.7	70.1	35.54	0.1
Aransas Wildlife Refuge	77.5	62.9	14.6	70.2	40.83	Trace
Victoria Regional Airport	79.6	60.4	19.2	70.0	40.10	0.3
Refugio 2 NW	81.9	60.0	21.9	71.0	40.00	NA [d]
Karnes City 2N	80.4	57.8	22.6	69.1	28.35	NA [d]

[a]NCDC Climatography No. 81 1971-2000 (NCDC Feb 2002)
[b]Value is calculated as the difference between the normal daily maximum and normal daily minimum temperatures
[c]NCDC Climatography No. 20 1971-2000 (NCDC Jul 2005)
[d]NA = Measurements not made at this station

Table 2.7-4
Climatological Extremes at Selected NWS and Cooperative Observing Stations in the VCS Area

Station	Maximum Temperature (°F)	Minimum Temperature (°F)	Maximum 24 hr Rainfall (Inches)	Maximum Monthly Rainfall (Inches)	Maximum 24 hr Snowfall (Inches)	Maximum Monthly Snowfall (Inches)
Palacios Municipal Airport	107[a,b,c] (09/05/2000)	9[a,b,c] (12/23/1989)	9.65[a,b,c] (05/07/1951)	24.28[b,c] (10/1949)	4.0[b,c] (02/12/1958)	4.0[b,c] (02/1958)
Beeville 5 NE	111[a,b,c] (07/09/1939)	8[a,b,c] (12/25/1983)	10.61[a,b,c] (09/22/1967)	22.62[b,c] (09/1967)	4.5[b,c] (12/25/2004)[e]	6.5[b,c] (01/1926)[e]
Port O' Connor	105[a,b,c] (09/06/2000)	10[a,b,c] (12/23/1989)	12.50[a,b,c] (07/10/1976)	34.44[c,d] (07/2006)	1.3[a,b,c] (02/09/1973)	1.3[a,b,c] (02/1973)
Point Comfort	107[a,b,c] (09/06/2000)	9[a,b,c] (12/23/1989)	14.65[a,b,c] (06/26/1960)	25.24[b,c] (06/1960)	Trace[a,b] (11/28/1976)	Trace[a,b] (11/1976)
Cuero	113[a,b,c] (09/05/2000)	7[a,b,c] (12/23/1989)	12.40[a,b,c] (06/30/1940)	21.27[b,c] (09/1967)	6.5[b,c] (02/13/1960)	6.5[b,c] (02/1960)
Maurbro	107[b,c] (07/27/1954)	8[b,c] (01/31/1949)	14.80[b,c] (06/26/1960)	22.47[b,c] (06/1960)	4.0[b,c] (02/13/1960)	4.0[b,c] (02/1960)
Yoakum	111[a,b,c] (09/06/2000)[f]	6[a,b,c] (12/23/1989)	10.70[a,b,c] (04/25/1938)	18.33[a,b,c] (10/1994)	2.5[b,c] (12/21/1929)	2.5[b,c] (12/1929)
Edna Highway 59 Bridge	NA[j]	NA[j]	17.58[b,c] (10/18/1994)	20.97[b,c] (10/1994)	0.0[c] (NA)	0.0[c] (NA)
Rockport	105[a,b,c] (09/06/2000)	12[a,b,c] (12/25/1983)	8.15[a,b,c] (09/19/1979)	20.85[b,c] (09/1967)	6.0[b,c] (12/25/2004)	6.0[b,c] (12/2004)
Goliad	112[a,b,c] (06/14/1998)[g]	7[a,b,c] (01/12/1962)	9.16[a,b,c] (09/21/1967)	22.19[b,c] (09/1967)	12.0[b,c] (12/25/2004)	12.0[b,c,d] (12/2004)
Sinton	109[a,b,c] (09/06/2000)	10[a,b,c] (12/23/1989)	12.35[a,b,c] (04/28/1930)	25.59[b,c] (09/1967)	7.0[b,c] (12/25/2004)	7.0[b,c] (12/2004)
Aransas Wildlife Refuge	103[b,l] (08/30/1954)[h]	9[a,b,c] (12/23/1989)	14.25[a,b,c] (11/01/1974)	22.65[d] (07/2007)	5.5[b,c,d] (12/25/2004)	5.5[b,c,d] (12/2004)
Victoria Regional Airport	111[a,b,c] (09/05/2000)	9[a,b,c] (12/23/1989)	9.87[a,b,c] (04/05/1991)	20.34[c] (07/2007)	2.1[a,b,c] (01/12/1985)	2.1[a,b,c] (01/1985)
Refugio 2 NW	112[b,c] (09/05/2000)	8[b,c] (01/12/1962)[i]	13.38[b,c] (10/16/1960)[i]	26.30[b,c] (09/1971)[i]	9.5[b,c] (12/25/2004)	9.5[b,c] (12/2004)
Karnes City 2N	111[b,c] (09/06/2000)	7[b,c] (12/23/1989)	11.00[b,c] (08/31/1981)	22.60[b,c] (09/1967)	5.0[b,c] (12/25/2004)	5.0[b,c] (12/2004)[k]

Notes:
a – NCDC Monthly Station Climate Summaries, Climatography of the United States No. 20 1971-2000 (NCDC Jul 2005)
b – NCDC Cooperative Summaries of the Day TD 3200 & DS 3200/3210 (NCDC Nov 2002; NCDC Jul 2006)
c – Utah State University Climate Center (USU Jun 2008)
d – NCDC Cooperative Observer Records for Texas (NCDC Jun 2008d)
e – Occurs on multiple dates: 01/23/1926, 12/25/2004; (most recent date shown in table)
f – Occurs on multiple dates: 06/15/1998, 09/06/2000; (most recent date shown in table)
g – Occurs on multiple dates: 07/09/1939, 08/13/1962, 06/14/1998; (most recent date shown in table)
h – Occurs on multiple dates: 06/27/1953, 08/30/1954; (most recent date shown in table)
i – Occurred at retired Refugio Co-op observing station (#417529), Period of Record Jan 1, 1948 – Nov 30, 1984
j – Not reported here. Less than 6 years of data available
k –Occurs for multiple months: 12/2004, 01/1926; (most recent month shown in table)
l – Occurred at retired Aransas Wildlife Refuge Co-op observing station (#410437), Period of Record Jun 1, 1940 – Dec 31, 1970

Table 2.7-5 (Sheet 1 of 2)
Morning and Afternoon Mixing Heights, Wind Speeds, and Ventilation Indices for the VCS Site Area

Period	Statistic[a]	Mixing Height (m, AGL)[b]		Wind Speed (m/sec)		Ventilation Index (m^2/sec)[c]	
		AM	PM	AM	PM	AM	PM
January	Min	275	586	2.9	2.5	914 (P)	1273 (M)
	Max	561	1134	4.0	3.5	2374 (F)	3754 (G)
	Mean	430	881	3.6	3.2	1628 (M)	2800 (F)
February	Min	305	765	2.7	2.4	1096 (P)	2259 (M)
	Max	590	1289	4.1	3.6	2269 (M)	4082 (G)
	Mean	448	1011	3.6	3.2	1707 (M)	3138 (F)
March	Min	290	931	3.2	2.7	1018 (P)	3235 (F)
	Max	802	1552	4.2	3.8	3193 (F)	4999 (G)
	Mean	544	1168	3.8	3.4	2167 (M)	3857 (G)
April	Min	312	916	3.4	2.9	1217 (M)	3280 (F)
	Max	922	1562	4.2	4.2	4035 (G)	5518 (G)
	Mean	642	1182	3.9	3.6	2688 (F)	4171 (G)
May	Min	401	894	3.3	2.6	1394 (M)	3140 (F)
	Max	972	1638	4.6	4.3	4062 (G)	5857 (G)
	Mean	640	1251	3.9	3.6	2668 (F)	4353 (G)
June	Min	213	1090	3.2	2.6	643 (P)	3625 (G)
	Max	1132	1929	4.5	3.9	4307 (G)	7006 (G)
	Mean	490	1458	3.7	3.4	1961 (M)	4916 (G)
July	Min	196	1149	2.9	3.0	640 (P)	3757 (G)
	Max	670	2020	4.5	4.0	2594 (F)	7766 (G)
	Mean	367	1597	3.5	3.4	1308 (M)	5428 (G)
August	Min	200	1247	2.5	2.7	537 (P)	3776 (G)
	Max	658	2151	4.0	4.0	2302 (M)	7669 (G)
	Mean	356	1647	3.3	3.3	1205 (M)	5502 (G)
September	Min	182	1116	2.7	2.8	538 (P)	3236 (F)
	Max	650	1852	4.2	4.0	2690 (F)	6924 (G)
	Mean	363	1433	3.3	3.3	1273 (M)	4679 (G)
October	Min	194	1001	2.4	2.5	648 (P)	3171 (F)
	Max	567	1759	4.3	3.9	2414 (F)	5643 (G)
	Mean	348	1314	3.4	3.2	1282 (M)	4046 (G)
November	Min	287	764	3.0	2.6	976 (P)	2552 (F)
	Max	587	1345	4.1	3.7	2352 (F)	4470 (G)
	Mean	418	1085	3.5	3.2	1578 (M)	3477 (F)
December	Min	275	594	3.0	2.4	1075 (P)	1751 (M)
	Max	631	1129	4.1	3.5	2775 (F)	3702 (G)
	Mean	405	891	3.5	3.1	1526 (M)	2819 (F)

Table 2.7-5 (Sheet 2 of 2)
Morning and Afternoon Mixing Heights, Wind Speeds, and Ventilation Indices for the VCS Site Area

Period	Statistic[a]	Mixing Height (m, AGL)[b]		Wind Speed (m/sec)		Ventilation Index (m^2/sec)[c]	
		AM	PM	AM	PM	AM	PM
Winter	Mean	427	925	3.6	3.2	1617 (M)	2912 (F)
Spring	Mean	608	1201	3.9	3.5	2506 (F)	4127 (G)
Summer	Mean	403	1569	3.5	3.4	1486 (M)	5286 (G)
Autumn	Mean	376	1278	3.4	3.2	1377 (M)	4067 (G)
Annual	Mean	454	1245	3.6	3.3	1748 (M)	4104 (G)

[a]Monthly minimum, maximum and mean values are based directly on summaries available from USDA—Forest Service Ventilation Climate Information System (VCIS) (USDA Oct 2007). Seasonal and annual mean values represent weighted averages based on the number of days in the appropriate months.

[b]AGL = above ground level

[c]Classifications of ventilation potential from Ventilation Index: P = Poor (0 to 1175 m^2/sec); M = Marginal (1176 to 2350 m^2/sec); F = Fair (2351 to 3525 m^2/sec); G = Good (> 3525 m^2/sec) (USDA Apr 2003).

Table 2.7-6
Seasonal and Annual Mean Wind Speeds for the VCS Units 1 and 2 Pre-Application Phase Monitoring Program (July 1, 2007 through June 30, 2008) and the Victoria, Texas, NWS Station

Primary Tower Elevation	Location	Winter	Spring	Summer	Autumn	Annual
Upper Level (60 m) (m/sec)	VCS Units 1 and 2 Site	6.4	6.9	5.3	5.1	5.9
Lower Level (10 m) (m/sec)	VCS Units 1 and 2 Site	4.4	4.9	3.5	3.1	4.0
Single Level (6.1 m) (m/sec)	Victoria Regional Airport[a]	4.4	4.8	3.8	3.9	4.2

[a]NCDC Jun 2008b
Winter = December, January, February
Spring = March, April, May
Summer = June, July, August
Autumn = September, October, November

Table 2.7-7 (Sheet 1 of 3)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site—10-Meter Level

Site Name: VICT
Number of Sectors Included: 1
10m Wind Speed (MPH)

Period of Record: 07/01/2007 01:00 to 06/30/2008 24:00
Width in Degrees 22.5
10m Wind Direction (deg)

Speed Greater Than or Equal to: 5.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	634	505	303	215	364	448	1300	1421	553	137	57	37	47	62	170	264
2	449	289	124	79	171	196	856	971	320	56	19	10	14	23	92	141
4	274	136	26	21	51	63	448	507	137	13	3	4	6	3	29	61
8	136	46	0	6	12	10	146	151	13	1	0	0	2	0	4	18
12	67	14	0	1	1	1	44	54	0	0	0	0	0	0	0	5
18	22	0	0	0	0	0	14	7	0	0	0	0	0	0	0	0
24	8	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater Than or Equal to: 10.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	337	183	62	40	87	151	719	863	321	50	16	8	19	29	85	133
2	252	126	27	8	53	64	505	621	196	16	4	1	3	14	50	84
4	164	63	5	0	24	19	257	341	87	2	0	0	0	2	16	38
8	67	18	0	0	7	4	65	104	8	0	0	0	0	0	2	11
12	28	2	0	0	0	0	14	31	0	0	0	0	0	0	0	2
18	8	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (Sheet 2 of 3)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site—10-Meter Level

Speed Greater Than or Equal to: 15.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	109	31	11	2	10	31	265	394	142	7	1	2	5	10	48	66
2	75	19	5	0	4	16	169	280	98	3	0	0	1	3	27	41
4	44	7	1	0	0	8	71	159	42	0	0	0	0	0	9	20
8	21	2	0	0	0	4	18	48	2	0	0	0	0	0	2	4
12	11	0	0	0	0	0	4	14	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater Than or Equal to: 20.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	16	2	1	0	0	5	36	113	52	1	0	0	2	3	25	29
2	11	0	0	0	0	3	19	78	30	0	0	0	0	1	12	21
4	7	0	0	0	0	1	7	37	10	0	0	0	0	0	3	9
8	3	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (Sheet 3 of 3)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site—10-Meter Level

Speed Greater Than or Equal to: 25.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	3	0	0	0	0	0	2	15	1	0	0	0	0	3	7	0
2	1	0	0	0	0	0	1	10	0	0	0	0	0	1	4	0
4	0	0	0	0	0	0	0	3	0	0	0	0	0	0	2	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater Than or Equal to: 30.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (Sheet 1 of 3)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site—60-Meter Level

Site Name: VICT
Number of Sectors Included: 1
60m Wind Speed (MPH)

Period of Record: 07/01/2007 01:00 to 06/30/2008 24:00
Width in Degrees 22.5
60m Wind Direction (deg)

Speed Greater Than or Equal to: 5.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	660	565	470	363	453	642	1312	1912	960	246	124	66	66	65	162	259
2	490	353	250	176	225	354	909	1442	636	125	50	25	23	25	91	163
4	309	173	83	55	87	124	479	894	325	34	16	3	9	3	37	81
8	162	56	13	10	18	24	150	383	83	2	5	0	3	0	5	24
12	89	22	1	1	6	4	56	176	18	0	0	0	0	0	0	6
18	36	3	0	0	0	0	15	54	0	0	0	0	0	0	0	0
24	14	0	0	0	0	0	6	24	0	0	0	0	0	0	0	0
30	2	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater Than or Equal to: 10.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	537	420	261	214	267	436	1136	1725	800	161	67	38	42	43	107	175
2	413	280	142	109	145	233	804	1322	528	82	27	17	17	19	66	115
4	263	151	52	37	62	75	430	829	252	21	9	3	8	3	26	57
8	133	54	13	4	18	12	142	353	55	0	4	0	3	0	4	20
12	72	21	1	0	6	0	53	162	12	0	0	0	0	0	0	6
18	32	3	0	0	0	0	15	51	0	0	0	0	0	0	0	0
24	14	0	0	0	0	0	6	23	0	0	0	0	0	0	0	0
30	2	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (Sheet 2 of 3)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site—60-Meter Level

Speed Greater Than or Equal to: 15.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	329	227	75	43	68	125	588	1043	388	61	17	16	16	28	72	98
2	239	151	35	16	37	58	399	751	250	29	5	6	5	11	43	62
4	137	67	5	0	17	11	193	438	121	4	3	0	1	1	17	32
8	60	18	0	0	5	0	53	178	30	0	0	0	0	0	3	13
12	28	0	0	0	0	0	12	90	8	0	0	0	0	0	0	4
18	8	0	0	0	0	0	1	38	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater Than or Equal to: 20.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	119	34	14	4	9	13	174	365	173	14	0	1	2	7	37	42
2	84	17	7	0	4	6	113	262	116	5	0	0	0	2	23	27
4	51	8	1	0	0	2	50	148	57	0	0	0	0	0	8	12
8	25	0	0	0	0	0	14	53	6	0	0	0	0	0	3	2
12	12	0	0	0	0	0	1	14	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (Sheet 3 of 3)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site—60-Meter Level

Speed Greater Than or Equal to: 25.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	28	5	1	0	0	4	30	125	74	0	0	0	0	4	21	8
2	18	2	0	0	0	1	18	84	45	0	0	0	0	2	13	2
4	9	0	0	0	0	0	9	40	18	0	0	0	0	0	5	0
8	0	0	0	0	0	0	1	5	0	0	0	0	0	0	1	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater Than or Equal to: 30.0 mph

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	3	0	1	0	0	0	3	25	8	0	0	0	0	2	8	0
2	1	0	0	0	0	0	2	15	1	0	0	0	0	1	6	0
4	0	0	0	0	0	0	0	7	0	0	0	0	0	0	4	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-9
Seasonal and Annual Vertical Stability Class and 10-Meter Level Wind Speed Distributions for the VCS Site (July 1, 2007 through June 30, 2008)

	Vertical Stability Categories[a]						
Period	A	B	C	D	E	F	G
Winter							
Frequency (%)	4.50	5.47	6.25	34.33	23.71	12.36	13.37
Wind Speed (m/sec)	6.9	6.0	5.3	5.3	4.0	2.6	2.3
Spring							
Frequency (%)	7.12	5.94	8.57	34.51	23.81	8.75	11.29
Wind Speed (m/sec)	7.2	6.3	6.0	6.0	4.1	2.6	2.3
Summer							
Frequency (%)	7.95	5.77	7.40	24.98	26.02	23.48	4.41
Wind Speed (m/sec)	7.1	5.6	4.6	4.0	2.8	1.9	1.8
Autumn							
Frequency (%)	2.58	4.28	9.21	22.65	19.01	18.78	23.48
Wind Speed (m/sec)	6.0	5.3	4.1	4.0	3.0	2.2	2.0
Annual							
Frequency (%)	5.55	5.37	7.86	29.13	23.15	15.84	13.10
Wind Speed (m/sec)	6.9	5.8	5.0	4.9	3.5	2.2	2.1

[a]Vertical stability based on temperature difference (ΔT) between the 60-meter and 10-meter measurement levels.

Table 2.7-10 (Sheet 1 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2008)

Site: Exelon Victoria County
Period: Months Jul-Jun for years 2007 - 2008
All Stabilities
Elevations: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	15	58	99	164	120	106	116	131	21	8	838
NNE	0	12	47	95	195	128	83	90	42	8	0	700
NE	0	19	53	80	197	79	40	22	16	2	0	508
ENE	0	22	37	71	127	60	33	16	5	0	0	371
E	0	16	55	82	186	96	55	30	28	0	0	548
ESE	0	21	49	66	183	114	90	53	39	8	0	623
SE	0	11	48	107	320	223	216	193	307	88	5	1518
SSE	0	22	36	97	329	209	182	244	303	157	51	1630
S	0	19	30	59	132	82	100	87	86	70	17	682
SSW	0	7	25	25	47	35	24	23	10	1	0	197
SW	0	11	19	16	29	15	13	5	2	0	0	110
WSW	0	9	24	24	23	9	6	2	3	0	0	100
W	0	9	25	26	19	6	10	8	2	4	0	109
WNW	0	16	22	34	28	10	7	10	14	0	3	144
NW	1	8	26	43	58	33	14	17	26	14	17	257
NNW	0	9	56	77	88	47	25	37	36	34	11	420
Tot	1	226	610	1001	2125	1266	1004	953	1050	407	112	8755

Hours of Calm	13
Hours of Variable Direction	5
Hours of Valid Data	8773
Hours of Missing Data	11
Hours in Period	8784

Table 2.7-10 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2008)

Site: Exelon Victoria County
Period: Months Jul-Jun for years 2007 - 2008
Stability Class A - Extremely Unstable based on Lapse Rate
Elevations: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	0	3	8	14	26	4	3	58
NNE	0	0	0	0	2	4	5	13	13	4	0	41
NE	0	0	0	0	1	3	2	2	1	1	0	10
ENE	0	0	0	0	0	0	2	2	1	0	0	5
E	0	0	0	0	0	0	1	3	2	0	0	6
ESE	0	0	0	0	0	0	2	2	5	0	0	9
SE	0	0	0	0	1	2	5	13	48	24	0	93
SSE	0	0	0	0	1	3	2	29	76	33	17	161
S	0	0	0	0	1	0	3	7	11	9	5	36
SSW	0	0	0	0	1	0	1	3	2	0	0	7
SW	0	0	0	0	0	0	0	2	2	0	0	4
WSW	0	0	0	0	0	0	0	0	1	0	0	1
W	0	0	0	0	0	0	2	1	0	0	0	3
WNW	0	0	0	0	0	0	1	1	2	0	2	6
NW	0	0	0	0	0	0	0	4	9	1	7	21
NNW	0	0	0	0	0	1	3	4	5	9	3	25
Tot	0	0	0	0	7	16	37	100	204	85	37	486

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 486
Hours of Missing Data 11
Hours in Period 8784

Table 2.7-10 (Sheet 3 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class B - Moderately Unstable based on Lapse Rate
Elevations: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	2	9	7	8	8	2	0	36
NNE	0	0	0	0	0	4	4	4	8	1	0	21
NE	0	0	0	1	4	3	4	1	2	0	0	15
ENE	0	0	0	1	0	6	7	3	0	0	0	17
E	0	0	0	0	5	5	3	3	6	0	0	22
ESE	0	0	0	0	3	9	8	6	5	2	0	33
SE	0	0	0	1	7	3	11	20	39	8	0	89
SSE	0	0	0	0	1	7	12	36	32	17	8	113
S	0	0	0	1	0	1	19	13	13	9	0	56
SSW	0	0	0	0	0	4	6	3	1	1	0	15
SW	0	0	0	0	0	1	1	1	0	0	0	3
WSW	0	0	0	0	1	0	0	1	0	0	0	2
W	0	0	0	0	0	0	2	1	1	0	0	4
WNW	0	0	0	0	0	0	0	1	4	0	1	6
NW	0	0	0	0	1	3	4	1	4	2	3	18
NNW	0	0	0	0	1	4	1	2	4	6	2	20
Tot	0	0	0	4	25	59	89	104	127	48	14	470

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	470
Hours of Missing Data	11
Hours in Period	8784

Table 2.7-10 (Sheet 4 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class C - Slightly Unstable based on Lapse Rate
Elevations: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	1	14	19	9	8	6	2	2	61
NNE	0	0	2	5	10	7	6	12	3	0	0	45
NE	0	0	1	3	11	17	7	3	1	0	0	43
ENE	0	0	0	5	5	8	8	1	1	0	0	28
E	0	0	0	2	14	18	9	4	4	0	0	51
ESE	0	0	0	3	10	12	12	9	5	0	0	51
SE	0	0	0	2	7	10	22	19	45	6	0	111
SSE	0	0	1	0	14	10	11	41	35	21	8	141
S	0	0	0	1	1	11	14	12	9	13	9	70
SSW	0	0	2	1	4	5	4	5	1	0	0	22
SW	0	0	0	0	3	3	6	0	0	0	0	12
WSW	0	0	0	2	1	0	1	1	0	0	0	5
W	0	0	1	2	1	0	3	0	1	0	0	8
WNW	0	0	0	1	1	1	2	1	1	0	0	7
NW	0	0	0	1	3	3	2	1	1	1	2	14
NNW	0	0	1	1	3	5	1	1	2	4	1	19
Tot	0	0	8	30	102	129	117	118	115	47	22	688

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	688
Hours of Missing Data	11
Hours in Period	8784

Table 2.7-10 (Sheet 5 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class D - Neutral based on Lapse Rate
Elevations: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	8	15	32	28	51	59	49	9	3	255
NNE	0	4	4	17	52	50	44	48	15	1	0	235
NE	0	2	6	13	43	26	11	9	11	0	0	121
ENE	0	1	5	9	32	16	9	8	2	0	0	82
E	0	2	7	11	33	31	29	18	15	0	0	146
ESE	0	1	4	0	29	39	45	34	21	6	0	179
SE	0	1	3	6	26	54	89	97	157	48	5	486
SSE	0	1	2	10	34	40	67	103	132	83	18	490
S	0	5	2	3	25	25	38	47	47	39	3	234
SSW	0	0	3	6	14	17	9	9	5	0	0	63
SW	0	0	2	6	12	4	4	2	0	0	0	30
WSW	0	0	3	6	8	1	3	0	1	0	0	22
W	0	1	3	6	2	3	2	2	0	4	0	23
WNW	0	0	3	6	5	2	3	3	5	0	0	27
NW	0	1	3	8	22	9	7	5	5	7	2	69
NNW	0	1	8	7	12	9	9	15	13	9	5	88
Tot	0	21	66	129	381	354	420	459	478	206	36	2550

Hours of Calm	2
Hours of Variable Direction	0
Hours of Valid Data	2552
Hours of Missing Data	11
Hours in Period	8784

Table 2.7-10 (Sheet 6 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class E - Slightly Stable based on Lapse Rate
Elevations: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	4	11	19	33	34	28	27	42	4	0	202
NNE	0	2	14	24	37	28	21	13	3	2	0	144
NE	0	5	16	26	52	19	10	7	1	1	0	137
ENE	0	8	9	19	41	18	4	2	1	0	0	102
E	0	7	12	20	64	31	12	2	1	0	0	149
ESE	0	3	7	10	50	38	23	2	2	0	0	135
SE	0	1	13	21	74	118	87	44	18	2	0	378
SSE	0	6	3	16	99	113	86	35	28	3	0	389
S	0	3	8	13	44	32	25	8	6	0	0	139
SSW	0	1	2	2	7	6	3	3	1	0	0	25
SW	0	2	5	4	4	4	2	0	0	0	0	21
WSW	0	0	5	2	3	2	1	0	1	0	0	14
W	0	3	4	4	3	3	1	4	0	0	0	22
WNW	0	1	5	7	5	1	0	4	2	0	0	25
NW	0	2	7	4	4	8	0	5	7	3	3	43
NNW	0	1	14	11	19	14	10	15	12	6	0	102
Tot	0	49	135	202	539	469	313	171	125	21	3	2027

Hours of Calm	1
Hours of Variable Direction	1
Hours of Valid Data	2029
Hours of Missing Data	11
Hours in Period	8784

Table 2.7-10 (Sheet 7 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class F - Moderately Stable based on Lapse Rate
Elevations: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	5	13	30	40	22	3	0	0	0	0	113
NNE	0	3	14	27	40	28	3	0	0	0	0	115
NE	0	7	17	17	43	7	5	0	0	0	0	96
ENE	0	6	15	25	35	8	3	0	0	0	0	92
E	0	3	26	36	38	7	1	0	0	0	0	111
ESE	0	9	21	34	55	10	0	0	0	0	0	129
SE	0	6	23	60	130	24	1	0	0	0	0	244
SSE	0	8	21	50	127	17	4	0	0	0	0	227
S	0	3	12	21	32	10	1	0	0	0	0	79
SSW	0	2	9	8	10	0	1	0	0	0	0	30
SW	0	6	2	1	2	2	0	0	0	0	0	13
WSW	0	4	3	2	2	5	1	0	0	0	0	17
W	0	1	6	3	1	0	0	0	0	0	0	11
WNW	0	2	6	5	4	2	1	0	0	0	0	20
NW	0	3	8	13	9	6	1	1	0	0	0	41
NNW	0	1	9	17	16	5	1	0	0	0	0	49
Tot	0	69	205	349	584	153	26	1	0	0	0	1387

Hours of Calm	1
Hours of Variable Direction	1
Hours of Valid Data	1389
Hours of Missing Data	11
Hours in Period	8784

Table 2.7-10 (Sheet 8 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class G - Extremely Stable based on Lapse Rate
Elevations: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	5	26	34	43	5	0	0	0	0	0	113
NNE	0	3	13	22	54	7	0	0	0	0	0	99
NE	0	5	13	20	43	4	1	0	0	0	0	86
ENE	0	7	8	12	14	4	0	0	0	0	0	45
E	0	4	10	13	32	4	0	0	0	0	0	63
ESE	0	8	17	19	36	6	0	0	1	0	0	87
SE	0	3	9	17	75	12	1	0	0	0	0	117
SSE	0	7	9	21	53	19	0	0	0	0	0	109
S	0	8	8	20	29	3	0	0	0	0	0	68
SSW	0	4	9	8	11	3	0	0	0	0	0	35
SW	0	3	10	5	8	1	0	0	0	0	0	27
WSW	0	5	13	12	8	1	0	0	0	0	0	39
W	0	4	11	11	12	0	0	0	0	0	0	38
WNW	0	13	8	15	13	4	0	0	0	0	0	53
NW	1	2	8	17	19	4	0	0	0	0	0	51
NNW	0	6	24	41	37	9	0	0	0	0	0	117
Tot	1	87	196	287	487	86	2	0	1	0	0	1147

Hours of Calm	9
Hours of Variable Direction	3
Hours of Valid Data	1159
Hours of Missing Data	11
Hours in Period	8784

Table 2.7-11 (Sheet 1 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2007)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
All Stabilities
Elevations: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	3	11	20	48	63	70	86	222	108	71	702
NNE	0	3	11	17	60	66	75	93	207	60	12	604
NE	0	4	9	16	81	96	93	77	98	26	2	502
ENE	0	1	9	19	53	75	87	84	64	9	0	401
E	0	5	9	14	63	88	102	102	89	15	2	489
ESE	0	2	13	17	59	89	140	153	177	19	7	676
SE	0	1	5	11	46	88	134	262	505	203	77	1332
SSE	0	2	3	10	54	78	174	304	774	315	220	1934
S	0	4	9	9	42	75	141	206	279	98	122	985
SSW	0	2	8	8	31	40	53	49	51	25	4	271
SW	0	1	7	7	28	31	18	22	28	4	0	146
WSW	0	1	7	13	18	9	4	11	23	2	1	89
W	0	1	5	9	13	13	9	14	14	4	1	83
WNW	0	0	1	6	9	15	7	5	17	12	4	76
NW	0	5	10	12	27	24	16	16	34	21	26	191
NNW	0	2	12	13	33	39	37	33	58	37	24	288
Tot	0	37	129	201	665	889	1160	1517	2640	958	573	8769

Hours of Calm	2
Hours of Variable Direction	1
Hours of Valid Data	8772
Hours of Missing Data	12
Hours in Period	8784

Table 2.7-11 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2007)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class A - Extremely Unstable based on Lapse Rate
Elevations: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	0	0	4	6	23	17	7	57
NNE	0	0	0	0	0	3	3	7	13	10	4	40
NE	0	0	0	0	0	4	0	1	5	1	0	11
ENE	0	0	0	0	0	0	0	3	2	1	0	6
E	0	0	0	0	0	0	0	2	3	0	0	5
ESE	0	0	0	0	0	0	0	2	3	0	0	5
SE	0	0	0	0	0	1	3	3	30	34	7	78
SSE	0	0	0	0	0	1	4	9	56	59	37	166
S	0	0	0	0	1	0	0	5	12	12	18	48
SSW	0	0	0	0	1	0	0	1	4	2	2	10
SW	0	0	0	0	0	0	0	1	2	0	0	3
WSW	0	0	0	0	0	0	0	0	2	0	0	2
W	0	0	0	0	0	0	0	2	1	0	0	3
WNW	0	0	0	0	0	0	0	1	3	0	1	5
NW	0	0	0	0	0	0	0	0	9	1	9	19
NNW	0	0	0	0	0	0	4	3	6	12	3	28
Tot	0	0	0	0	2	9	18	46	174	149	88	486

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	486
Hours of Missing Data	12
Hours in Period	8784

Table 2.7-11 (Sheet 3 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2007)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class B - Moderately Unstable based on Lapse Rate
Elevations: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	2	5	5	6	7	6	3	34
NNE	0	0	0	0	0	2	3	2	7	5	2	21
NE	0	0	0	1	3	3	3	3	1	1	0	15
ENE	0	0	0	0	1	3	5	6	3	0	0	18
E	0	0	0	0	3	2	3	5	5	1	0	19
ESE	0	0	0	0	3	2	11	4	7	3	0	30
SE	0	0	0	0	2	3	6	14	29	18	8	80
SSE	0	0	0	0	3	1	11	9	44	20	24	112
S	0	0	0	0	1	1	5	19	26	11	9	72
SSW	0	0	0	0	0	0	6	5	5	0	1	17
SW	0	0	0	0	0	0	1	1	1	0	0	3
WSW	0	0	0	0	0	0	0	0	1	0	0	1
W	0	0	0	0	0	0	0	2	2	0	0	4
WNW	0	0	0	0	0	1	0	0	2	1	1	5
NW	0	0	0	0	1	1	3	3	5	3	2	18
NNW	0	0	0	0	0	2	4	0	5	5	5	21
Tot	0	0	0	1	19	26	66	79	150	74	55	470

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	470
Hours of Missing Data	12
Hours in Period	8784

Table 2.7-11 (Sheet 4 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2007)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class C - Slightly Unstable based on Lapse Rate
Elevations: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	1	1	11	11	11	6	11	5	2	59
NNE	0	0	1	1	12	3	5	6	14	2	0	44
NE	0	0	1	3	6	12	12	6	1	1	0	42
ENE	0	0	0	1	10	3	7	5	3	0	0	29
E	0	0	0	1	7	16	10	8	6	0	1	49
ESE	0	0	0	2	7	10	8	8	11	1	0	47
SE	0	0	1	2	7	7	9	22	43	18	3	112
SSE	0	0	0	0	7	8	8	10	54	18	25	130
S	0	0	1	0	3	4	12	11	20	8	26	85
SSW	0	0	1	0	1	5	6	5	8	0	0	26
SW	0	0	0	0	1	3	3	4	0	0	0	11
WSW	0	0	1	1	2	0	0	1	1	0	0	6
W	0	0	0	0	3	0	1	2	1	0	0	7
WNW	0	0	0	1	0	0	3	0	1	1	0	6
NW	0	0	0	1	4	3	1	1	1	1	0	12
NNW	0	0	1	1	4	4	2	0	3	3	5	23
Tot	0	0	8	15	85	89	98	95	178	58	62	688

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	688
Hours of Missing Data	12
Hours in Period	8784

Table 2.7-11 (Sheet 5 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2007)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class D - Neutral based on Lapse Rate
Elevations: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	3	10	19	20	22	23	73	41	29	240
NNE	0	2	4	9	28	31	33	30	73	15	2	227
NE	0	3	3	5	40	27	18	10	21	12	1	140
ENE	0	1	3	8	19	17	14	8	10	2	0	82
E	0	2	7	6	22	23	14	20	27	9	1	131
ESE	0	0	2	3	14	23	26	33	52	12	6	171
SE	0	0	2	4	16	26	36	56	142	103	51	436
SSE	0	1	1	4	7	21	32	52	149	125	125	517
S	0	2	3	3	18	23	22	30	69	39	67	276
SSW	0	1	3	1	12	12	13	13	12	11	1	79
SW	0	0	3	2	10	9	4	4	4	0	0	36
WSW	0	1	1	6	6	2	1	3	0	1	0	21
W	0	0	3	3	6	3	2	1	1	1	1	21
WNW	0	0	0	2	4	3	1	1	6	3	2	22
NW	0	1	5	8	11	11	3	4	9	3	8	63
NNW	0	0	8	4	12	15	5	9	18	9	10	90
Tot	0	14	51	78	244	266	246	297	666	386	304	2552

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	2552
Hours of Missing Data	12
Hours in Period	8784

Table 2.7-11 (Sheet 6 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2007)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class E - Slightly Stable based on Lapse Rate
Elevations: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	4	3	9	13	15	21	47	37	30	180
NNE	0	0	3	2	11	18	15	22	33	20	4	128
NE	0	0	2	5	14	26	24	15	31	4	1	122
ENE	0	0	3	5	11	31	30	23	12	0	0	115
E	0	1	1	0	10	25	34	28	25	4	0	128
ESE	0	0	6	7	8	18	31	51	34	1	1	157
SE	0	0	0	3	6	23	31	74	147	21	8	313
SSE	0	0	1	4	10	18	41	84	235	50	9	452
S	0	1	3	5	6	18	37	50	66	17	2	205
SSW	0	1	3	5	5	7	5	8	2	8	0	44
SW	0	1	1	1	5	9	5	3	5	1	0	31
WSW	0	0	0	3	2	2	1	2	1	0	1	12
W	0	0	0	2	1	3	2	2	3	2	0	15
WNW	0	0	0	1	0	5	1	2	0	5	0	14
NW	0	0	2	2	5	4	3	4	3	8	7	38
NNW	0	1	2	6	9	7	10	8	22	8	1	74
Tot	0	6	31	54	112	227	285	397	666	186	64	2028

Hours of Calm	0
Hours of Variable Direction	1
Hours of Valid Data	2029
Hours of Missing Data	12
Hours in Period	8784

Table 2.7-11 (Sheet 7 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2007)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class F - Moderately Stable based on Lapse Rate
Elevations: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	0	3	6	10	10	16	34	1	0	81
NNE	0	1	2	4	6	5	8	13	37	7	0	83
NE	0	0	1	0	9	11	22	24	21	4	0	92
ENE	0	0	0	1	8	13	12	19	11	3	0	67
E	0	2	0	4	8	13	29	16	9	1	0	82
ESE	0	0	0	2	12	24	43	39	34	1	0	155
SE	0	1	1	1	8	18	27	49	50	3	0	158
SSE	0	0	0	1	14	18	62	119	132	5	0	351
S	0	1	1	0	6	14	40	67	51	2	0	182
SSW	0	0	1	1	3	5	13	9	6	0	0	38
SW	0	0	2	3	5	9	1	2	3	2	0	27
WSW	0	0	1	0	4	2	1	2	1	0	0	11
W	0	1	1	2	0	3	0	4	3	0	0	14
WNW	0	0	0	0	4	3	0	0	2	1	0	10
NW	0	0	1	0	3	4	1	2	4	3	0	18
NNW	0	0	0	0	3	5	4	6	0	0	0	18
Tot	0	7	11	22	99	157	273	387	398	33	0	1387

Hours of Calm	1
Hours of Variable Direction	0
Hours of Valid Data	1388
Hours of Missing Data	12
Hours in Period	8784

Table 2.7-11 (Sheet 8 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007 through June 30, 2007)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
Stability Class G - Extremely Stable based on Lapse Rate
Elevations: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	3	3	1	4	3	8	27	1	0	51
NNE	0	0	1	1	3	4	8	13	30	1	0	61
NE	0	1	2	2	9	13	14	18	18	3	0	80
ENE	0	0	3	4	4	8	19	20	23	3	0	84
E	0	0	1	3	13	9	12	23	14	0	0	75
ESE	0	2	5	3	15	12	21	16	36	1	0	111
SE	0	0	1	1	7	10	22	44	64	6	0	155
SSE	0	1	1	1	13	11	16	21	104	38	0	206
S	0	0	1	1	7	15	25	24	35	9	0	117
SSW	0	0	0	1	9	11	10	8	14	4	0	57
SW	0	0	1	1	7	1	4	7	13	1	0	35
WSW	0	0	4	3	4	3	1	3	17	1	0	36
W	0	0	1	2	3	4	4	1	3	1	0	19
WNW	0	0	1	2	1	3	2	1	3	1	0	14
NW	0	4	2	1	3	1	5	2	3	2	0	23
NNW	0	1	1	2	5	6	8	7	4	0	0	34
Tot	0	10	28	31	104	115	174	216	408	72	0	1158

Hours of Calm	1
Hours of Variable Direction	0
Hours of Valid Data	1159
Hours of Missing Data	12
Hours in Period	8784

Table 2.7-12
Sector-Specific Downwind Distances Between the Units 1 and 2 Midpoint and LPZ Boundary

Direction Sector	Distance to LPZ (feet)	Distance to LPZ (meters)
S	25,415	7,746
SSW	25,323	7,718
SW	25,302	7,712
WSW	25,355	7,728
W	25,475	7,765
WNW	25,645	7,817
NW	25,752	7,849
NNW	25,565	7,792
N	25,415	7,746
NNE	25,323	7,718
NE	25,302	7,712
ENE	25,355	7,728
E	25,475	7,765
ESE	25,645	7,817
SE	25,751	7,849
SSE	25,565	7,792

Table 2.7-13
PAVAN Output—Bounding 50 Percentile X/Q Value at the EAB
(Building Wake Credit Not Included)

Percent of Time CHIQ is Equaled or Exceeded		
X/Q (sec/m^3)	With Respect to Total Time	When the Wind Blows Into This Sector Only
4.232×10^{-4}	1.000	1.000
2.381×10^{-4}	3.000	3.000
1.756×10^{-4}	5.000	5.000
1.616×10^{-4}	5.000	5.000
1.339×10^{-4}	15.000	15.000
1.126×10^{-4}	20.000	20.000
9.711×10^{-5}	25.000	25.000
8.473×10^{-5}	30.000	30.000
7.190×10^{-5}	35.000	35.000
6.154×10^{-5}	40.000	40.000
5.294×10^{-5}	45.000	45.000
4.566×10^{-5}	50.000	50.000
3.918×10^{-5}	55.000	55.000
3.347×10^{-5}	60.000	60.000
2.843×10^{-5}	65.000	65.000
2.394×10^{-5}	70.000	70.000
1.963×10^{-5}	75.000	75.000
1.530×10^{-5}	80.000	80.000
1.756×10^{-4}	5.000	5.000

Table 2.7-14
PAVAN Output—Bounding 50 Percentile X/Q Value at the LPZ Boundary (Building Wake Credit Not Included)

Percent of Time CHIQ is Equaled or Exceeded		
X/Q (sec/m^3)	With Respect to Total Time	When the Wind Blows Into This Sector Only
8.449×10^{-5}	1.000	1.000
4.993×10^{-5}	3.000	3.000
3.779×10^{-5}	5.000	5.000
2.460×10^{-5}	5.000	5.000
1.788×10^{-5}	15.000	15.000
1.332×10^{-5}	20.000	20.000
1.035×10^{-5}	25.000	25.000
7.884×10^{-6}	30.000	30.000
5.851×10^{-6}	35.000	35.000
4.410×10^{-6}	40.000	40.000
3.355×10^{-6}	45.000	45.000
2.688×10^{-6}	50.000	50.000
2.182×10^{-6}	55.000	55.000
1.766×10^{-6}	60.000	60.000
1.419×10^{-6}	65.000	65.000
1.127×10^{-6}	70.000	70.000
8.806×10^{-7}	75.000	75.000
3.779×10^{-5}	5.000	5.000

Table 2.7-15 (Sheet 1 of 2)
Shortest Distances from the Source Boundary to Receptors of Interest by Downwind Direction Sector for XOQDOQ Modeling

Direction	Distance to Vegetable Garden, Meat Animal, and Resident from (meters)		Closer of two (meters)
	VCS Unit 1	VCS Unit 2	VCS Unit 1 or Unit 2
N	5198	4973	4973
NNE	7306	7017	7017
NE	4056	3750	3750
ENE	9624	9366	9366
E	13245	13036	13036
ESE	8610	8513	8513
SE	—	—	—
SSE	6856	7049	6856
S	9624	9865	9624
SSW	3911	4217	3911
SW	3766	4056	3766
WSW	10075	10316	10075
W	7435	7596	7435
WNW	7500	7580	7500
NW	2945	2881	2881
NNW*	2607	2462	2462

Notes:
No receptors of interest in a given sector are indicated by a dash (—).
*Vegetable garden location for NNW sector is 4233 meters.

Table 2.7-15 (Sheet 2 of 2)
Shortest Distance from the Source Boundary to Receptors of Interest by Dowwind Direction Sector for XOQDOQ Modeling

Direction	Distance to Property Boundary (meters)
N	1558
NNE	2167
NE	2856
ENE	2899
E	4080
ESE	6444
SE	6100
SSE	4191
S	2387
SSW	1761
SW	1205
WSW	1040
W	1063
WNW	1170
NW	1478
NNW	1477

Table 2.7-16
XOQDOQ-Predicted Maximum X/Q and D/Q Values at Receptors of Interest

Type of Location	Direction from Site	Distance (miles)	χ/Q (sec/m^3) (No Decay)	χ/Q (sec/m^3) (2.26-Day Decay)	χ/Q (sec/m^3) (8-Day Decay)	D/Q (1/m^2)
Residence/Meat	NNW	1.53	2.2×10^{-6}	2.2×10^{-6}	1.8×10^{-6}	1.2×10^{-8}
Vegetable Garden	NW	1.79	1.6×10^{-6}	1.6×10^{-6}	1.3×10^{-6}	7.7×10^{-9}
Property Boundary	W	0.66	7.4×10^{-6}	7.4×10^{-6}	6.7×10^{-6}	4.4×10^{-8}*
Unit 2 Reactor	NNE	0.19	2.3×10^{-5}	2.3×10^{-5}	2.2×10^{-5}	7.9×10^{-8}

**D/Q value for the property boundary is located in the NNW direction at a distance of 0.92 miles*

Table 2.7-17 (Sheet 1 of 2)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

No Decay Undepleted	DISTANCE IN MILES FROM THE SITE										
NW	0.25	0.5	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	6.584E-5	2.083E-5	1.104E-5	5.585E-6	2.275E-6	1.249E-6	7.995E-7	5.625E-7	4.217E-7	3.307E-7	2.684E-7
	DISTANCE IN MILES FROM THE SITE										
NW	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	2.235E-7	1.177E-7	7.758E-8	4.556E-8	3.136E-8	2.352E-8	1.862E-8	1.529E-8	1.290E-8	1.111E-8	9.720E-9
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
NW	0.5 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50	
X/Q (s/m^3)	1.079E-5	2.554E-6	8.245E-7	4.273E-7	2.702E-7	1.234E-7	4.637E-8	2.365E-8	1.533E-8	1.112E-8	
2.26-Day Decay, Undepleted	DISTANCE IN MILES FROM THE SITE										
NW	0.25	0.5	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	6.579E-5	2.081E-5	1.102E-5	5.571E-6	2.266E-6	1.242E-6	7.942E-7	5.580E-7	4.177E-7	3.272E-7	2.651E-7
	DISTANCE IN MILES FROM THE SITE										
NW	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	2.205E-7	1.153E-7	7.548E-8	4.371E-8	2.967E-8	2.195E-8	1.713E-8	1.387E-8	1.154E-8	9.803E-9	8.461E-9
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
NW	0.5 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50	
X/Q (s/m^3)	1.077E-5	2.545E-6	8.192E-7	4.233E-7	2.670E-7	1.210E-7	4.453E-8	2.208E-8	1.392E-8	9.821E-9	

Table 2.7-17 (Sheet 2 of 2)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

8.0-Day Decay, Depleted	DISTANCE IN MILES FROM THE SITE										
NW	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	6.230E-5	1.902E-5	9.830E-6	4.886E-6	1.930E-6	1.032E-6	6.464E-7	4.458E-7	3.282E-7	2.531E-7	2.022E-7
	DISTANCE IN MILES FROM THE SITE										
NW	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	1.660E-7	8.250E-8	5.172E-8	2.800E-8	1.803E-8	1.276E-8	9.589E-9	7.508E-9	6.060E-9	5.005E-9	4.210E-9
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
NW	0.5 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50	
X/Q (s/m^3)	9.674E-6	2.188E-6	6.691E-7	3.332E-7	2.039E-7	8.737E-8	2.884E-8	1.290E-8	7.551E-9	5.023E-9	
Relative Deposition /Area	DISTANCE IN MILES FROM THE SITE										
NNW	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
D/Q ($1/m^2$)	4.306E-7	1.456E-7	7.476E-8	3.554E-8	1.277E-8	6.331E-9	3.728E-9	2.441E-9	1.718E-9	1.273E-9	9.809E-10
	DISTANCE IN MILES FROM THE SITE										
NNW	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
D/Q ($1/m^2$)	7.793E-10	3.462E-10	2.097E-10	1.060E-10	6.415E-11	4.301E-11	3.082E-11	2.314E-11	1.799E-11	1.437E-11	1.173E-11
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
NNW	0.5 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50	
D/Q ($1/m^2$)	7.307E-8	1.497E-8	3.907E-9	1.755E-9	9.927E-10	3.818E-10	1.104E-10	4.377E-11	2.338E-11	1.447E-11	

Table 2.7-18
Long-Term Average X/Q and D/Q Values for Routine Releases at Specific Receptors of Interest

Type of Location	Direction From Site	Distance (Miles)	Distance (Meters)	X/Q(Sec/m^3) NO DECAY UNDEPLETED	2.26 DAY DECAY UNDEPLETED	8.00 Day DECAY DEPLETED	D/Q (1/m^2)
Res/Meat	SSW	2.43	3911.	5.2E-07	5.2E-07	4.2E-07	1.7E-09
Res/Meat	SW	2.34	3766.	5.2E-07	5.1E-07	4.2E-07	1.4E-09
Res/Meat	W	4.62	7435.	1.4E-07	1.4E-07	1.1E-07	3.1E-10
Res/Meat	WNW	4.66	7500.	1.6E-07	1.6E-07	1.2E-07	3.5E-10
Res/Meat	NW	1.79	2881.	1.6E-06	1.6E-06	1.3E-06	7.7E-09
Res/Meat	NNW	1.53	2462.	2.2E-06	2.2E-06	1.8E-06	1.2E-08
Res/Meat	N	3.09	4973.	2.6E-07	2.6E-07	2.1E-07	9.5E-10
Res/Meat	NNE	4.36	7017.	5.9E-08	5.8E-08	4.5E-08	1.3E-10
Res/Meat	NE	2.33	3750.	1.4E-07	1.4E-07	1.2E-07	3.0E-10
Res/Meat	SSE	4.26	6856.	1.5E-07	1.5E-07	1.1E-07	2.9E-10
Veg	SSW	2.43	3911.	5.2E-07	5.2E-07	4.2E-07	1.7E-09
Veg	SW	2.34	3766.	5.2E-07	5.1E-07	4.2E-07	1.4E-09
Veg	W	4.62	7435.	1.4E-07	1.4E-07	1.1E-07	3.1E-10
Veg	WNW	4.66	7500.	1.6E-07	1.6E-07	1.2E-07	3.5E-10
Veg	NW	1.79	2881.	1.6E-06	1.6E-06	1.3E-06	7.7E-09
Veg	NNW	2.63	4233.	7.2E-07	7.1E-07	5.8E-07	3.3E-09
Veg	N	3.09	4973.	2.6E-07	2.6E-07	2.1E-07	9.5E-10
Veg	NNE	4.36	7017.	5.9E-08	5.8E-08	4.5E-08	1.3E-10
Veg	NE	2.33	3750.	1.4E-07	1.4E-07	1.2E-07	3.0E-10
Veg	SSE	4.26	6856.	1.5E-07	1.5E-07	1.1E-07	2.9E-10
Property Bndry	S	1.48	2387.	1.6E-06	1.6E-06	1.4E-06	6.7E-09
Property Bndry	SSW	1.09	1761.	2.8E-06	2.8E-06	2.4E-06	1.2E-08
Property Bndry	SW	.75	1205.	6.2E-06	6.2E-06	5.5E-06	2.3E-08
Property Bndry	WSW	.65	1040.	6.0E-06	6.0E-06	5.4E-06	2.2E-08
Property Bndry	W	.66	1063.	7.4E-06	7.4E-06	6.7E-06	3.1E-08
Property Bndry	WNW	.73	1170.	7.1E-06	7.1E-06	6.3E-06	3.0E-08
Property Bndry	NW	.92	1478.	6.8E-06	6.8E-06	6.0E-06	4.1E-08
Property Bndry	NNW	.92	1477.	6.8E-06	6.8E-06	6.0E-06	4.4E-08
Property Bndry	N	.97	1558.	3.0E-06	3.0E-06	2.6E-06	1.6E-08
Property Bndry	NNE	1.35	2167.	5.7E-07	5.7E-07	4.9E-07	2.0E-09
Property Bndry	NE	1.77	2856.	2.5E-07	2.4E-07	2.1E-07	5.7E-10
Property Bndry	ENE	1.80	2899.	2.7E-07	2.7E-07	2.2E-07	5.0E-10
Property Bndry	E	2.54	4080.	1.3E-07	1.3E-07	1.1E-07	2.4E-10
Property Bndry	ESE	4.00	6444.	8.3E-08	8.2E-08	6.4E-08	1.1E-10
Property Bndry	SE	3.79	6100.	2.3E-07	2.0E-07	1.7E-07	2.3E-10
Property Bndry	SSE	2.60	4191.	3.6E-07	3.6E-07	2.9E-07	8.7E-10
Unit 1 to 2	NNE	.19	305.	2.3E-05	2.3E-05	2.2E-05	7.9E-08
Unit 1 to 2	NE	.19	305.	1.7E-05	1.7E-05	1.7E-05	4.4E-08
Unit 1 to 2	ENE	.19	305.	2.0E-05	2.0E-05	2.0E-05	4.0E-08

Table 2.7-19
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 Miles, No Decay, Undepleted

Release Point - Ground Level - No Intermittent Releases
NO DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	4.700E-05	1.467E-05	7.600E-06	3.797E-06	1.554E-06	8.601E-07	5.540E-07	3.917E-07	2.949E-07	2.321E-07	1.889E-07
SSW	4.143E-05	1.307E-05	6.817E-06	3.416E-06	1.394E-06	7.682E-07	4.934E-07	3.480E-07	2.614E-07	2.054E-07	1.670E-07
SW	3.781E-05	1.186E-05	6.199E-06	3.113E-06	1.274E-06	7.042E-07	4.531E-07	3.201E-07	2.408E-07	1.894E-07	1.541E-07
WSW	2.889E-05	9.073E-06	4.787E-06	2.420E-06	9.910E-07	5.467E-07	3.513E-07	2.479E-07	1.863E-07	1.464E-07	1.190E-07
W	3.678E-05	1.164E-05	6.153E-06	3.109E-06	1.268E-06	6.973E-07	4.471E-07	3.149E-07	2.363E-07	1.855E-07	1.506E-07
WNW	4.183E-05	1.295E-05	6.748E-06	3.399E-06	1.397E-06	7.738E-07	4.989E-07	3.529E-07	2.658E-07	2.093E-07	1.704E-07
NW	6.584E-05	2.083E-05	1.104E-05	5.585E-06	2.275E-06	1.249E-06	7.995E-07	5.625E-07	4.217E-07	3.307E-07	2.684E-07
NNW	6.566E-05	2.076E-05	1.098E-05	5.547E-06	2.256E-06	1.238E-06	7.920E-07	5.570E-07	4.175E-07	3.274E-07	2.656E-07
N	3.357E-05	1.058E-05	5.517E-06	2.760E-06	1.124E-06	6.187E-07	3.971E-07	2.799E-07	2.102E-07	1.651E-07	1.342E-07
NNE	1.425E-05	4.372E-06	2.235E-06	1.112E-06	4.569E-07	2.537E-07	1.639E-07	1.162E-07	8.762E-08	6.909E-08	5.632E-08
NE	1.072E-05	3.301E-06	1.690E-06	8.409E-07	3.467E-07	1.932E-07	1.251E-07	8.885E-08	6.711E-08	5.298E-08	4.323E-08
ENE	1.254E-05	3.766E-06	1.888E-06	9.322E-07	3.890E-07	2.194E-07	1.433E-07	1.024E-07	7.780E-08	6.171E-08	5.055E-08
E	1.201E-05	3.655E-06	1.843E-06	9.091E-07	3.771E-07	2.116E-07	1.378E-07	9.827E-08	7.449E-08	5.899E-08	4.826E-08
ESE	1.694E-05	5.079E-06	2.540E-06	1.251E-06	5.230E-07	2.955E-07	1.933E-07	1.383E-07	1.052E-07	8.348E-08	6.843E-08
SE	4.243E-05	1.256E-05	6.191E-06	3.028E-06	1.272E-06	7.229E-07	4.749E-07	3.410E-07	2.600E-07	2.068E-07	1.699E-07
SSE	3.355E-05	1.022E-05	5.171E-06	2.557E-06	1.061E-06	5.953E-07	3.875E-07	2.762E-07	2.093E-07	1.657E-07	1.355E-07

0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.578E-07	8.396E-08	5.575E-08	3.308E-08	2.295E-08	1.731E-08	1.376E-08	1.135E-08	9.608E-09	8.299E-09	7.283E-09
SSW	1.393E-07	7.370E-08	4.876E-08	2.879E-08	1.990E-08	1.497E-08	1.188E-08	9.776E-09	8.264E-09	7.129E-09	6.248E-09
SW	1.286E-07	6.828E-08	4.526E-08	2.679E-08	1.855E-08	1.397E-08	1.110E-08	9.143E-09	7.733E-09	6.675E-09	5.853E-09
WSW	9.928E-08	5.256E-08	3.478E-08	2.053E-08	1.418E-08	1.066E-08	8.455E-09	6.956E-09	5.877E-09	5.067E-09	4.439E-09
W	1.255E-07	6.621E-08	4.370E-08	2.572E-08	1.773E-08	1.331E-08	1.055E-08	8.669E-09	7.319E-09	6.306E-09	5.522E-09
WNW	1.423E-07	7.578E-08	5.033E-08	2.987E-08	2.071E-08	1.562E-08	1.242E-08	1.023E-08	8.663E-09	7.481E-09	6.563E-09
NW	2.235E-07	1.177E-07	7.758E-08	4.556E-08	3.136E-08	2.352E-08	1.862E-08	1.529E-08	1.290E-08	1.111E-08	9.720E-09
NNW	2.212E-07	1.164E-07	7.674E-08	4.507E-08	3.103E-08	2.328E-08	1.843E-08	1.514E-08	1.277E-08	1.100E-08	9.629E-09
N	1.119E-07	5.924E-08	3.920E-08	2.315E-08	1.601E-08	1.205E-08	9.561E-09	7.871E-09	6.655E-09	5.741E-09	5.033E-09
NNE	4.710E-08	2.520E-08	1.679E-08	1.002E-08	6.977E-09	5.280E-09	4.209E-09	3.478E-09	2.950E-09	2.552E-09	2.243E-09
NE	3.619E-08	1.941E-08	1.296E-08	7.745E-09	5.398E-09	4.087E-09	3.259E-09	2.694E-09	2.286E-09	1.978E-09	1.738E-09
ENE	4.247E-08	2.307E-08	1.553E-08	9.385E-09	6.587E-09	5.014E-09	4.016E-09	3.331E-09	2.834E-09	2.459E-09	2.166E-09
E	4.049E-08	2.190E-08	1.471E-08	8.858E-09	6.205E-09	4.716E-09	3.773E-09	3.127E-09	2.658E-09	2.305E-09	2.029E-09
ESE	5.752E-08	3.131E-08	2.111E-08	1.278E-08	8.980E-09	6.841E-09	5.482E-09	4.550E-09	3.873E-09	3.361E-09	2.962E-09
SE	1.430E-07	7.835E-08	5.305E-08	3.230E-08	2.278E-08	1.740E-08	1.398E-08	1.162E-08	9.907E-09	8.610E-09	7.597E-09
SSE	1.137E-07	6.146E-08	4.125E-08	2.482E-08	1.737E-08	1.320E-08	1.055E-08	8.739E-09	7.427E-09	6.437E-09	5.666E-09

Table 2.7-20
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 Miles, No Decay, Undepleted

Release Point - Ground Level - No Intermittent Releases
NO DECAY, UNDEPLETED
0CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	7.481E-06	1.744E-06	5.707E-07	2.986E-07	1.902E-07	8.783E-08	3.361E-08	1.739E-08	1.138E-08	8.310E-09
SSW	6.694E-06	1.565E-06	5.085E-07	2.648E-07	1.681E-07	7.718E-08	2.927E-08	1.505E-08	9.800E-09	7.139E-09
SW	6.085E-06	1.430E-06	4.669E-07	2.439E-07	1.551E-07	7.146E-08	2.723E-08	1.404E-08	9.165E-09	6.684E-09
WSW	4.688E-06	1.111E-06	3.621E-07	1.887E-07	1.198E-07	5.504E-08	2.087E-08	1.072E-08	6.973E-09	5.074E-09
W	6.019E-06	1.423E-06	4.609E-07	2.394E-07	1.516E-07	6.938E-08	2.616E-08	1.339E-08	8.691E-09	6.316E-09
WNW	6.637E-06	1.565E-06	5.138E-07	2.692E-07	1.715E-07	7.926E-08	3.034E-08	1.569E-08	1.026E-08	7.491E-09
NW	1.079E-05	2.554E-06	8.245E-07	4.273E-07	2.702E-07	1.234E-07	4.637E-08	2.365E-08	1.533E-08	1.112E-08
NNW	1.074E-05	2.535E-06	8.168E-07	4.230E-07	2.674E-07	1.221E-07	4.587E-08	2.341E-08	1.518E-08	1.102E-08
N	5.418E-06	1.263E-06	4.093E-07	2.130E-07	1.351E-07	6.204E-08	2.354E-08	1.211E-08	7.890E-09	5.750E-09
NNE	2.211E-06	5.123E-07	1.688E-07	8.872E-08	5.669E-08	2.633E-08	1.017E-08	5.304E-09	3.486E-09	2.555E-09
NE	1.671E-06	3.883E-07	1.288E-07	6.794E-08	4.351E-08	2.027E-08	7.860E-09	4.105E-09	2.700E-09	1.980E-09
ENE	1.881E-06	4.343E-07	1.472E-07	7.871E-08	5.086E-08	2.403E-08	9.507E-09	5.034E-09	3.337E-09	2.462E-09
E	1.831E-06	4.218E-07	1.417E-07	7.538E-08	4.856E-08	2.283E-08	8.978E-09	4.736E-09	3.133E-09	2.308E-09
ESE	2.532E-06	5.838E-07	1.986E-07	1.064E-07	6.885E-08	3.260E-08	1.294E-08	6.868E-09	4.558E-09	3.365E-09
SE	6.201E-06	1.418E-06	4.875E-07	2.629E-07	1.709E-07	8.148E-08	3.268E-08	1.747E-08	1.164E-08	8.619E-09
SSE	5.130E-06	1.186E-06	3.984E-07	2.118E-07	1.364E-07	6.409E-08	2.516E-08	1.325E-08	8.757E-09	6.445E-09

Table 2.7-21
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 Miles, 2.26-Day Decay, Undepleted

Release Point - Ground Level - No Intermittent Releases
2.260 DAY DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	4.696E-05	1.465E-05	7.582E-06	3.785E-06	1.547E-06	8.545E-07	5.495E-07	3.879E-07	2.915E-07	2.291E-07	1.861E-07
SSW	4.140E-05	1.305E-05	6.801E-06	3.406E-06	1.387E-06	7.634E-07	4.896E-07	3.448E-07	2.586E-07	2.029E-07	1.646E-07
SW	3.777E-05	1.184E-05	6.183E-06	3.102E-06	1.268E-06	6.991E-07	4.491E-07	3.167E-07	2.378E-07	1.867E-07	1.516E-07
WSW	2.887E-05	9.055E-06	4.773E-06	2.411E-06	9.852E-07	5.424E-07	3.479E-07	2.450E-07	1.837E-07	1.441E-07	1.169E-07
W	3.675E-05	1.162E-05	6.138E-06	3.098E-06	1.261E-06	6.925E-07	4.432E-07	3.116E-07	2.334E-07	1.829E-07	1.482E-07
WNW	4.179E-05	1.292E-05	6.731E-06	3.387E-06	1.390E-06	7.684E-07	4.945E-07	3.492E-07	2.625E-07	2.063E-07	1.676E-07
NW	6.579E-05	2.081E-05	1.102E-05	5.571E-06	2.266E-06	1.242E-06	7.942E-07	5.580E-07	4.177E-07	3.272E-07	2.651E-07
NNW	6.561E-05	2.074E-05	1.096E-05	5.532E-06	2.246E-06	1.231E-06	7.864E-07	5.523E-07	4.133E-07	3.236E-07	2.621E-07
N	3.354E-05	1.057E-05	5.504E-06	2.751E-06	1.118E-06	6.145E-07	3.937E-07	2.771E-07	2.077E-07	1.629E-07	1.321E-07
NNE	1.424E-05	4.364E-06	2.229E-06	1.108E-06	4.543E-07	2.518E-07	1.623E-07	1.148E-07	8.643E-08	6.801E-08	5.532E-08
NE	1.071E-05	3.294E-06	1.685E-06	8.370E-07	3.443E-07	1.914E-07	1.237E-07	8.761E-08	6.602E-08	5.200E-08	4.233E-08
ENE	1.253E-05	3.758E-06	1.882E-06	9.280E-07	3.864E-07	2.174E-07	1.417E-07	1.010E-07	7.657E-08	6.059E-08	4.952E-08
E	1.200E-05	3.647E-06	1.837E-06	9.051E-07	3.746E-07	2.098E-07	1.363E-07	9.697E-08	7.335E-08	5.795E-08	4.730E-08
ESE	1.692E-05	5.067E-06	2.531E-06	1.245E-06	5.193E-07	2.927E-07	1.910E-07	1.364E-07	1.034E-07	8.188E-08	6.696E-08
SE	4.211E-05	1.238E-05	6.062E-06	2.946E-06	1.220E-06	6.834E-07	4.425E-07	3.132E-07	2.353E-07	1.845E-07	1.494E-07
SSE	3.352E-05	1.020E-05	5.158E-06	2.548E-06	1.055E-06	5.911E-07	3.840E-07	2.733E-07	2.067E-07	1.634E-07	1.334E-07

0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.552E-07	8.189E-08	5.391E-08	3.145E-08	2.144E-08	1.590E-08	1.243E-08	1.008E-08	8.390E-09	7.126E-09	6.149E-09
SSW	1.371E-07	7.199E-08	4.725E-08	2.746E-08	1.868E-08	1.383E-08	1.080E-08	8.754E-09	7.285E-09	6.187E-09	5.339E-09
SW	1.263E-07	6.645E-08	4.365E-08	2.537E-08	1.725E-08	1.276E-08	9.958E-09	8.057E-09	6.695E-09	5.676E-09	4.890E-09
WSW	9.733E-08	5.101E-08	3.341E-08	1.932E-08	1.308E-08	9.641E-09	7.494E-09	6.043E-09	5.005E-09	4.231E-09	3.634E-09
W	1.233E-07	6.449E-08	4.219E-08	2.439E-08	1.652E-08	1.219E-08	9.490E-09	7.664E-09	6.359E-09	5.385E-09	4.634E-09
WNW	1.398E-07	7.373E-08	4.852E-08	2.826E-08	1.924E-08	1.424E-08	1.112E-08	8.995E-09	7.475E-09	6.338E-09	5.460E-09
NW	2.205E-07	1.153E-07	7.548E-08	4.371E-08	2.967E-08	2.195E-08	1.713E-08	1.387E-08	1.154E-08	9.803E-09	8.461E-09
NNW	2.180E-07	1.139E-07	7.451E-08	4.311E-08	2.924E-08	2.161E-08	1.685E-08	1.364E-08	1.134E-08	9.622E-09	8.298E-09
N	1.100E-07	5.771E-08	3.784E-08	2.196E-08	1.491E-08	1.102E-08	8.594E-09	6.950E-09	5.773E-09	4.894E-09	4.215E-09
NNE	4.618E-08	2.445E-08	1.613E-08	9.432E-09	6.437E-09	4.773E-09	3.729E-09	3.020E-09	2.510E-09	2.129E-09	1.834E-09
NE	3.535E-08	1.873E-08	1.236E-08	7.213E-09	4.910E-09	3.631E-09	2.829E-09	2.284E-09	1.893E-09	1.601E-09	1.375E-09
ENE	4.150E-08	2.228E-08	1.483E-08	8.759E-09	6.008E-09	4.469E-09	3.499E-09	2.836E-09	2.359E-09	2.001E-09	1.724E-09
E	3.960E-08	2.118E-08	1.407E-08	8.289E-09	5.680E-09	4.224E-09	3.306E-09	2.681E-09	2.230E-09	1.892E-09	1.631E-09
ESE	5.615E-08	3.019E-08	2.011E-08	1.188E-08	8.146E-09	6.056E-09	4.737E-09	3.837E-09	3.189E-09	2.702E-09	2.325E-09
SE	1.240E-07	6.337E-08	4.012E-08	2.154E-08	1.355E-08	9.336E-09	6.839E-09	5.239E-09	4.153E-09	3.385E-09	2.820E-09
SSE	1.117E-07	5.983E-08	3.979E-08	2.351E-08	1.616E-08	1.205E-08	9.466E-09	7.701E-09	6.428E-09	5.472E-09	4.731E-09

Table 2.7-22
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 Miles, 2.26-Day Decay, Undepleted

Release Point - Ground Level - No Intermittent Releases
2.260 DAY DECAY, UNDEPLETED
0CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	7.464E-06	1.737E-06	5.662E-07	2.953E-07	1.874E-07	8.575E-08	3.200E-08	1.599E-08	1.011E-08	7.139E-09
SSW	6.680E-06	1.559E-06	5.047E-07	2.620E-07	1.658E-07	7.546E-08	2.795E-08	1.391E-08	8.780E-09	6.198E-09
SW	6.070E-06	1.423E-06	4.628E-07	2.409E-07	1.526E-07	6.962E-08	2.583E-08	1.284E-08	8.081E-09	5.687E-09
WSW	4.675E-06	1.105E-06	3.586E-07	1.861E-07	1.177E-07	5.348E-08	1.968E-08	9.700E-09	6.062E-09	4.240E-09
W	6.005E-06	1.417E-06	4.571E-07	2.365E-07	1.493E-07	6.766E-08	2.485E-08	1.227E-08	7.689E-09	5.395E-09
WNW	6.621E-06	1.557E-06	5.094E-07	2.658E-07	1.688E-07	7.720E-08	2.875E-08	1.432E-08	9.022E-09	6.350E-09
NW	1.077E-05	2.545E-06	8.192E-07	4.233E-07	2.670E-07	1.210E-07	4.453E-08	2.208E-08	1.392E-08	9.821E-09
NNW	1.072E-05	2.525E-06	8.112E-07	4.188E-07	2.640E-07	1.195E-07	4.393E-08	2.174E-08	1.368E-08	9.640E-09
N	5.406E-06	1.257E-06	4.060E-07	2.105E-07	1.330E-07	6.050E-08	2.236E-08	1.109E-08	6.971E-09	4.903E-09
NNE	2.205E-06	5.096E-07	1.672E-07	8.752E-08	5.570E-08	2.558E-08	9.590E-09	4.799E-09	3.028E-09	2.133E-09
NE	1.666E-06	3.859E-07	1.273E-07	6.684E-08	4.261E-08	1.959E-08	7.333E-09	3.651E-09	2.291E-09	1.604E-09
ENE	1.875E-06	4.316E-07	1.456E-07	7.747E-08	4.983E-08	2.324E-08	8.886E-09	4.491E-09	2.844E-09	2.005E-09
E	1.825E-06	4.192E-07	1.402E-07	7.423E-08	4.761E-08	2.211E-08	8.414E-09	4.245E-09	2.688E-09	1.896E-09
ESE	2.523E-06	5.800E-07	1.963E-07	1.046E-07	6.738E-08	3.148E-08	1.205E-08	6.086E-09	3.847E-09	2.707E-09
SE	6.081E-06	1.365E-06	4.550E-07	2.382E-07	1.504E-07	6.651E-08	2.211E-08	9.460E-09	5.282E-09	3.403E-09
SSE	5.118E-06	1.181E-06	3.949E-07	2.092E-07	1.342E-07	6.244E-08	2.386E-08	1.211E-08	7.720E-09	5.481E-09

Table 2.7-23
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 Miles, 8.00-Day Decay, Depleted

Release Point - Ground Level - No Intermittent Releases
8.000 DAY DECAY, DEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	4.447E-05	1.339E-05	6.768E-06	3.321E-06	1.318E-06	7.109E-07	4.477E-07	3.103E-07	2.293E-07	1.775E-07	1.422E-07
SSW	3.920E-05	1.193E-05	6.071E-06	2.988E-06	1.182E-06	6.350E-07	3.988E-07	2.757E-07	2.034E-07	1.571E-07	1.257E-07
SW	3.577E-05	1.082E-05	5.520E-06	2.722E-06	1.081E-06	5.819E-07	3.661E-07	2.535E-07	1.872E-07	1.448E-07	1.160E-07
WSW	2.734E-05	8.280E-06	4.262E-06	2.116E-06	8.403E-07	4.517E-07	2.838E-07	1.963E-07	1.448E-07	1.119E-07	8.952E-08
W	3.480E-05	1.062E-05	5.480E-06	2.719E-06	1.075E-06	5.763E-07	3.613E-07	2.494E-07	1.837E-07	1.418E-07	1.134E-07
WNW	3.958E-05	1.182E-05	6.009E-06	2.972E-06	1.185E-06	6.395E-07	4.031E-07	2.795E-07	2.067E-07	1.600E-07	1.282E-07
NW	6.230E-05	1.902E-05	9.830E-06	4.886E-06	1.930E-06	1.032E-06	6.464E-07	4.458E-07	3.282E-07	2.531E-07	2.022E-07
NNW	6.213E-05	1.895E-05	9.781E-06	4.852E-06	1.914E-06	1.023E-06	6.402E-07	4.414E-07	3.248E-07	2.505E-07	2.001E-07
N	3.176E-05	9.661E-06	4.913E-06	2.414E-06	9.530E-07	5.113E-07	3.209E-07	2.217E-07	1.635E-07	1.263E-07	1.010E-07
NNE	1.348E-05	3.991E-06	1.990E-06	9.728E-07	3.874E-07	2.097E-07	1.324E-07	9.198E-08	6.811E-08	5.280E-08	4.237E-08
NE	1.014E-05	3.013E-06	1.505E-06	7.351E-07	2.939E-07	1.596E-07	1.010E-07	7.029E-08	5.213E-08	4.046E-08	3.249E-08
ENE	1.186E-05	3.437E-06	1.681E-06	8.150E-07	3.297E-07	1.812E-07	1.157E-07	8.105E-08	6.044E-08	4.713E-08	3.800E-08
E	1.136E-05	3.336E-06	1.641E-06	7.948E-07	3.196E-07	1.748E-07	1.113E-07	7.776E-08	5.787E-08	4.505E-08	3.628E-08
ESE	1.603E-05	4.635E-06	2.261E-06	1.094E-06	4.433E-07	2.440E-07	1.561E-07	1.094E-07	8.168E-08	6.373E-08	5.142E-08
SE	4.007E-05	1.142E-05	5.484E-06	2.630E-06	1.068E-06	5.891E-07	3.770E-07	2.643E-07	1.971E-07	1.536E-07	1.237E-07
SSE	3.175E-05	9.324E-06	4.605E-06	2.236E-06	8.997E-07	4.919E-07	3.131E-07	2.187E-07	1.628E-07	1.267E-07	1.020E-07

0ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.171E-07	5.877E-08	3.710E-08	2.028E-08	1.315E-08	9.350E-09	7.052E-09	5.539E-09	4.482E-09	3.710E-09	3.126E-09
SSW	1.034E-07	5.161E-08	3.246E-08	1.766E-08	1.141E-08	8.099E-09	6.098E-09	4.783E-09	3.866E-09	3.197E-09	2.692E-09
SW	9.539E-08	4.776E-08	3.010E-08	1.641E-08	1.061E-08	7.536E-09	5.676E-09	4.452E-09	3.599E-09	2.976E-09	2.505E-09
WSW	7.359E-08	3.674E-08	2.310E-08	1.255E-08	8.093E-09	5.733E-09	4.308E-09	3.373E-09	2.722E-09	2.247E-09	1.889E-09
W	9.310E-08	4.633E-08	2.907E-08	1.575E-08	1.015E-08	7.185E-09	5.398E-09	4.226E-09	3.409E-09	2.815E-09	2.366E-09
WNW	1.056E-07	5.301E-08	3.346E-08	1.828E-08	1.184E-08	8.418E-09	6.345E-09	4.980E-09	4.027E-09	3.331E-09	2.805E-09
NW	1.660E-07	8.250E-08	5.172E-08	2.800E-08	1.803E-08	1.276E-08	9.589E-09	7.508E-09	6.060E-09	5.005E-09	4.210E-09
NNW	1.642E-07	8.158E-08	5.113E-08	2.767E-08	1.782E-08	1.261E-08	9.475E-09	7.418E-09	5.986E-09	4.943E-09	4.157E-09
N	8.302E-08	4.146E-08	2.607E-08	1.418E-08	9.161E-09	6.499E-09	4.891E-09	3.835E-09	3.098E-09	2.561E-09	2.155E-09
NNE	3.492E-08	1.761E-08	1.115E-08	6.124E-09	3.982E-09	2.839E-09	2.145E-09	1.687E-09	1.366E-09	1.131E-09	9.539E-10
NE	2.680E-08	1.355E-08	8.589E-09	4.720E-09	3.069E-09	2.187E-09	1.651E-09	1.298E-09	1.050E-09	8.693E-10	7.324E-10
ENE	3.145E-08	1.610E-08	1.030E-08	5.723E-09	3.748E-09	2.685E-09	2.036E-09	1.606E-09	1.304E-09	1.082E-09	9.142E-10
E	2.999E-08	1.529E-08	9.756E-09	5.405E-09	3.534E-09	2.529E-09	1.917E-09	1.511E-09	1.226E-09	1.017E-09	8.590E-10
ESE	4.258E-08	2.185E-08	1.399E-08	7.784E-09	5.101E-09	3.656E-09	2.773E-09	2.188E-09	1.776E-09	1.474E-09	1.245E-09
SE	1.023E-07	5.187E-08	3.276E-08	1.770E-08	1.125E-08	7.817E-09	5.751E-09	4.403E-09	3.471E-09	2.799E-09	2.298E-09
SSE	8.433E-08	4.300E-08	2.743E-08	1.520E-08	9.940E-09	7.117E-09	5.396E-09	4.256E-09	3.456E-09	2.870E-09	2.425E-09

Table 2.7-24
Long-Term Average X/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 Miles, 8.00-Day Decay, Depleted

Release Point - Ground Level - No Intermittent Releases
8.000 DAY DECAY, DEPLETED
0CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	6.708E-06	1.493E-06	4.629E-07	2.327E-07	1.434E-07	6.210E-08	2.085E-08	9.443E-09	5.569E-09	3.723E-09
SSW	6.002E-06	1.340E-06	4.125E-07	2.064E-07	1.268E-07	5.460E-08	1.817E-08	8.182E-09	4.809E-09	3.208E-09
SW	5.455E-06	1.224E-06	3.786E-07	1.900E-07	1.169E-07	5.050E-08	1.687E-08	7.612E-09	4.477E-09	2.986E-09
WSW	4.202E-06	9.512E-07	2.936E-07	1.470E-07	9.025E-08	3.887E-08	1.291E-08	5.792E-09	3.392E-09	2.255E-09
W	5.396E-06	1.219E-06	3.739E-07	1.865E-07	1.143E-07	4.905E-08	1.622E-08	7.261E-09	4.250E-09	2.825E-09
WNW	5.950E-06	1.340E-06	4.167E-07	2.097E-07	1.292E-07	5.600E-08	1.879E-08	8.502E-09	5.007E-09	3.343E-09
NW	9.674E-06	2.188E-06	6.691E-07	3.332E-07	2.039E-07	8.737E-08	2.884E-08	1.290E-08	7.551E-09	5.023E-09
NNW	9.629E-06	2.171E-06	6.628E-07	3.298E-07	2.017E-07	8.641E-08	2.851E-08	1.275E-08	7.460E-09	4.961E-09
N	4.858E-06	1.081E-06	3.320E-07	1.660E-07	1.018E-07	4.386E-08	1.459E-08	6.566E-09	3.856E-09	2.570E-09
NNE	1.983E-06	4.385E-07	1.368E-07	6.910E-08	4.270E-08	1.859E-08	6.290E-09	2.866E-09	1.695E-09	1.135E-09
NE	1.498E-06	3.322E-07	1.043E-07	5.287E-08	3.274E-08	1.429E-08	4.846E-09	2.208E-09	1.304E-09	8.722E-10
ENE	1.686E-06	3.715E-07	1.193E-07	6.126E-08	3.828E-08	1.693E-08	5.862E-09	2.709E-09	1.614E-09	1.086E-09
E	1.642E-06	3.609E-07	1.148E-07	5.867E-08	3.655E-08	1.610E-08	5.541E-09	2.552E-09	1.518E-09	1.021E-09
ESE	2.270E-06	4.993E-07	1.609E-07	8.277E-08	5.180E-08	2.296E-08	7.970E-09	3.688E-09	2.198E-09	1.479E-09
SE	5.536E-06	1.202E-06	3.885E-07	1.997E-07	1.246E-07	5.458E-08	1.818E-08	7.906E-09	4.433E-09	2.812E-09
SSE	4.601E-06	1.015E-06	3.230E-07	1.650E-07	1.028E-07	4.526E-08	1.558E-08	7.181E-09	4.277E-09	2.879E-09

Table 2.7-25
Long-Term Average D/Q Values (1/m^2) for Routine Releases at Distances Between 0.25 and 50 Miles

Release Point - Ground Level - No Intermittent Releases
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
********** RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS **********

DIRECTION FROM SITE	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
					DISTANCES IN MILES						
S	2.214E-07	7.485E-08	3.843E-08	1.827E-08	6.563E-09	3.255E-09	1.916E-09	1.255E-09	8.830E-10	6.544E-10	5.043E-10
SSW	1.849E-07	6.253E-08	3.210E-08	1.526E-08	5.482E-09	2.719E-09	1.601E-09	1.048E-09	7.376E-10	5.466E-10	4.212E-10
SW	1.342E-07	4.538E-08	2.330E-08	1.108E-08	3.979E-09	1.973E-09	1.162E-09	7.607E-10	5.353E-10	3.967E-10	3.057E-10
WSW	9.800E-08	3.314E-08	1.702E-08	8.089E-09	2.906E-09	1.441E-09	8.485E-10	5.556E-10	3.909E-10	2.897E-10	2.233E-10
W	1.448E-07	4.895E-08	2.513E-08	1.195E-08	4.292E-09	2.128E-09	1.253E-09	8.206E-10	5.774E-10	4.279E-10	3.298E-10
WNW	1.646E-07	5.565E-08	2.857E-08	1.358E-08	4.879E-09	2.420E-09	1.425E-09	9.329E-10	6.565E-10	4.865E-10	3.749E-10
NW	4.010E-07	1.356E-07	6.962E-08	3.310E-08	1.189E-08	5.896E-09	3.472E-09	2.273E-09	1.600E-09	1.185E-09	9.135E-10
NNW	4.306E-07	1.456E-07	7.476E-08	3.554E-08	1.277E-08	6.331E-09	3.728E-09	2.441E-09	1.718E-09	1.273E-09	9.809E-10
N	1.801E-07	6.092E-08	3.128E-08	1.487E-08	5.341E-09	2.649E-09	1.560E-09	1.021E-09	7.186E-10	5.326E-10	4.104E-10
NNE	5.204E-08	1.760E-08	9.035E-09	4.295E-09	1.543E-09	7.652E-10	4.505E-10	2.950E-10	2.076E-10	1.538E-10	1.186E-10
NE	2.906E-08	9.826E-09	5.045E-09	2.398E-09	8.615E-10	4.272E-10	2.516E-10	1.647E-10	1.159E-10	8.590E-11	6.620E-11
ENE	2.641E-08	8.932E-09	4.586E-09	2.180E-09	7.832E-10	3.884E-10	2.287E-10	1.498E-10	1.054E-10	7.809E-11	6.018E-11
E	2.879E-08	9.736E-09	4.999E-09	2.377E-09	8.537E-10	4.234E-10	2.493E-10	1.632E-10	1.149E-10	8.512E-11	6.559E-11
ESE	3.804E-08	1.286E-08	6.604E-09	3.140E-09	1.128E-09	5.593E-10	3.293E-10	2.156E-10	1.517E-10	1.124E-10	8.666E-11
SE	7.026E-08	2.376E-08	1.220E-08	5.800E-09	2.083E-09	1.033E-09	6.083E-10	3.983E-10	2.803E-10	2.077E-10	1.601E-10
SSE	1.109E-07	3.752E-08	1.926E-08	9.158E-09	3.289E-09	1.631E-09	9.605E-10	6.290E-10	4.426E-10	3.280E-10	2.527E-10

0DIRECTION FROM SITE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
					DISTANCES IN MILES						
S	4.006E-10	1.780E-10	1.078E-10	5.449E-11	3.298E-11	2.211E-11	1.585E-11	1.190E-11	9.251E-12	7.390E-12	6.032E-12
SSW	3.347E-10	1.487E-10	9.005E-11	4.552E-11	2.755E-11	1.847E-11	1.324E-11	9.939E-12	7.728E-12	6.173E-12	5.038E-12
SW	2.429E-10	1.079E-10	6.535E-11	3.303E-11	1.999E-11	1.341E-11	9.605E-12	7.213E-12	5.608E-12	4.480E-12	3.656E-12
WSW	1.774E-10	7.879E-11	4.773E-11	2.412E-11	1.460E-11	9.790E-12	7.015E-12	5.267E-12	4.096E-12	3.272E-12	2.670E-12
W	2.620E-10	1.164E-10	7.050E-11	3.563E-11	2.157E-11	1.446E-11	1.036E-11	7.781E-12	6.050E-12	4.832E-12	3.944E-12
WNW	2.978E-10	1.323E-10	8.015E-11	4.051E-11	2.452E-11	1.644E-11	1.178E-11	8.845E-12	6.878E-12	5.494E-12	4.484E-12
NW	7.257E-10	3.224E-10	1.953E-10	9.871E-11	5.974E-11	4.006E-11	2.870E-11	2.155E-11	1.676E-11	1.339E-11	1.093E-11
NNW	7.793E-10	3.462E-10	2.097E-10	1.060E-10	6.415E-11	4.301E-11	3.082E-11	2.314E-11	1.799E-11	1.437E-11	1.173E-11
N	3.260E-10	1.448E-10	8.774E-11	4.435E-11	2.684E-11	1.800E-11	1.290E-11	9.683E-12	7.529E-12	6.014E-12	4.909E-12
NNE	9.418E-11	4.184E-11	2.534E-11	1.281E-11	7.753E-12	5.198E-12	3.725E-12	2.797E-12	2.175E-12	1.737E-12	1.418E-12
NE	5.259E-11	2.336E-11	1.415E-11	7.153E-12	4.329E-12	2.903E-12	2.080E-12	1.562E-12	1.214E-12	9.700E-13	7.917E-13
ENE	4.781E-11	2.124E-11	1.286E-11	6.503E-12	3.936E-12	2.639E-12	1.891E-12	1.420E-12	1.104E-12	8.818E-13	7.198E-13
E	5.211E-11	2.315E-11	1.402E-11	7.088E-12	4.290E-12	2.876E-12	2.061E-12	1.548E-12	1.203E-12	9.612E-13	7.846E-13
ESE	6.884E-11	3.058E-11	1.853E-11	9.364E-12	5.667E-12	3.800E-12	2.723E-12	2.045E-12	1.590E-12	1.270E-12	1.036E-12
SE	1.272E-10	5.649E-11	3.422E-11	1.730E-11	1.047E-11	7.019E-12	5.030E-12	3.777E-12	2.936E-12	2.346E-12	1.915E-12
SSE	2.008E-10	8.920E-11	5.403E-11	2.731E-11	1.653E-11	1.108E-11	7.941E-12	5.963E-12	4.637E-12	3.704E-12	3.023E-12

Table 2.7-26
Long-Term Average D/Q Values ($1/m^2$) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 Miles

Release Point - Ground Level - No Intermittent Releases
0********** RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS **********

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES .5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.757E-08	7.695E-09	2.009E-09	9.022E-10	5.104E-10	1.963E-10	5.678E-11	2.250E-11	1.202E-11	7.438E-12
SSW	3.138E-08	6.428E-09	1.678E-09	7.536E-10	4.263E-10	1.639E-10	4.743E-11	1.880E-11	1.004E-11	6.213E-12
SW	2.277E-08	4.665E-09	1.218E-09	5.469E-10	3.094E-10	1.190E-10	3.442E-11	1.364E-11	7.285E-12	4.509E-12
WSW	1.663E-08	3.407E-09	8.893E-10	3.994E-10	2.260E-10	8.689E-11	2.514E-11	9.963E-12	5.320E-12	3.293E-12
W	2.457E-08	5.032E-09	1.314E-09	5.900E-10	3.338E-10	1.283E-10	3.713E-11	1.472E-11	7.859E-12	4.864E-12
WNW	2.793E-08	5.720E-09	1.493E-09	6.707E-10	3.794E-10	1.459E-10	4.221E-11	1.673E-11	8.934E-12	5.530E-12
NW	6.805E-08	1.394E-08	3.639E-09	1.634E-09	9.245E-10	3.555E-10	1.029E-10	4.077E-11	2.177E-11	1.347E-11
NNW	7.307E-08	1.497E-08	3.907E-09	1.755E-09	9.927E-10	3.818E-10	1.104E-10	4.377E-11	2.338E-11	1.447E-11
N	3.057E-08	6.262E-09	1.635E-09	7.342E-10	4.154E-10	1.597E-10	4.621E-11	1.831E-11	9.780E-12	6.054E-12
NNE	8.831E-09	1.809E-09	4.722E-10	2.121E-10	1.200E-10	4.614E-11	1.335E-11	5.290E-12	2.825E-12	1.749E-12
NE	4.931E-09	1.010E-09	2.637E-10	1.184E-10	6.699E-11	2.576E-11	7.453E-12	2.954E-12	1.577E-12	9.764E-13
ENE	4.483E-09	9.182E-10	2.397E-10	1.077E-10	6.090E-11	2.342E-11	6.776E-12	2.685E-12	1.434E-12	8.876E-13
E	4.886E-09	1.001E-09	2.613E-10	1.173E-10	6.638E-11	2.553E-11	7.385E-12	2.927E-12	1.563E-12	9.675E-13
ESE	6.455E-09	1.322E-09	3.452E-10	1.550E-10	8.770E-11	3.373E-11	9.757E-12	3.867E-12	2.065E-12	1.278E-12
SE	1.192E-08	2.442E-09	6.376E-10	2.864E-10	1.620E-10	6.230E-11	1.802E-11	7.143E-12	3.815E-12	2.361E-12
SSE	1.883E-08	3.857E-09	1.007E-09	4.522E-10	2.558E-10	9.837E-11	2.846E-11	1.128E-11	6.023E-12	3.728E-12

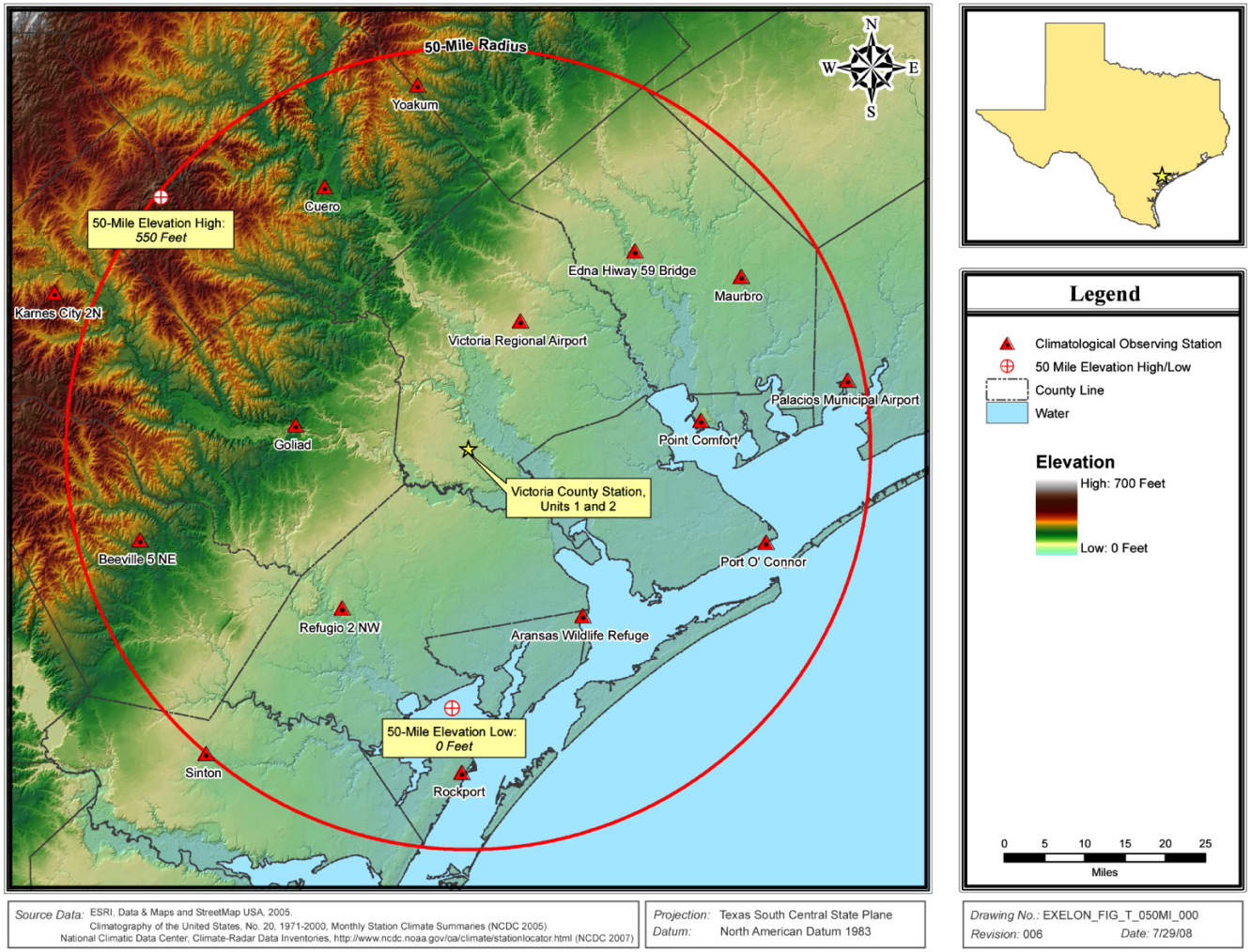

Figure 2.7-1 Climatological Observing Stations Near the Victoria County Station

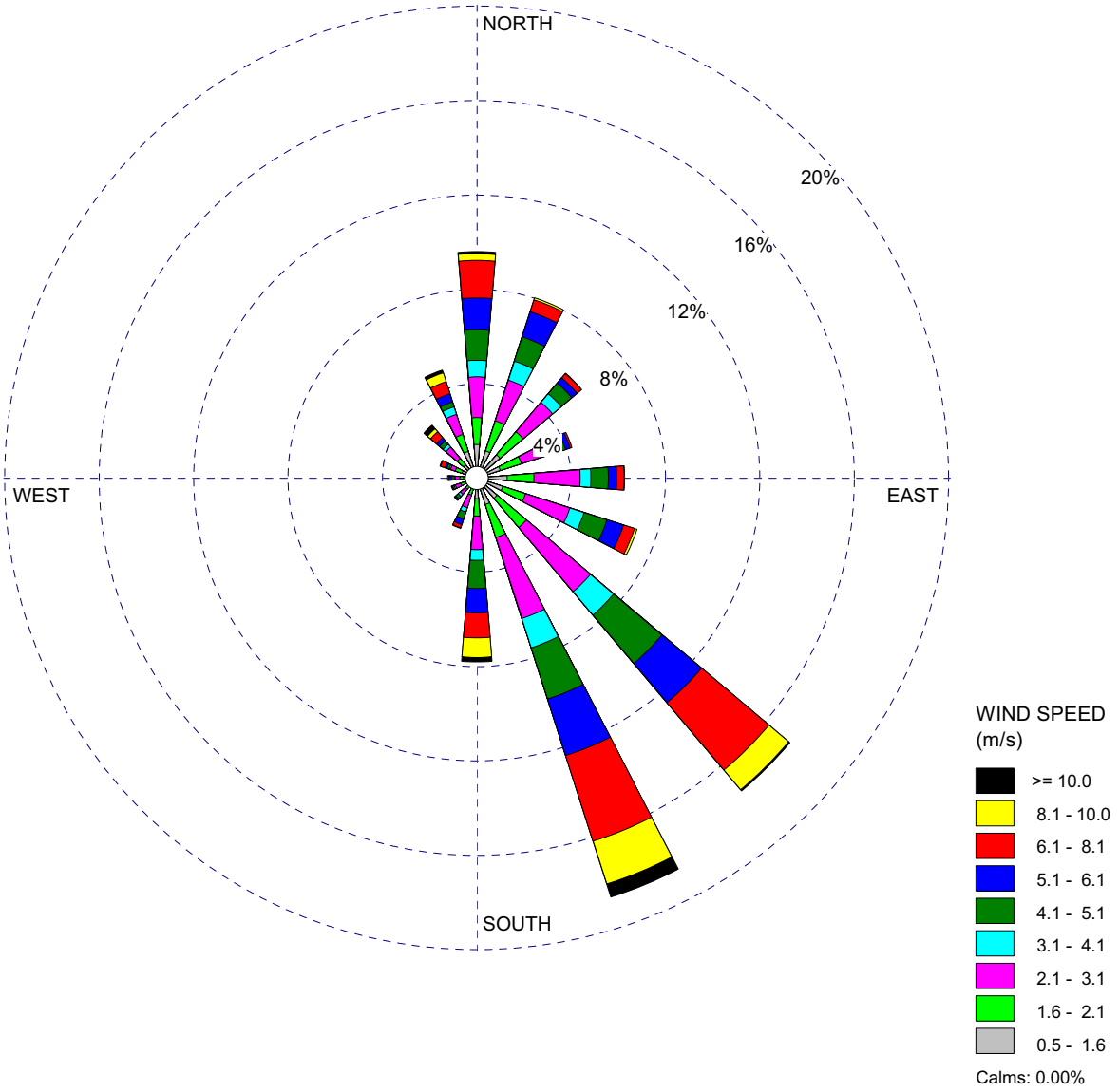

Figure 2.7-2 10-Meter Level Wind Rose—Annual VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

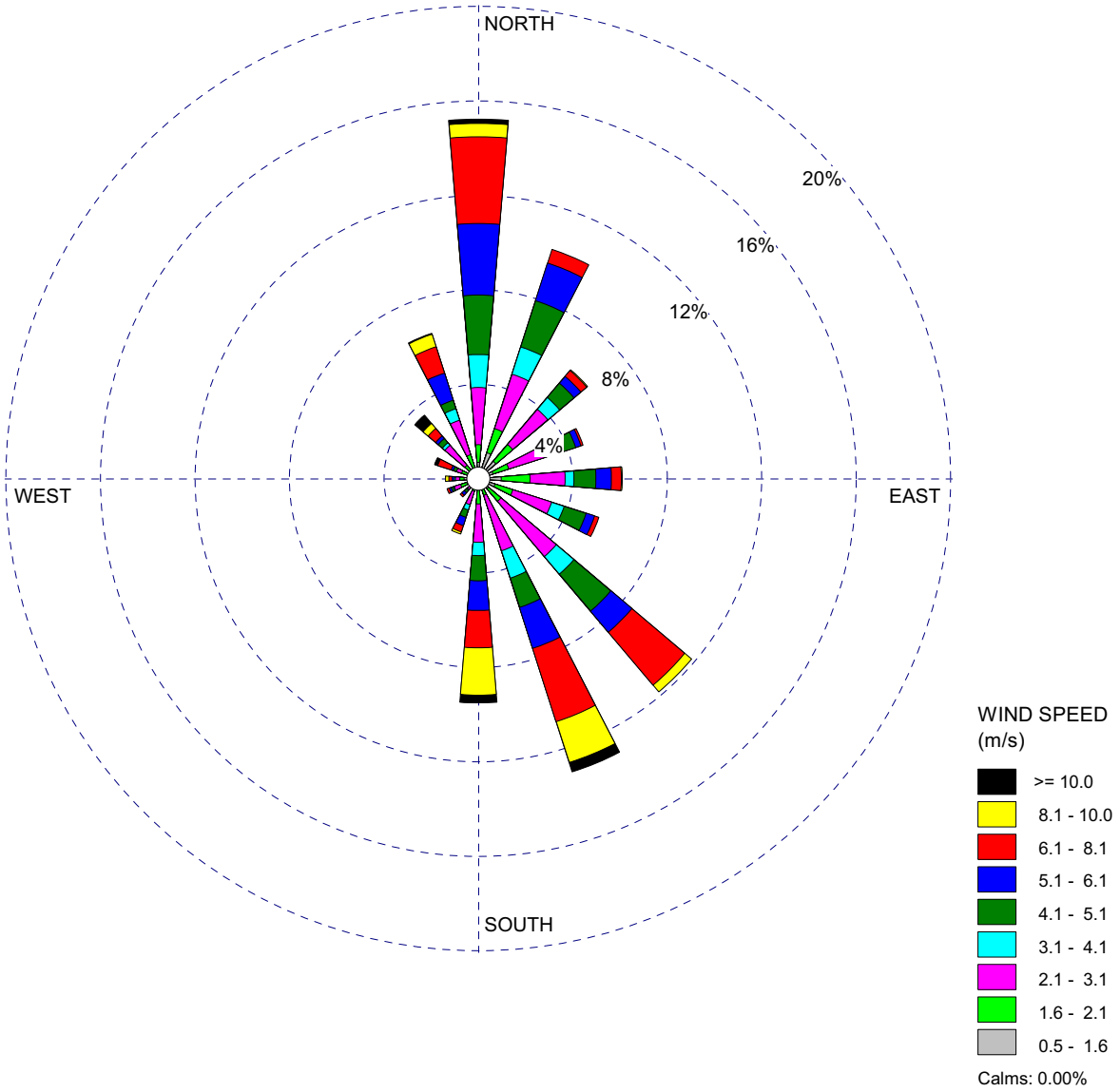

Figure 2.7-3 10-Meter Level Wind Rose—Winter VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

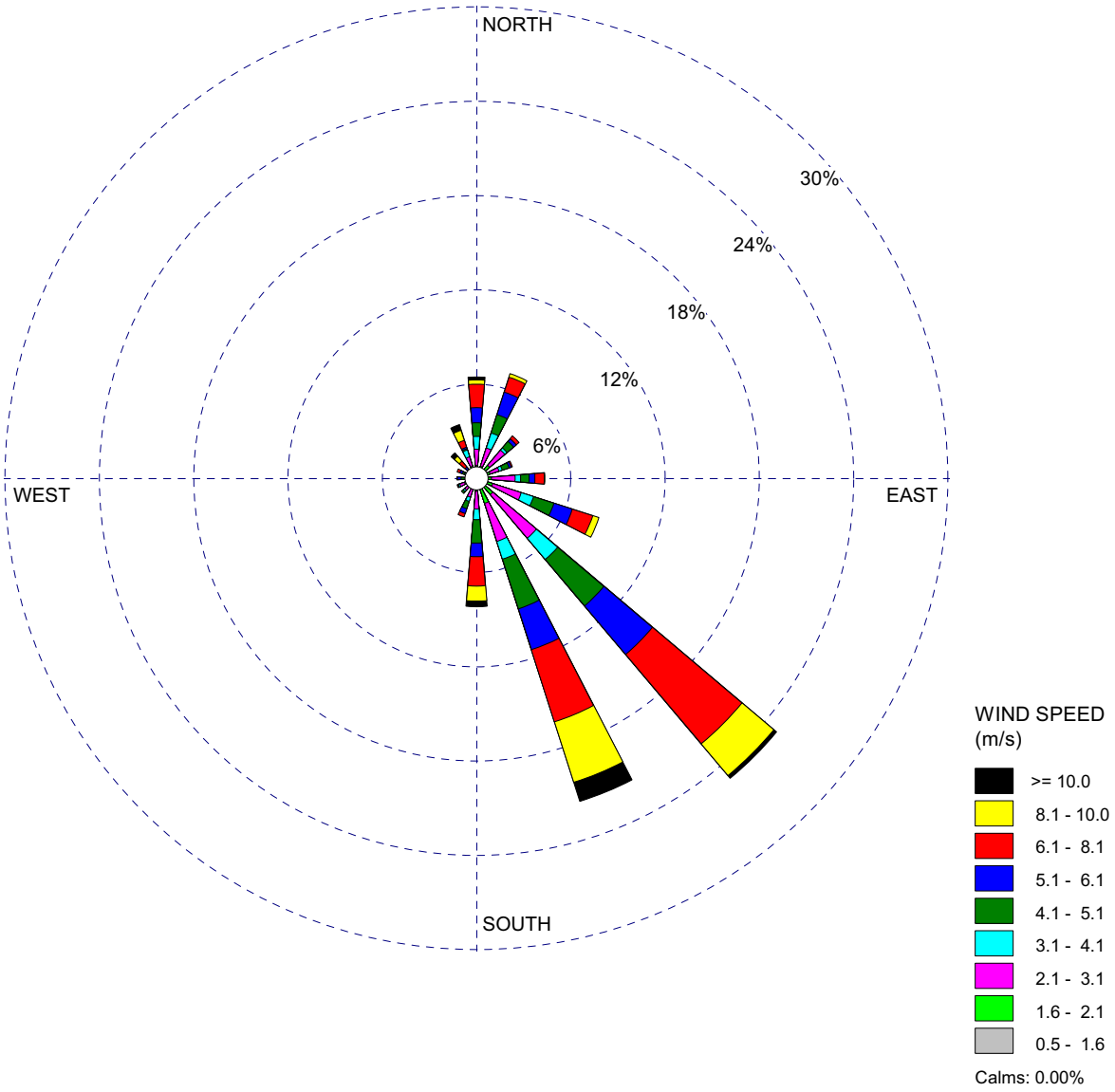

Figure 2.7-4 10-Meter Level Wind Rose—Spring VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

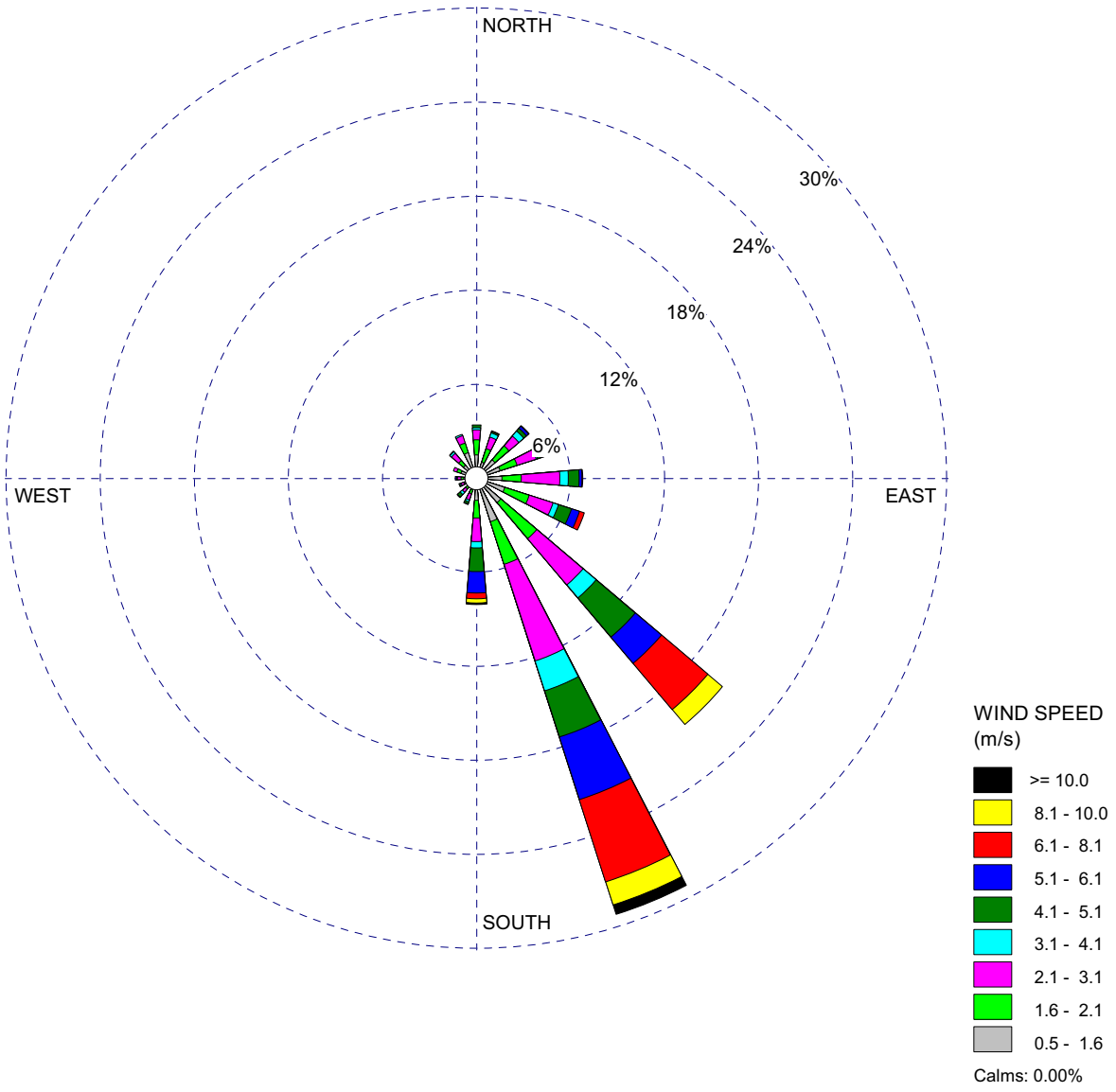

Figure 2.7-5 10-Meter Level Wind Rose—Summer VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

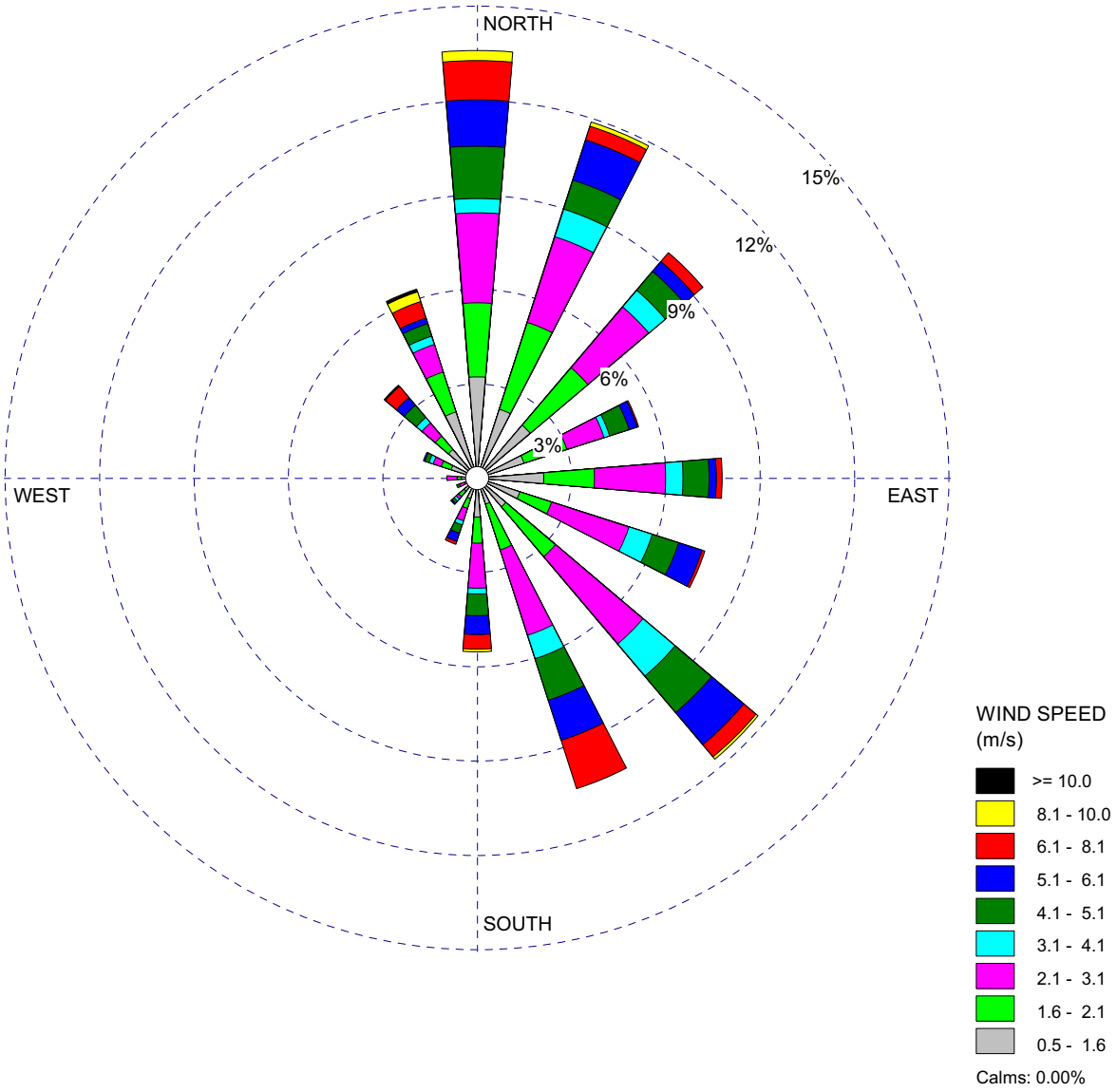

Figure 2.7-6 10-Meter Level Wind Rose—Autumn VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

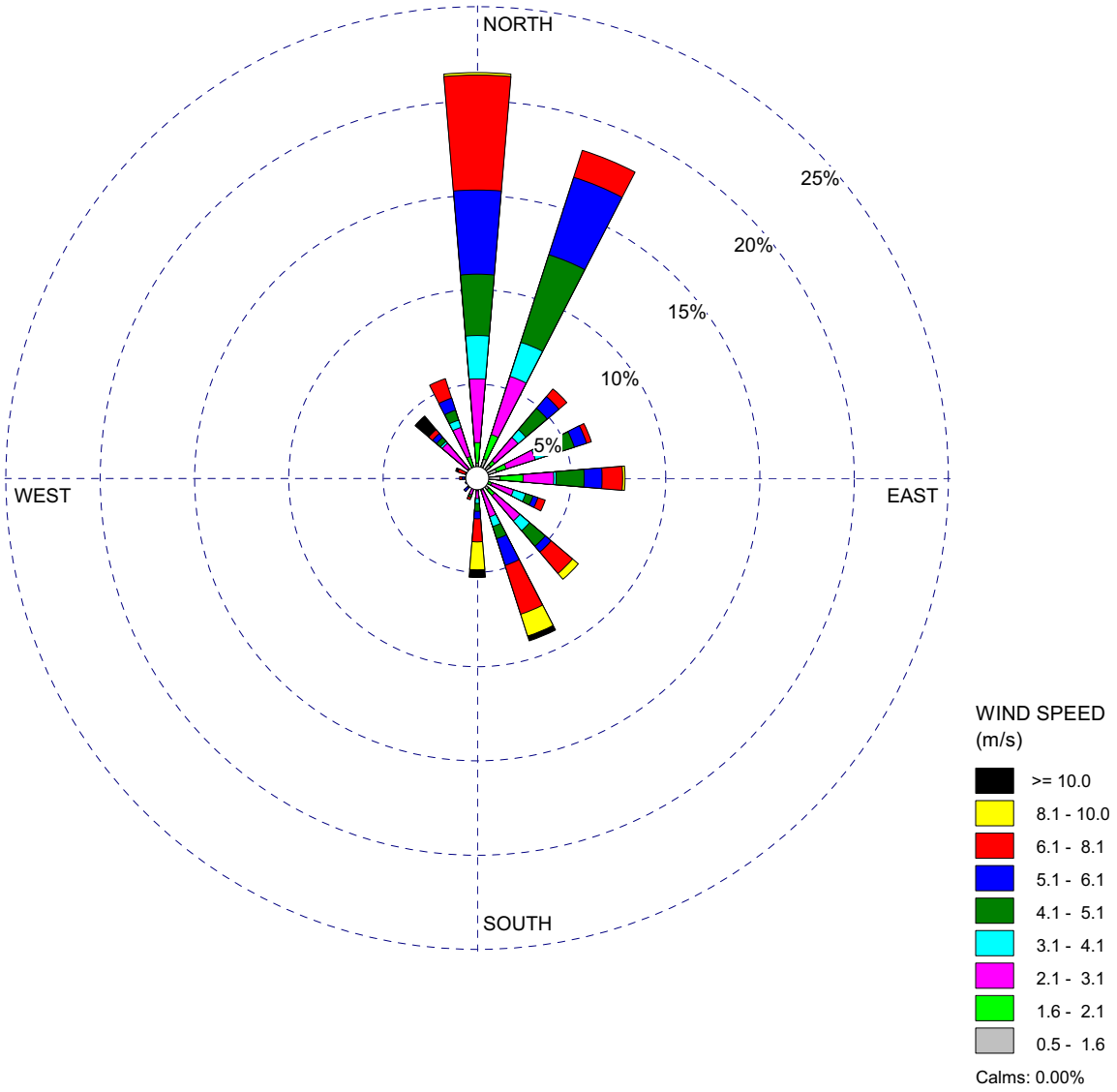

Figure 2.7-7 (Sheet 1 of 12) 10-Meter Level Wind Rose—January VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

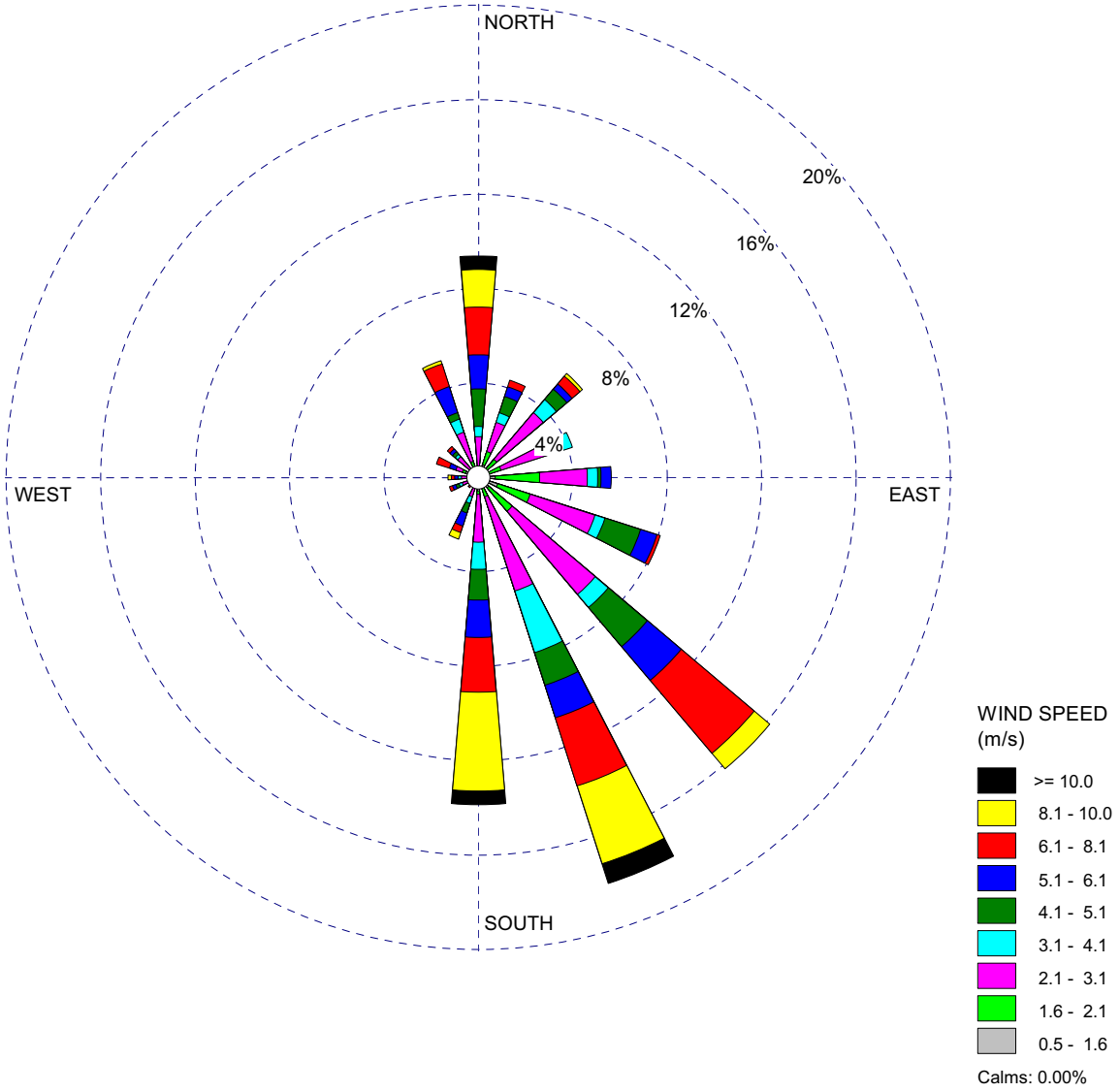

Figure 2.7-7 (Sheet 2 of 12) 10-Meter Level Wind Rose—February VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

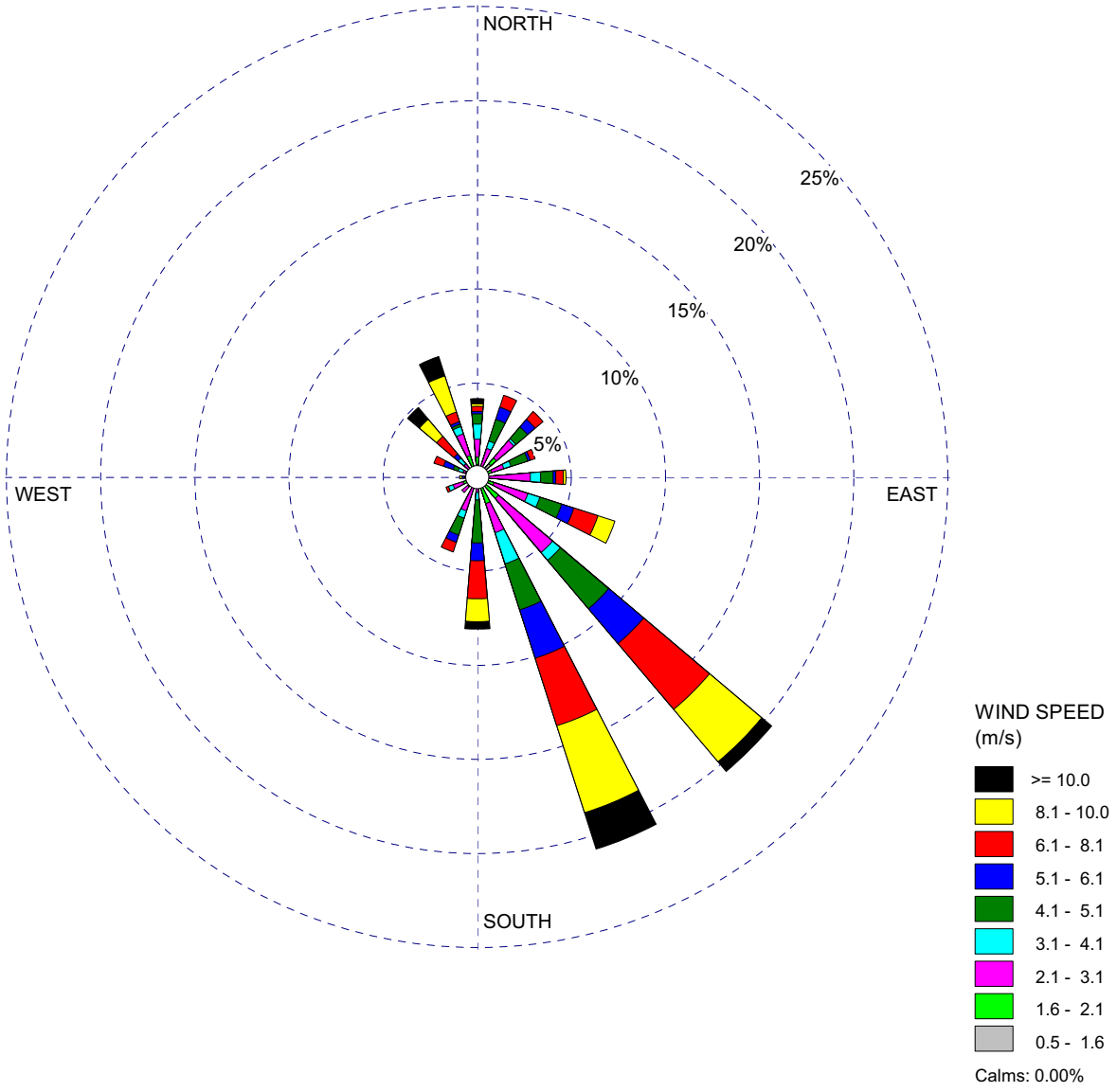

Figure 2.7-7 (Sheet 3 of 12) 10-Meter Level Wind Rose—March VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

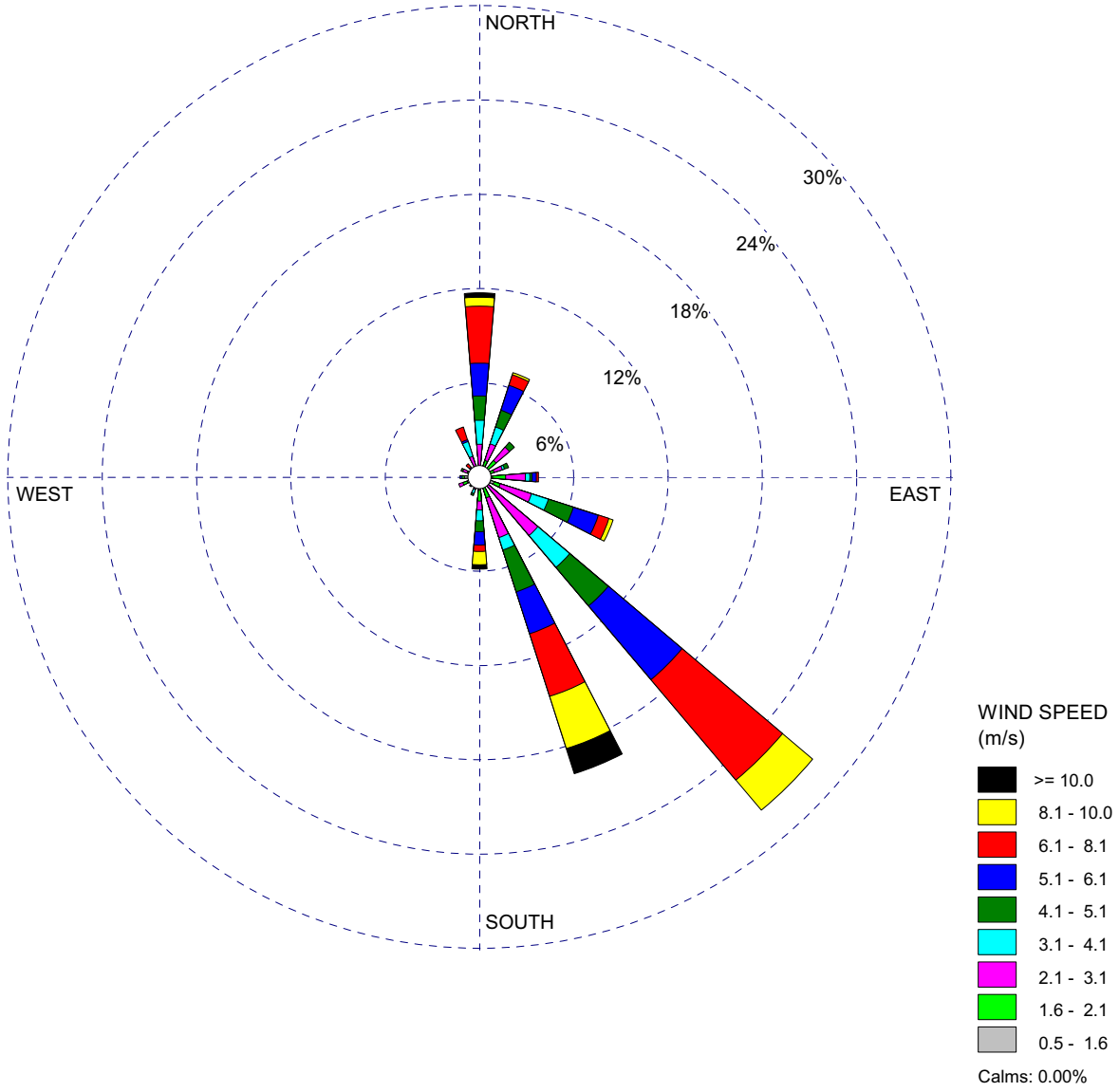

Figure 2.7-7 (Sheet 4 of 12) 10-Meter Level Wind Rose—April VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

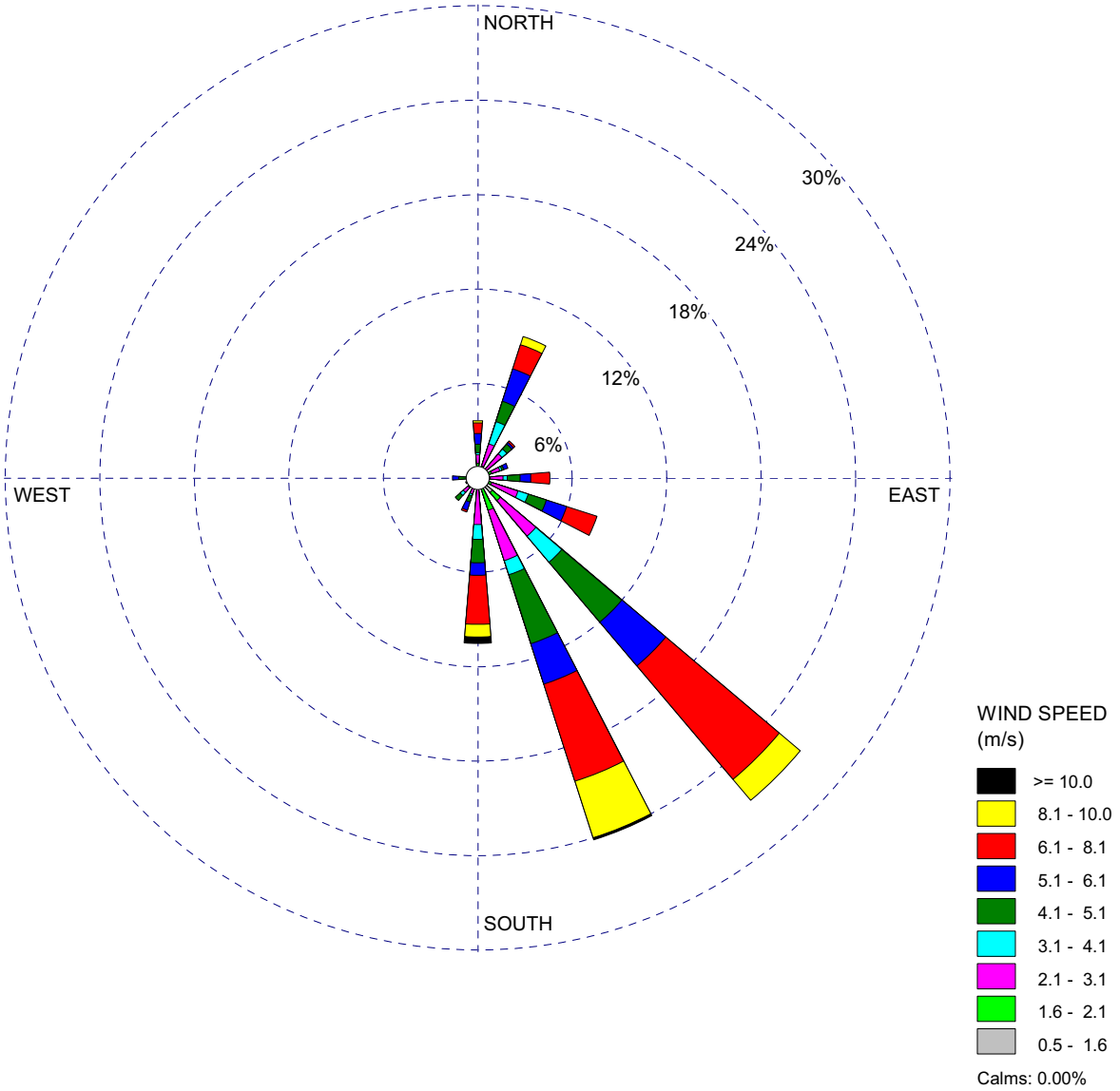

Figure 2.7-7 (Sheet 5 of 12) 10-Meter Level Wind Rose—May VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

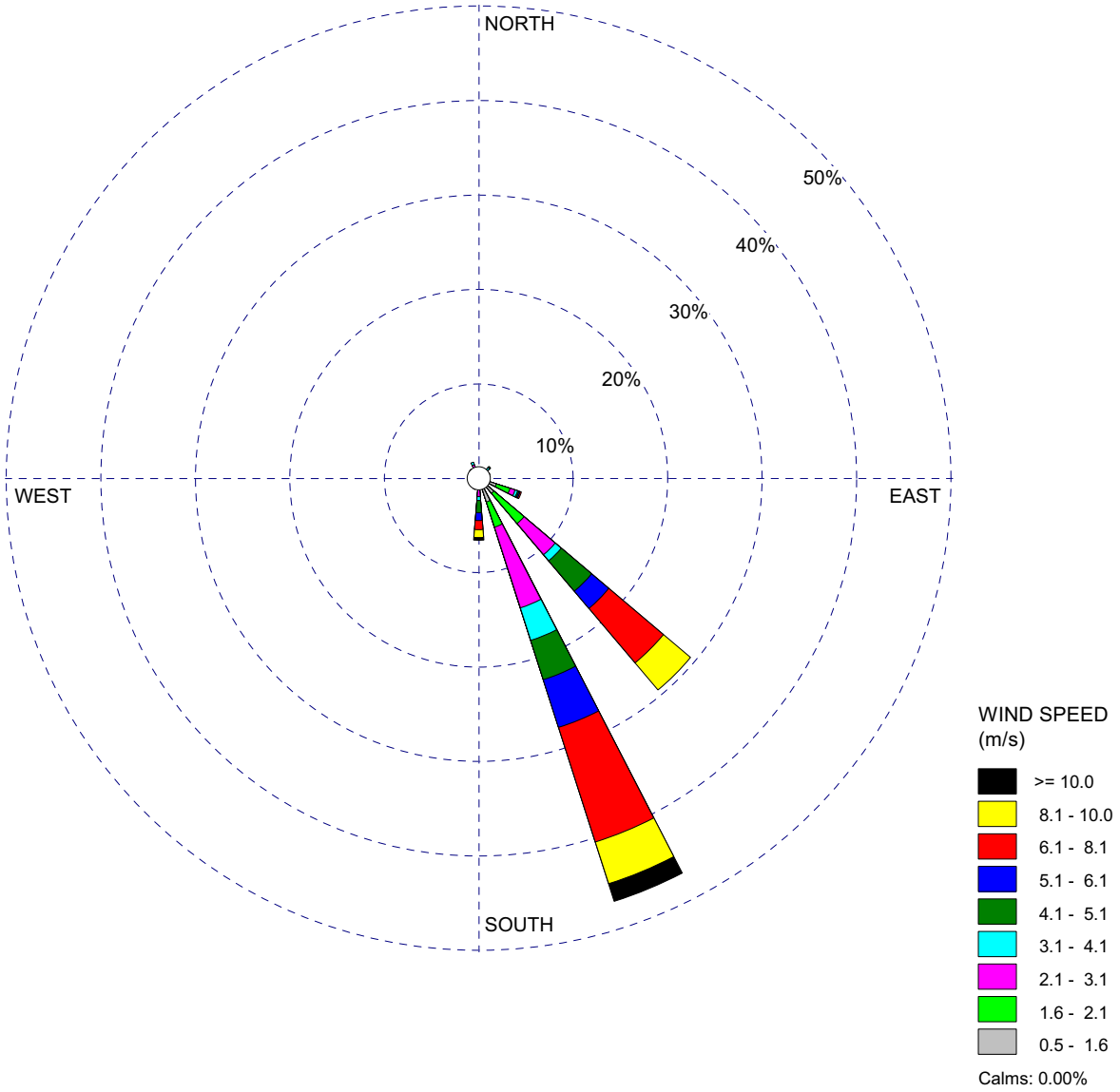

Figure 2.7-7 (Sheet 6 of 12) 10-Meter Level Wind Rose—June VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

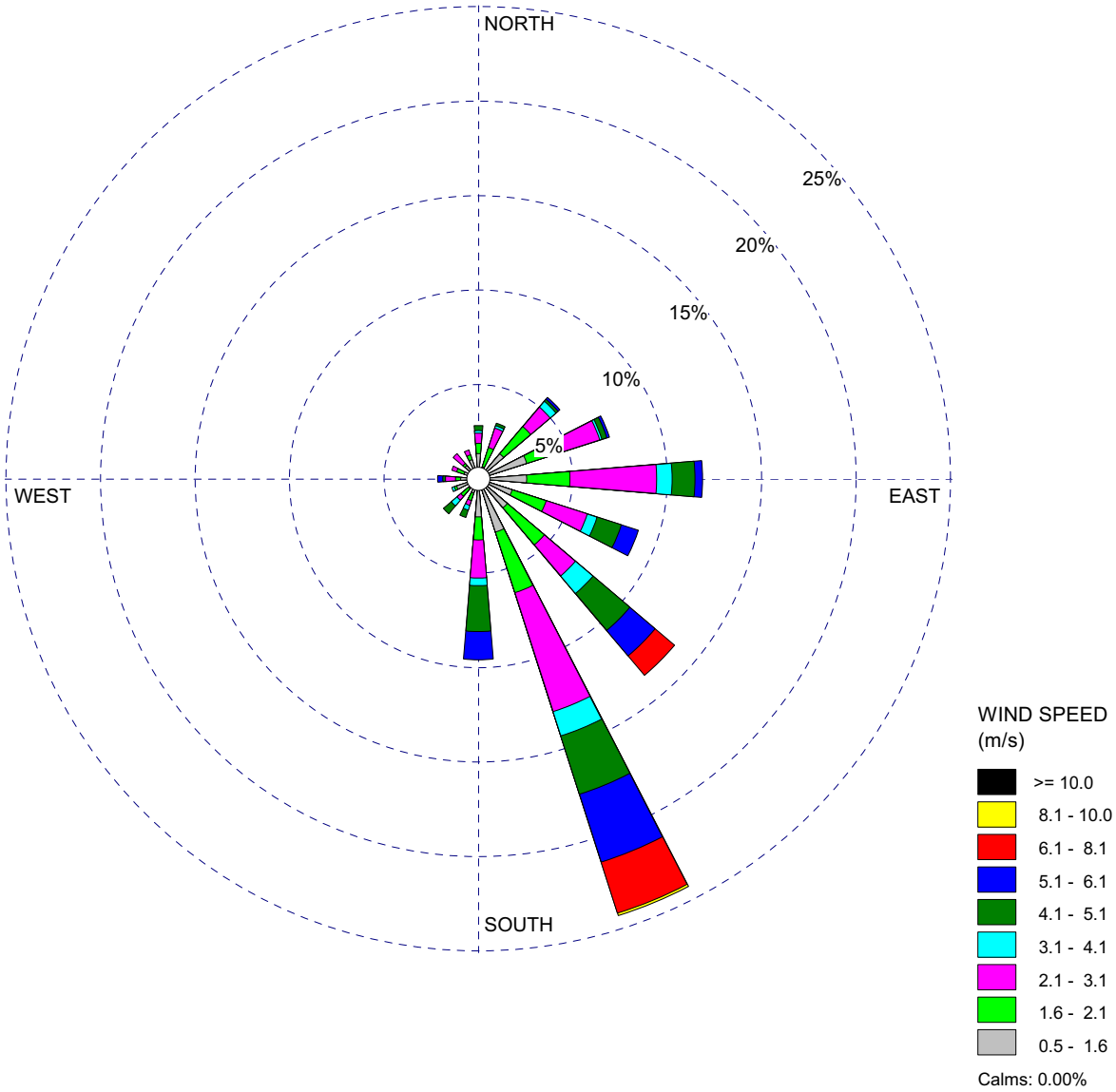

Figure 2.7-7 (Sheet 7 of 12) 10-Meter Level Wind Rose—July VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

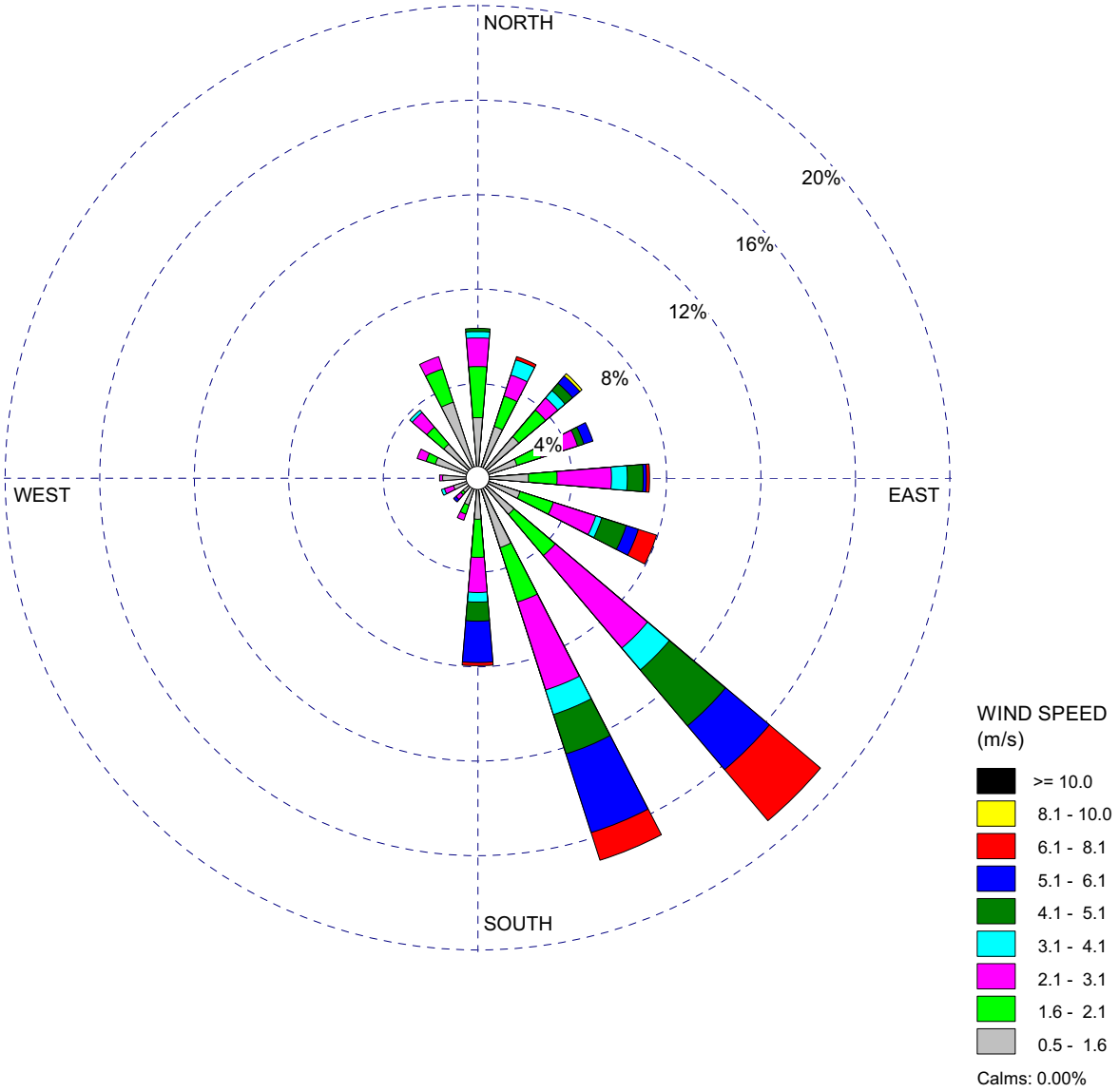

Figure 2.7-7 (Sheet 8 of 12) 10-Meter Level Wind Rose—August VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

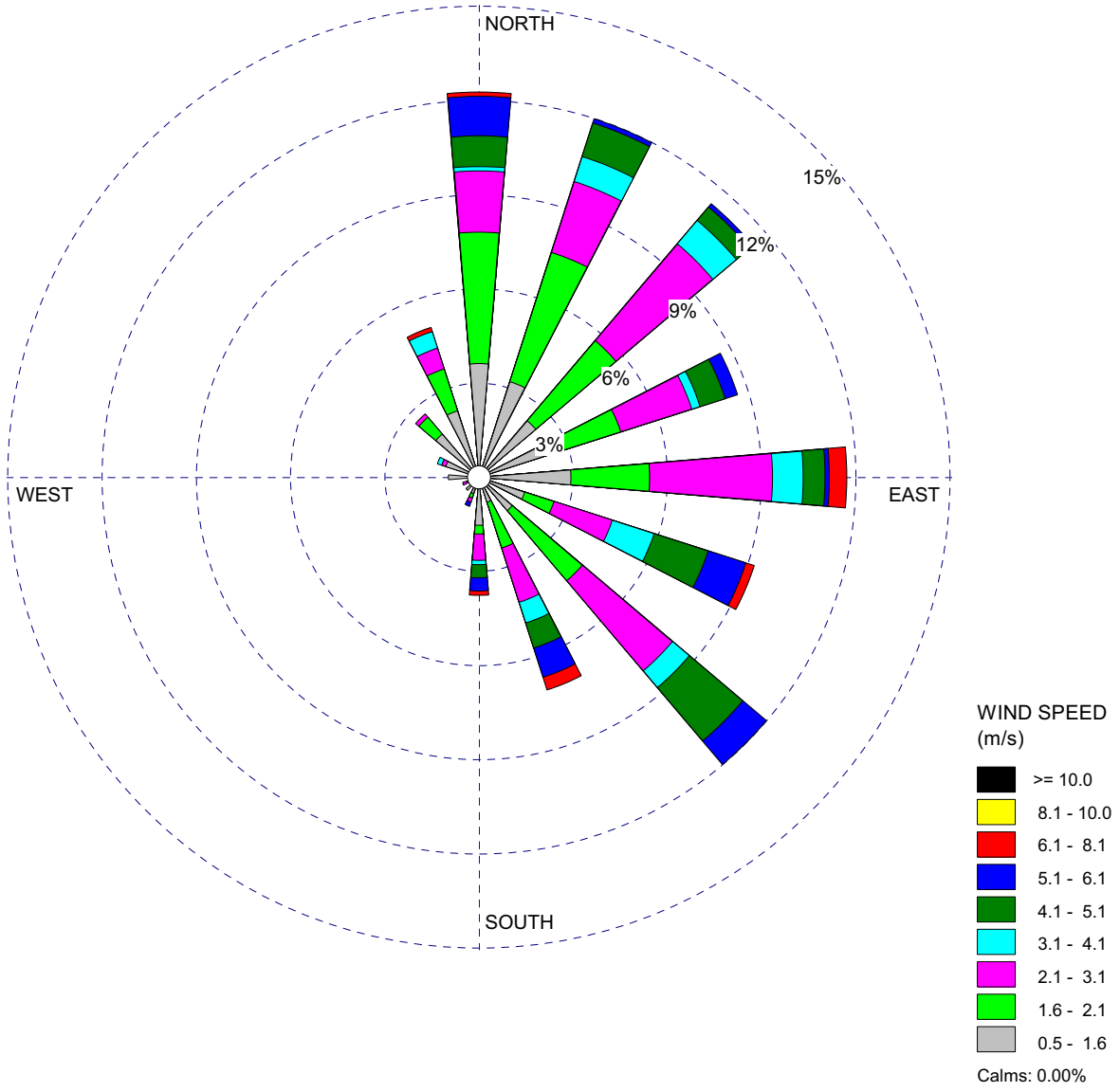

Figure 2.7-7 (Sheet 9 of 12) 10-Meter Level Wind Rose—September VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

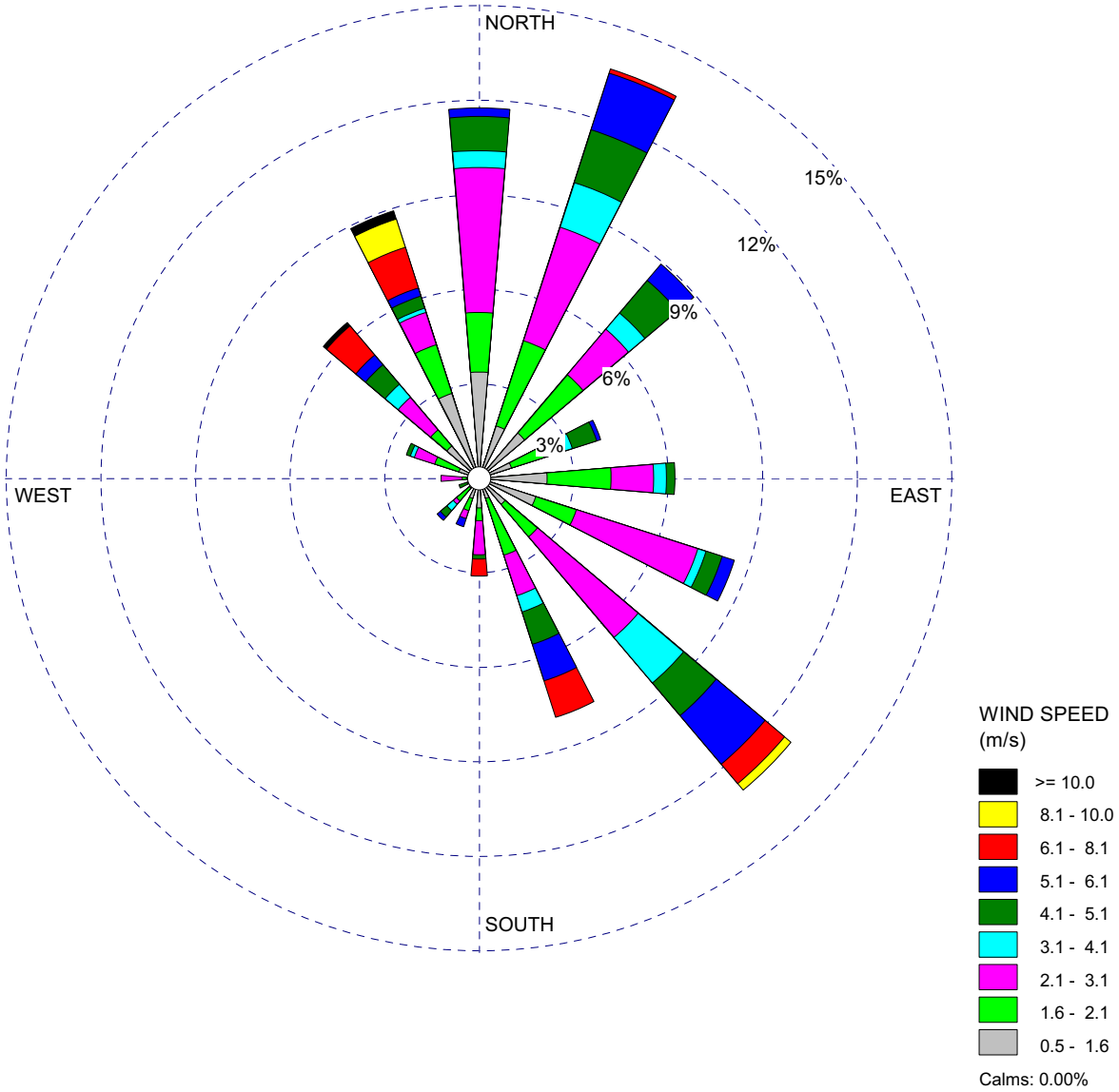

Figure 2.7-7 (Sheet 10 of 12) 10-Meter Level Wind Rose—October VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

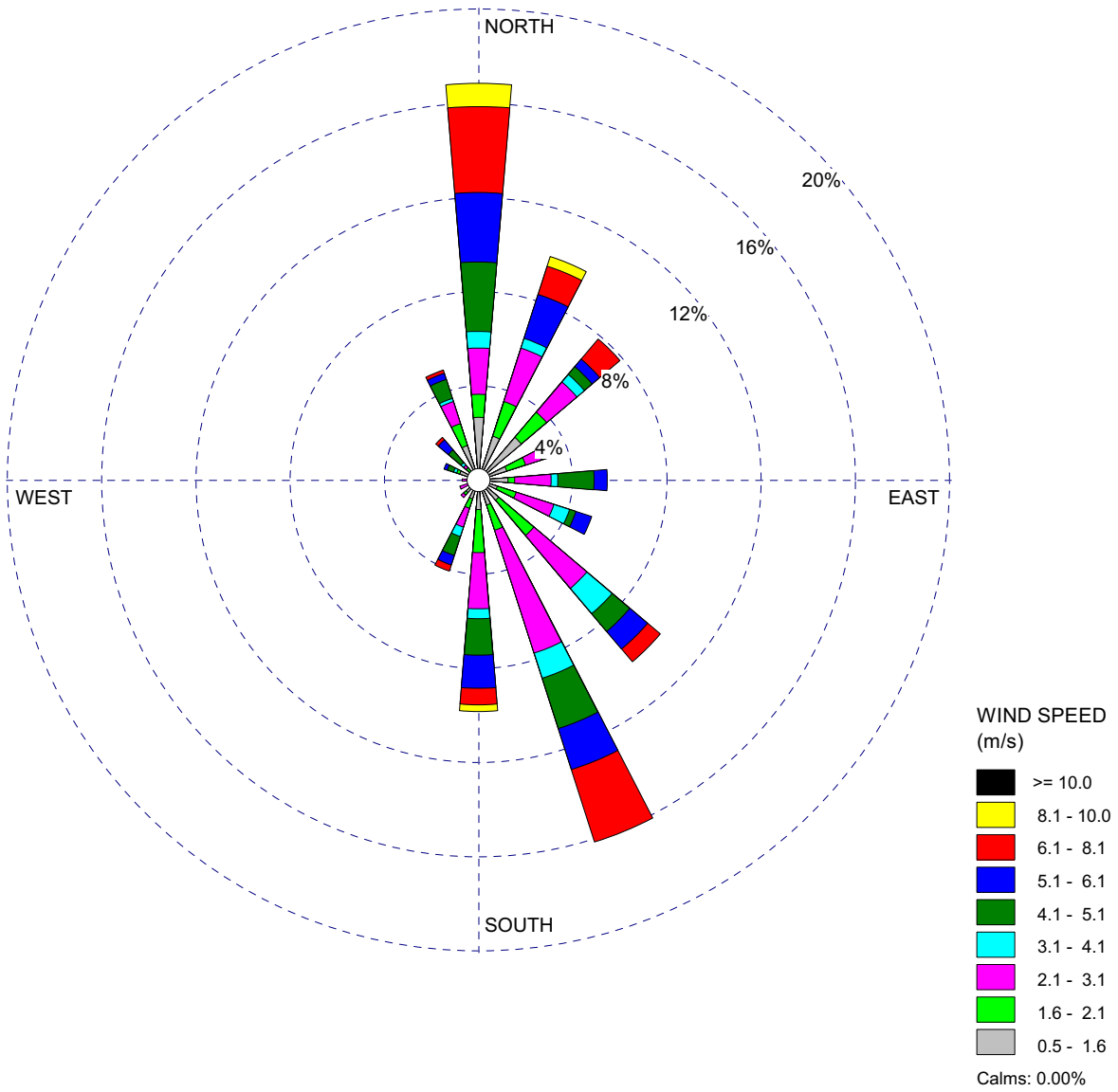

Figure 2.7-7 (Sheet 11 of 12) 10-Meter Level Wind Rose—November VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

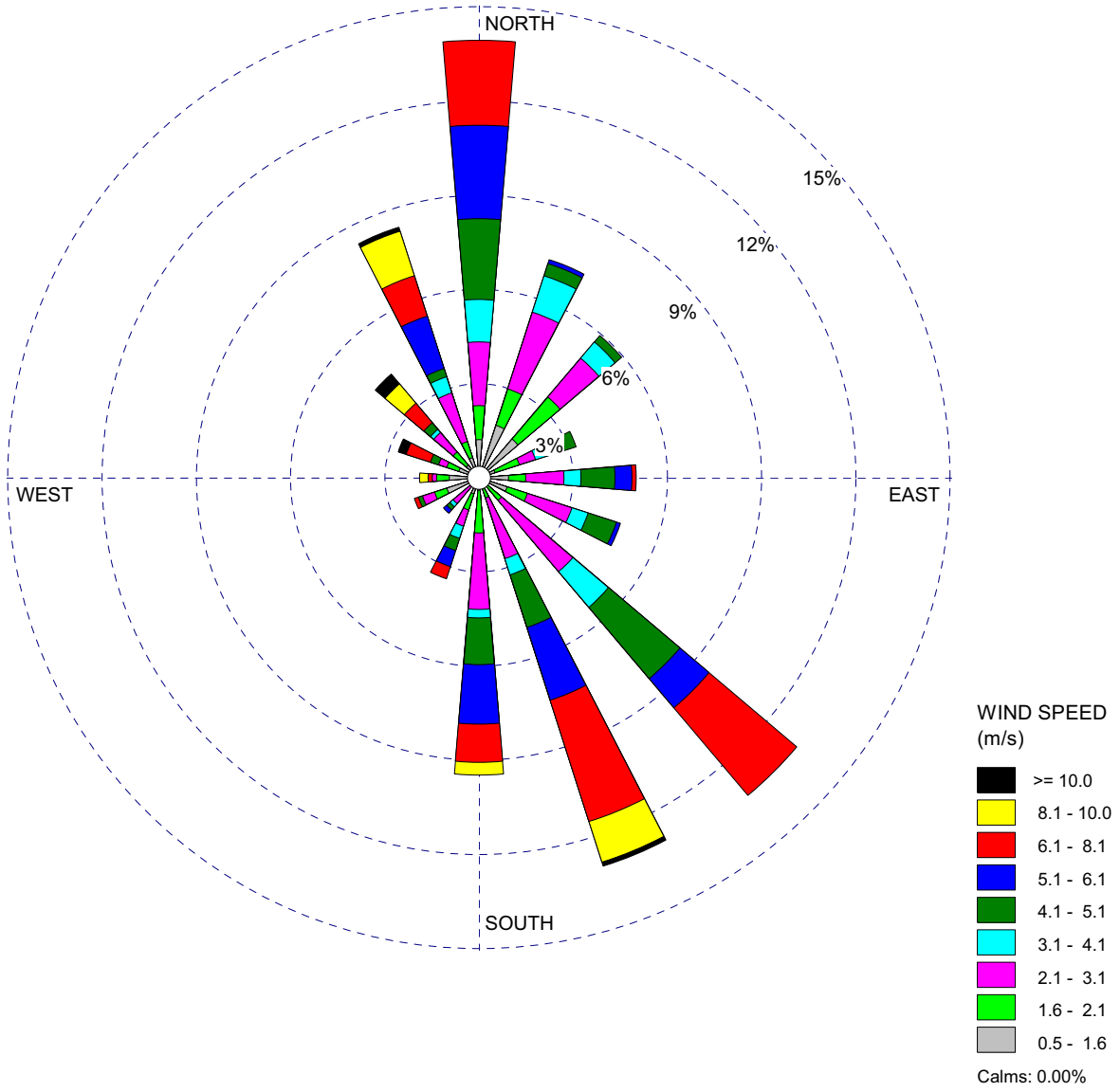

Figure 2.7-7 (Sheet 12 of 12) 10-Meter Level Wind Rose—December VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

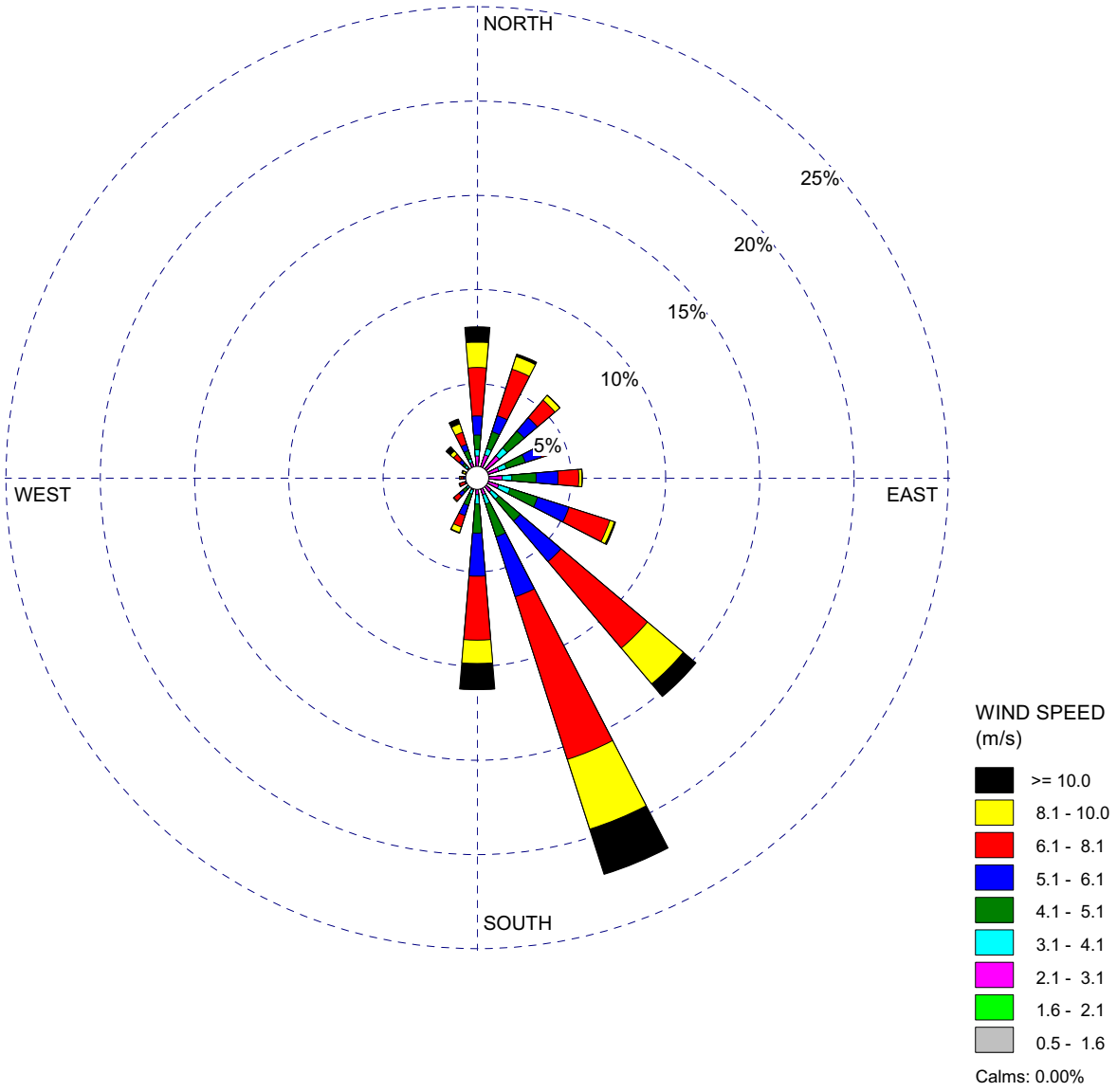

Figure 2.7-8 60-Meter Level Wind Rose—Annual
VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

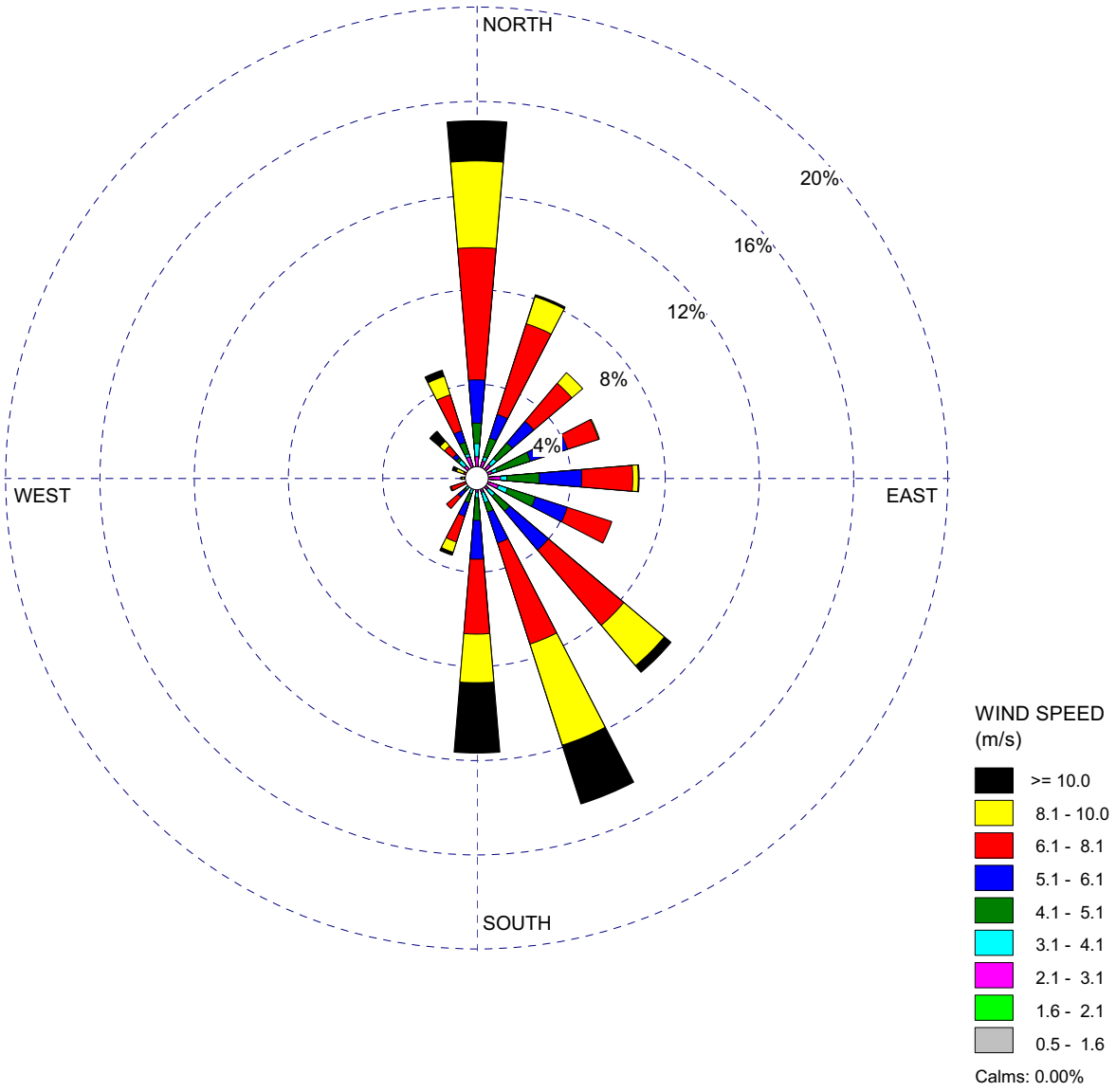

Figure 2.7-9 60-Meter Level Wind Rose—Winter
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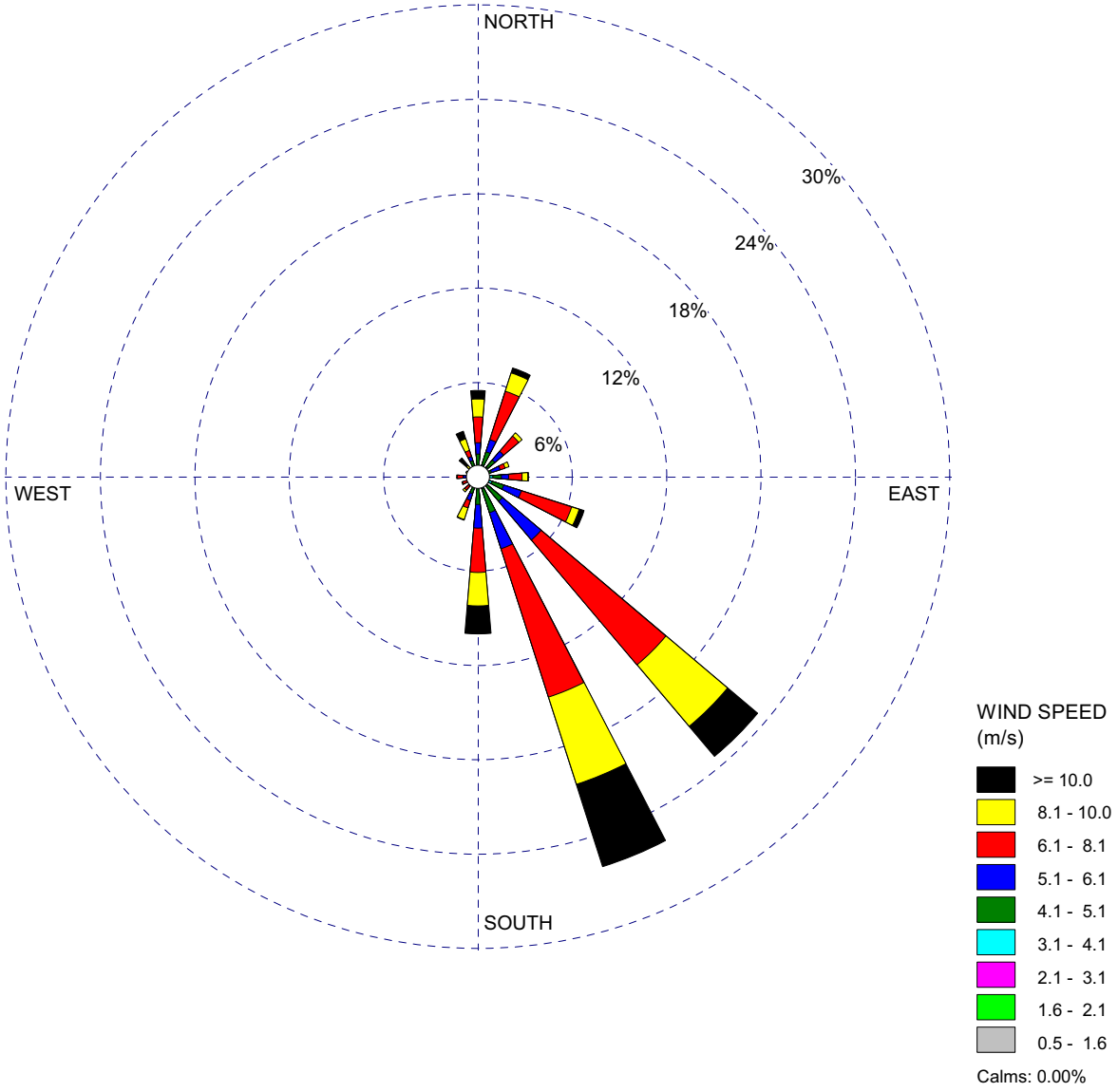

Figure 2.7-10 60-Meter Level Wind Rose—Spring
VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

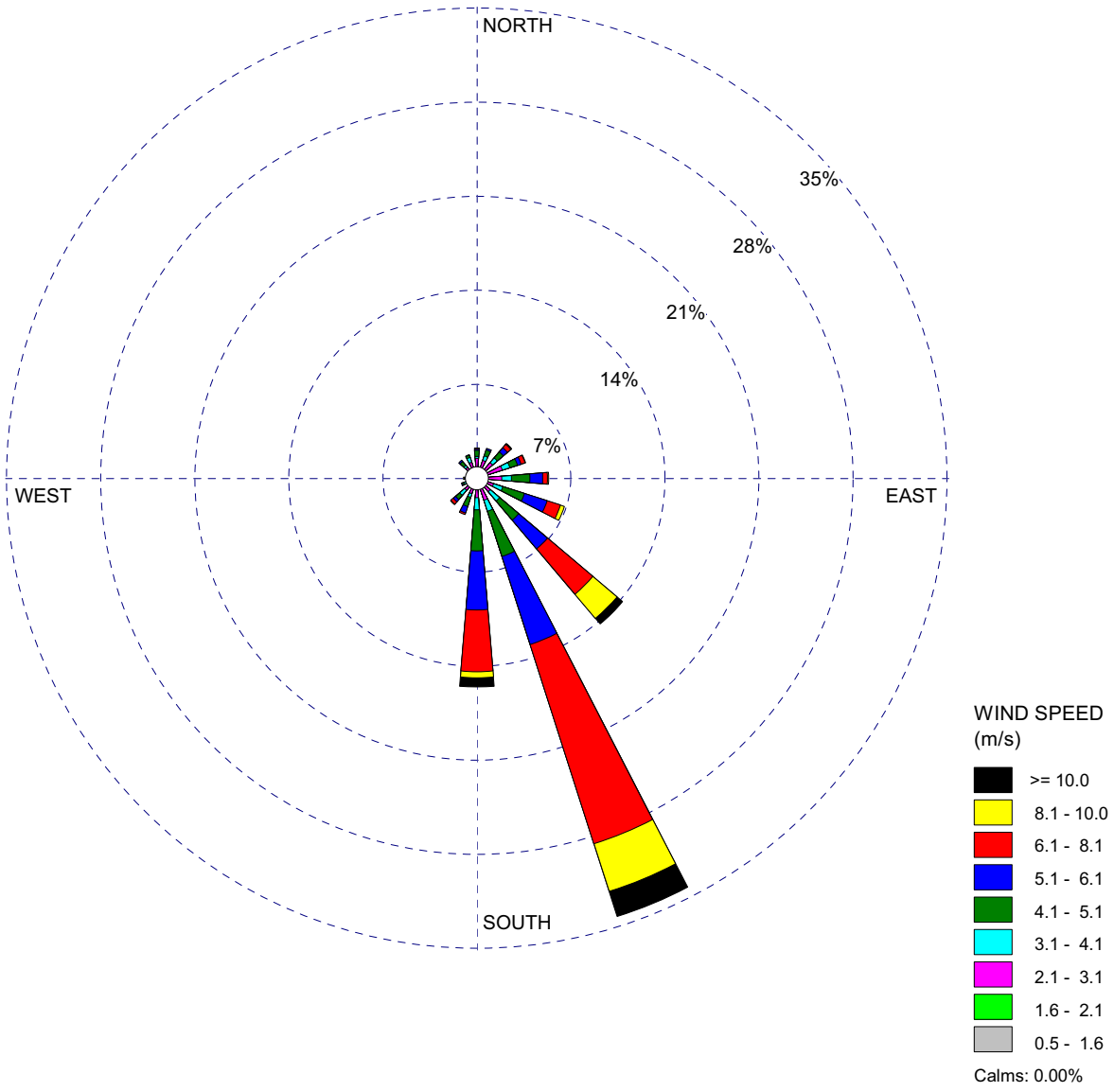

Figure 2.7-11 60-Meter Level Wind Rose—Summer
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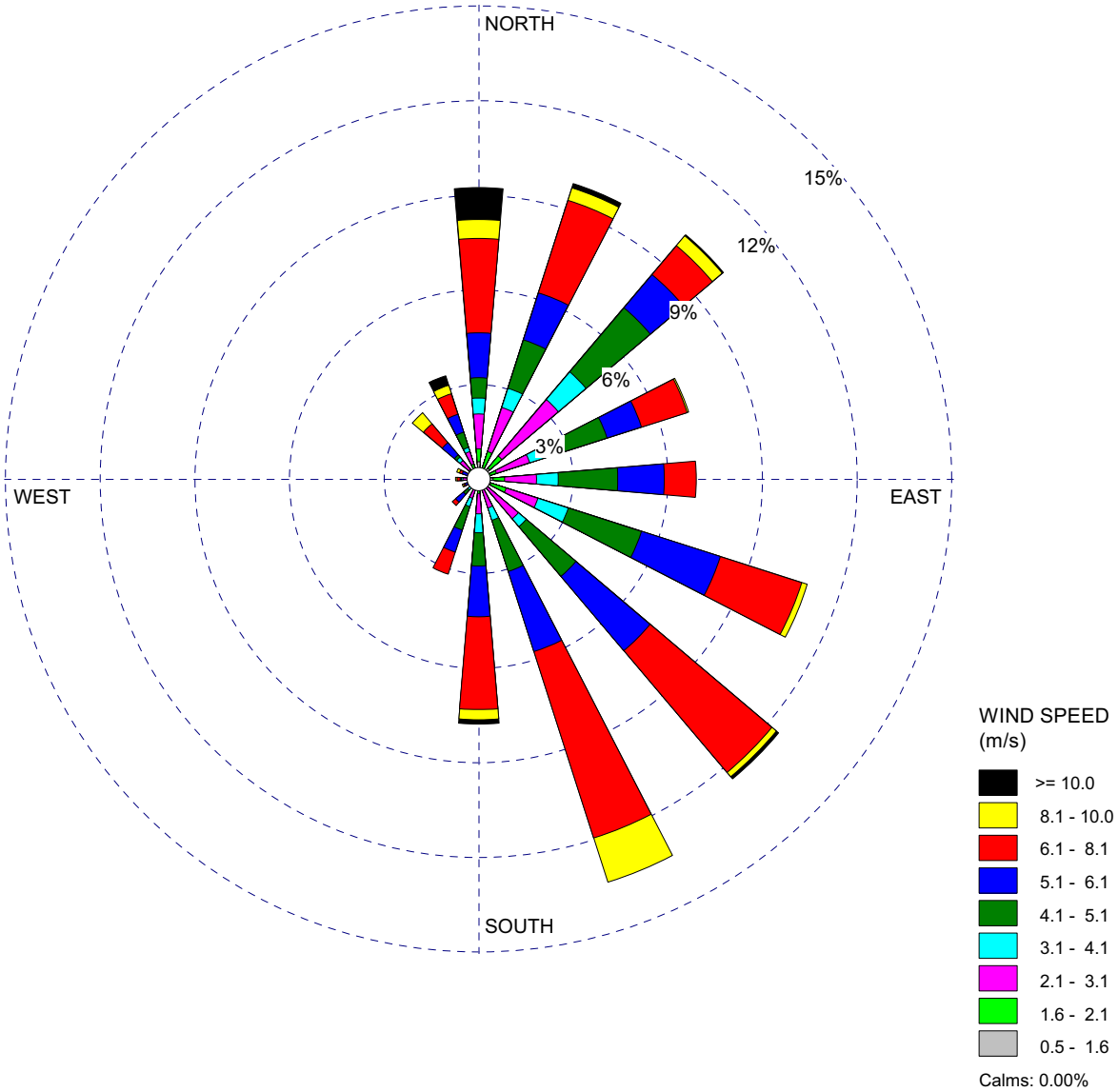

Figure 2.7-12 60-Meter Level Wind Rose—Autumn
VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

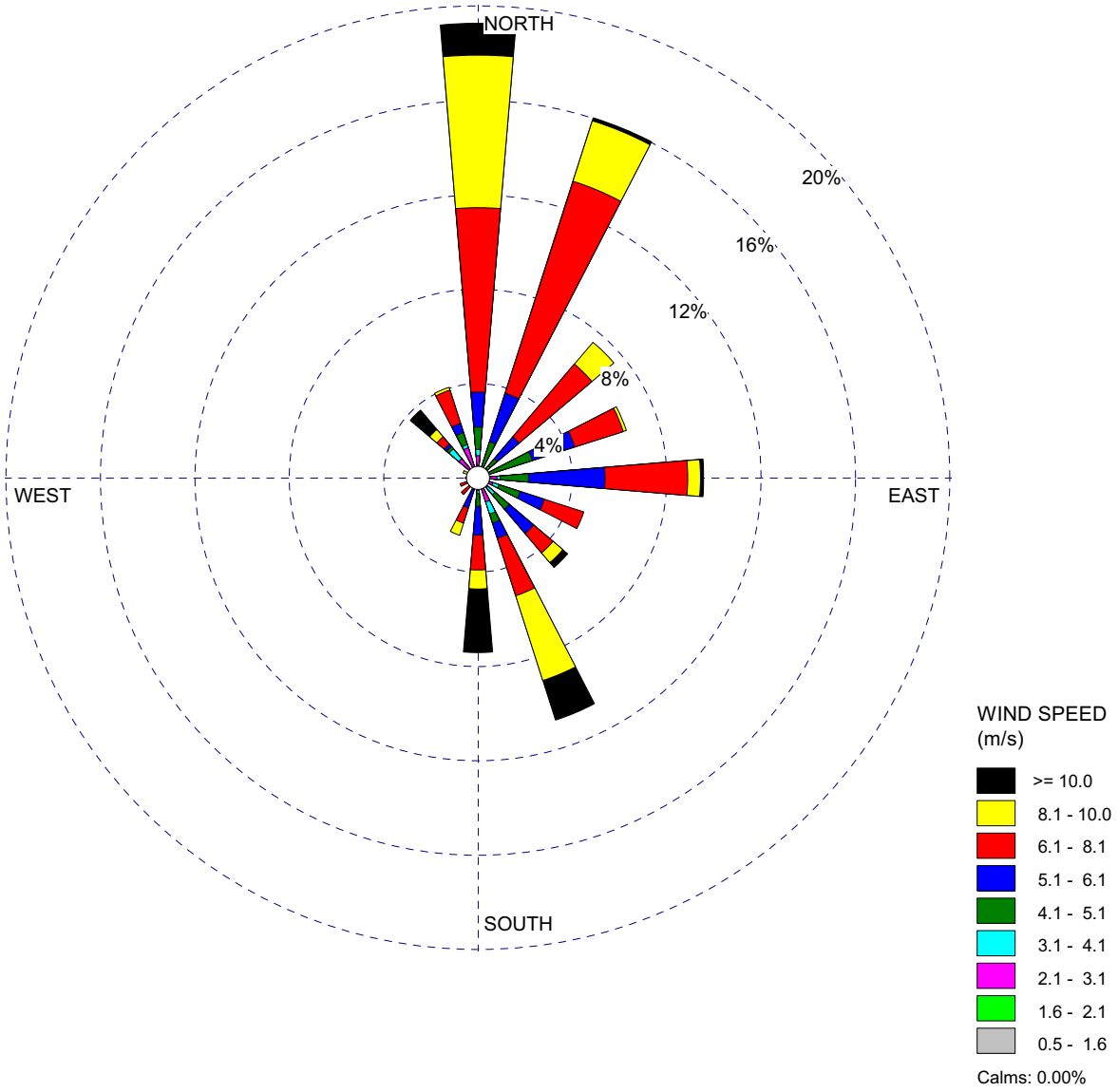

Figure 2.7-13 (Sheet 1 of 12) 60-Meter Level Wind Rose—January VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

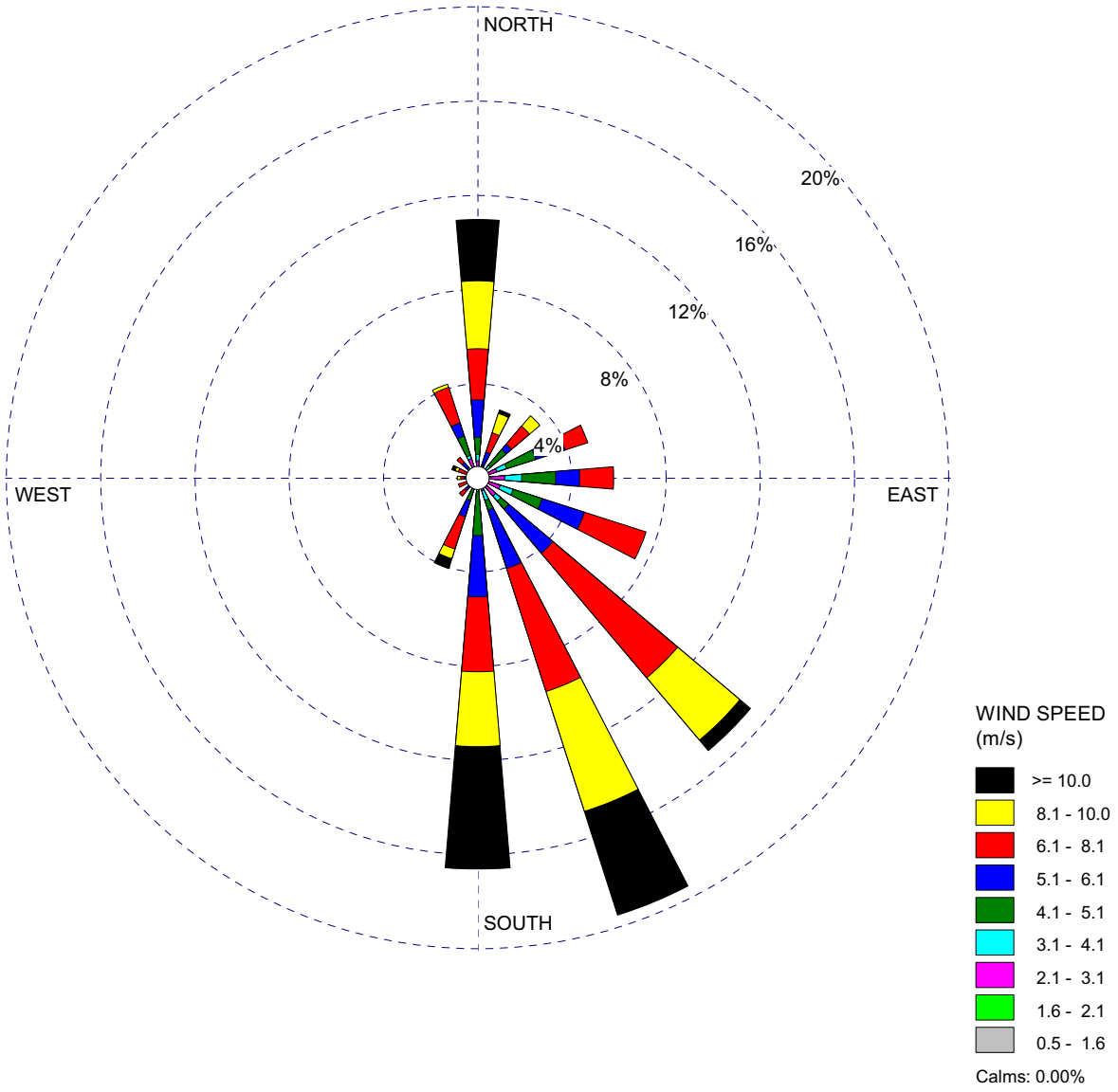

Figure 2.7-13 (Sheet 2 of 12) 60-Meter Level Wind Rose—February VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

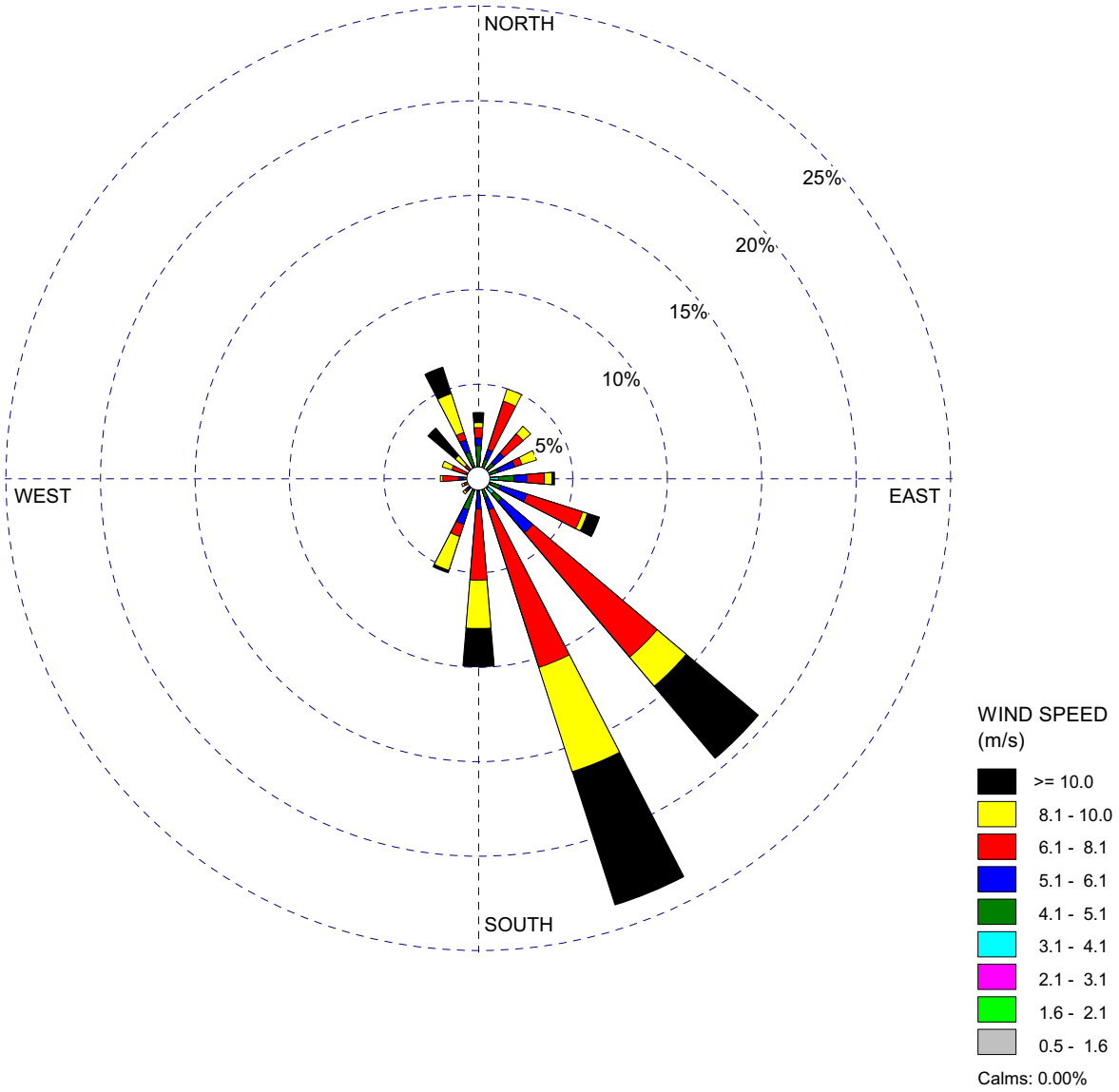

Figure 2.7-13 (Sheet 3 of 12) 60-Meter Level Wind Rose—March VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

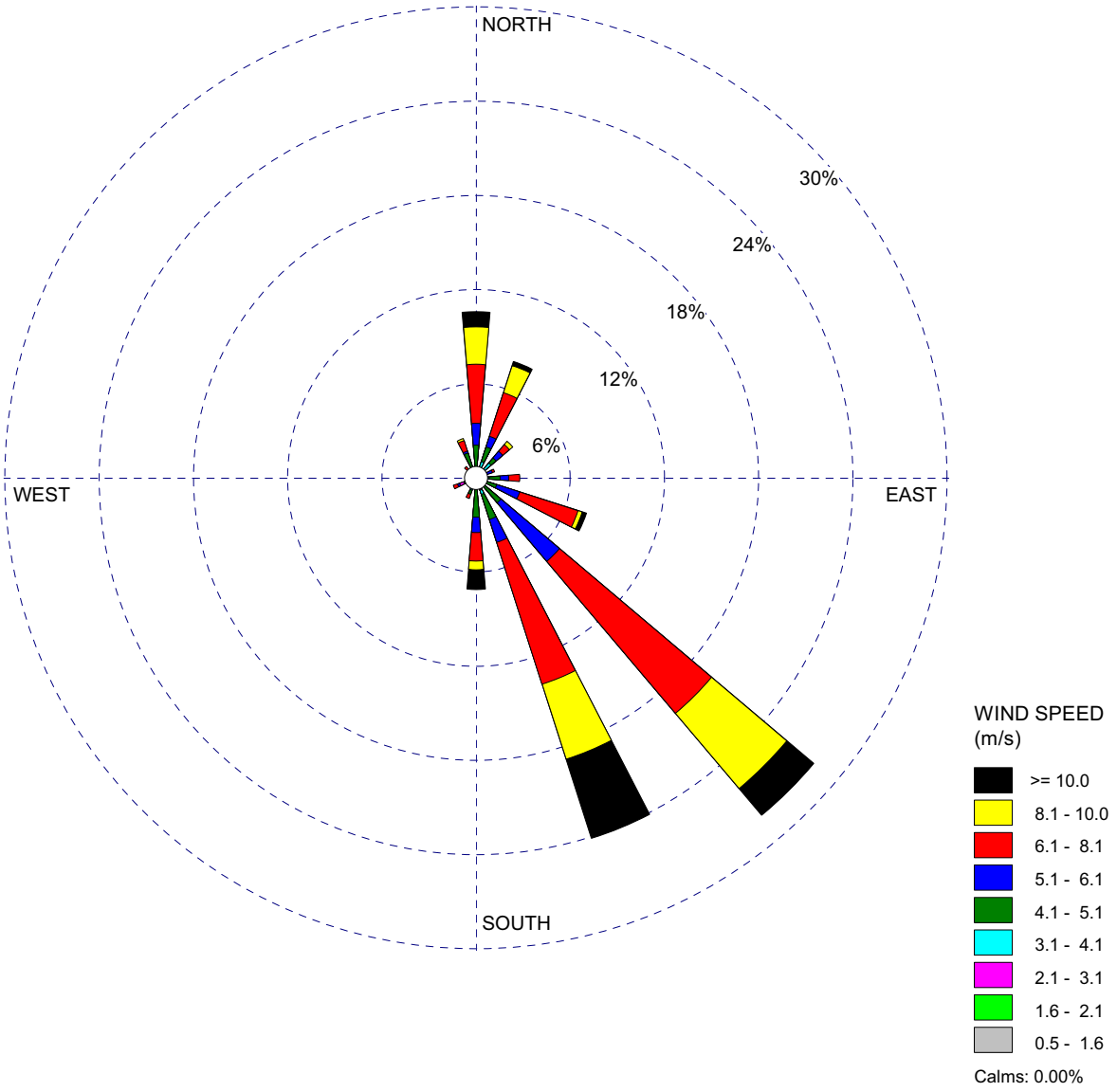

Figure 2.7-13 (Sheet 4 of 12) 60-Meter Level Wind Rose—April VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

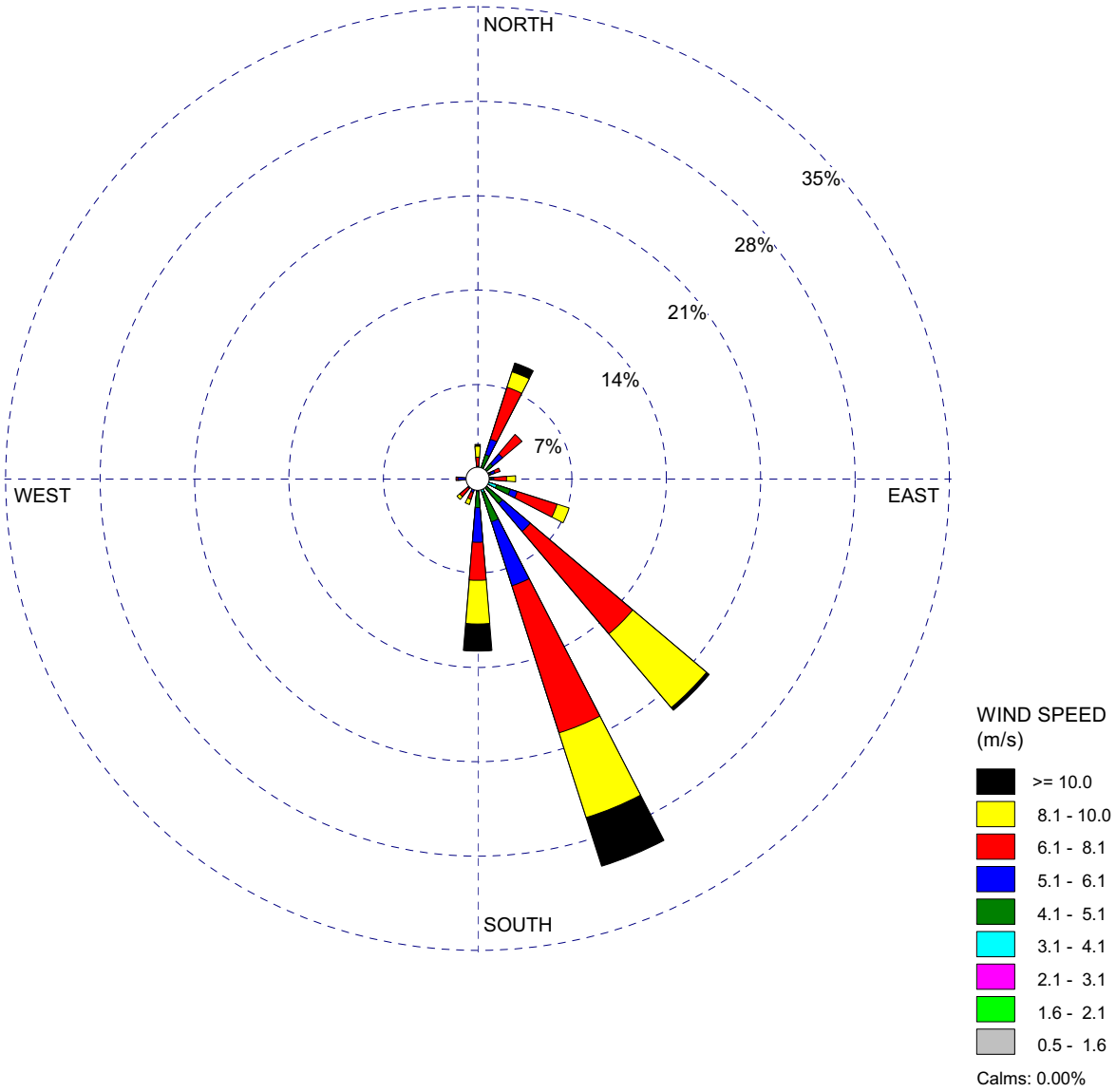

Figure 2.7-13 (Sheet 5 of 12) 60-Meter Level Wind Rose—May VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

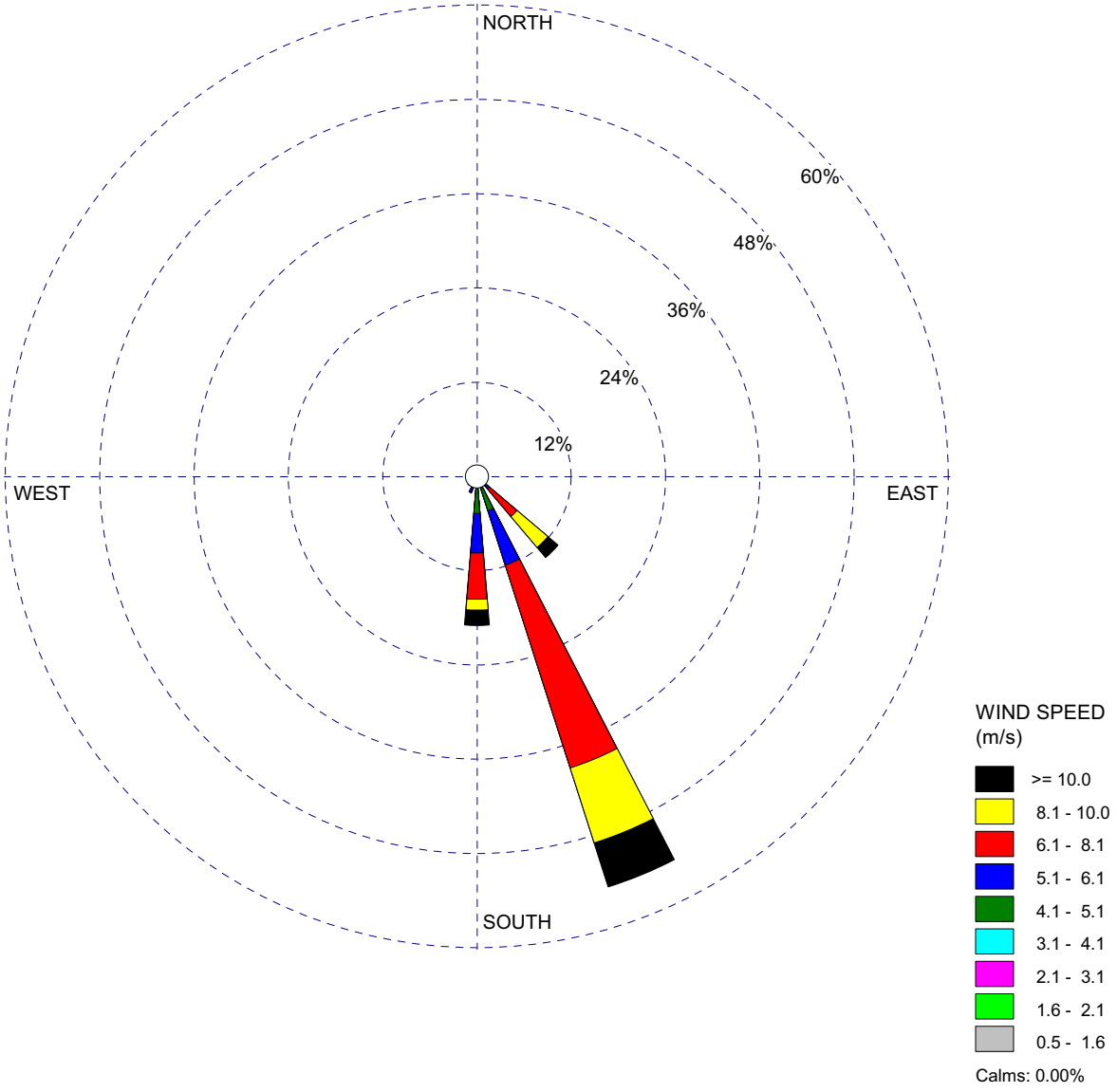

Figure 2.7-13 (Sheet 6 of 12) 60-Meter Level Wind Rose—June VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

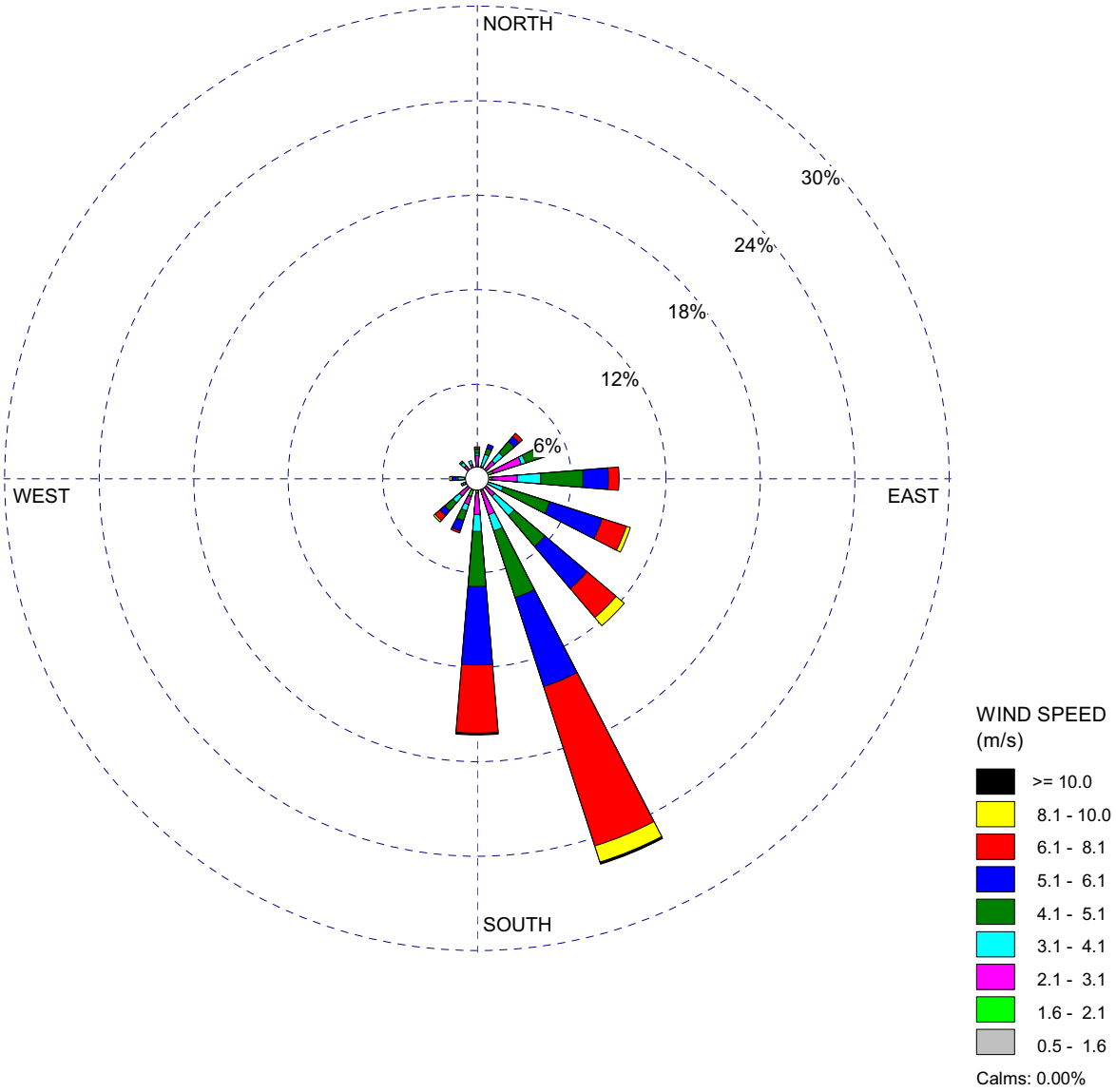

Figure 2.7-13 (Sheet 7 of 12) 60-Meter Level Wind Rose—July VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

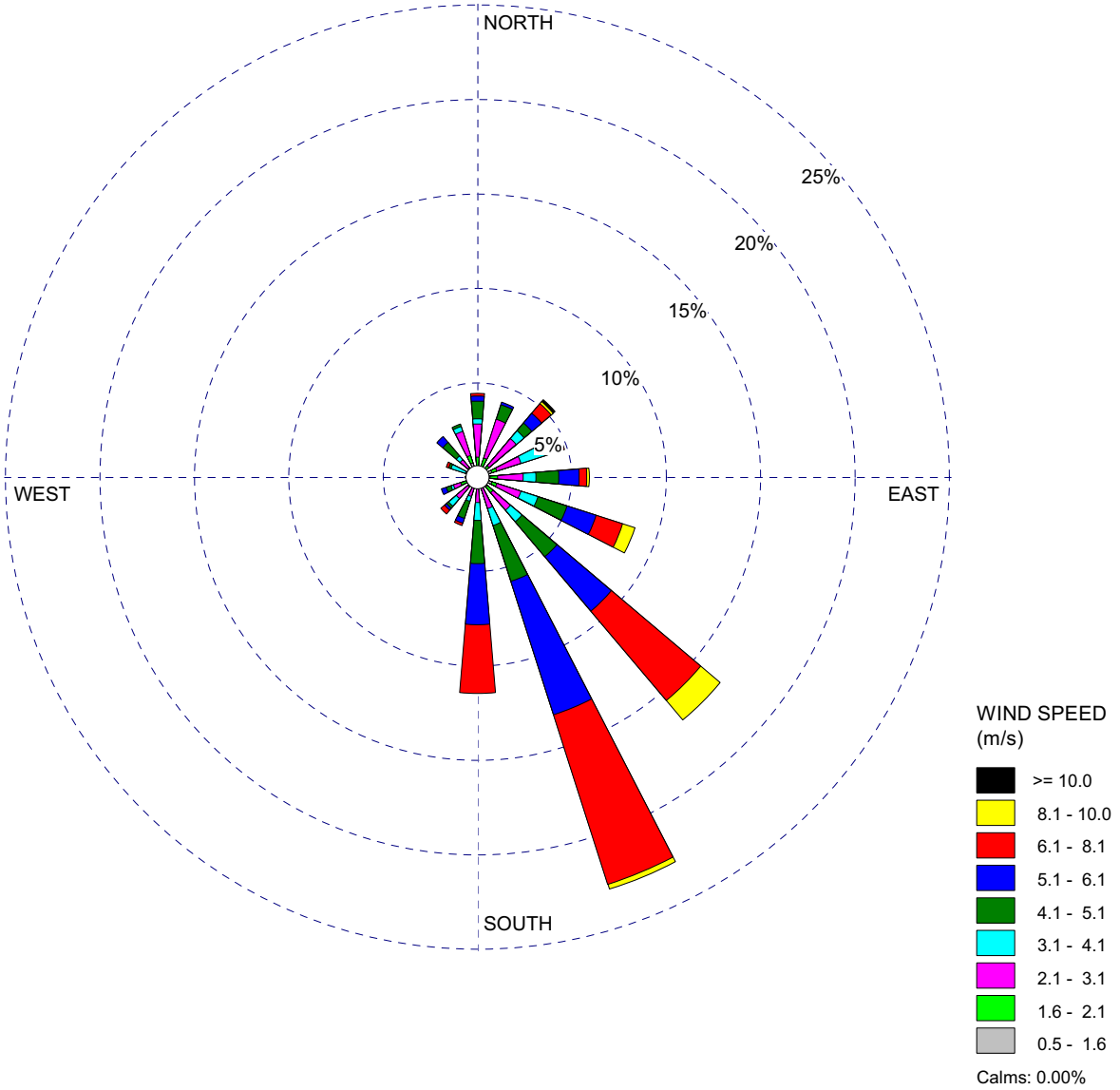

Figure 2.7-13 (Sheet 8 of 12) 60-Meter Level Wind Rose—August VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

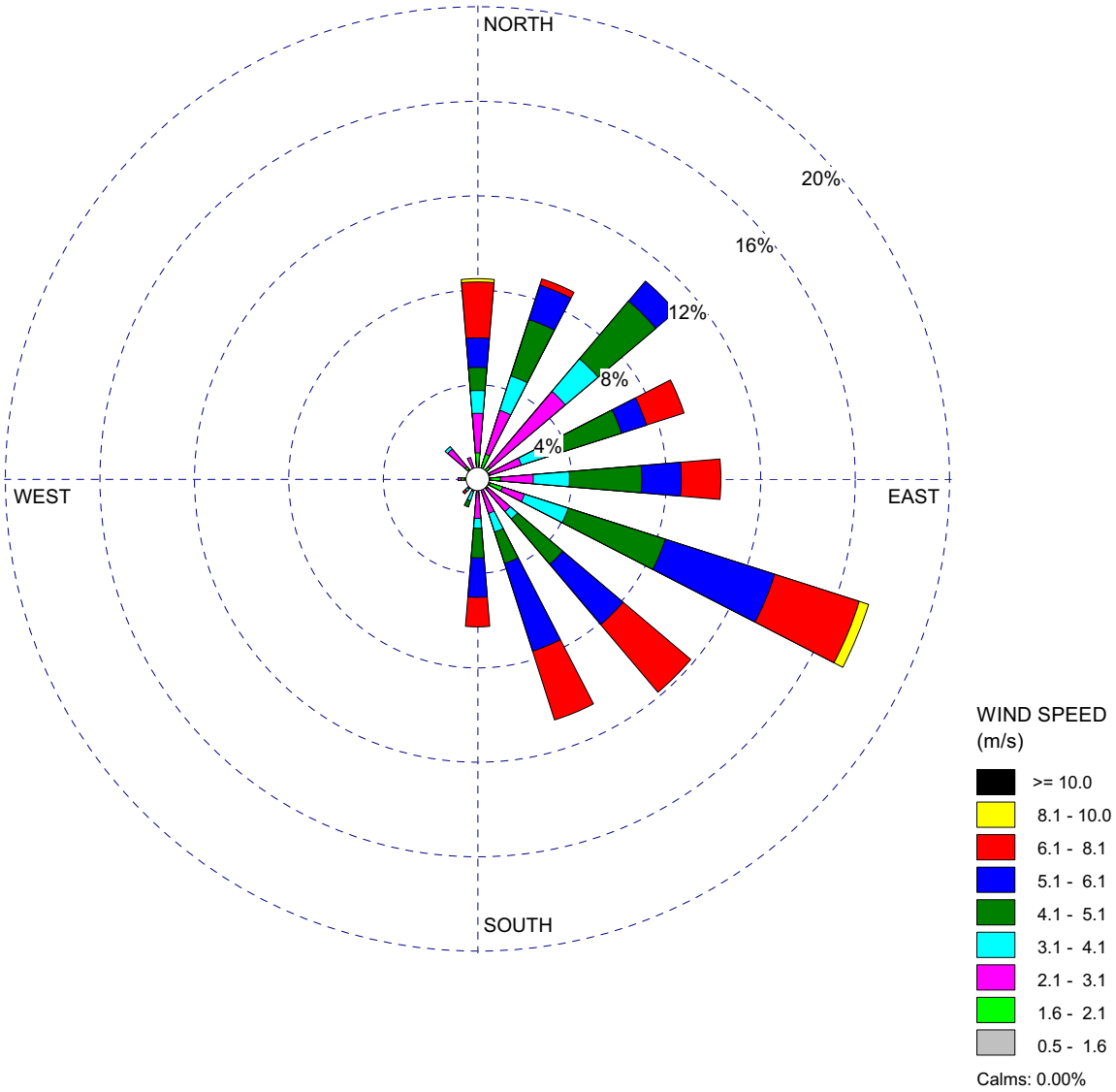

Figure 2.7-13 (Sheet 9 of 12) 60-Meter Level Wind Rose—September VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

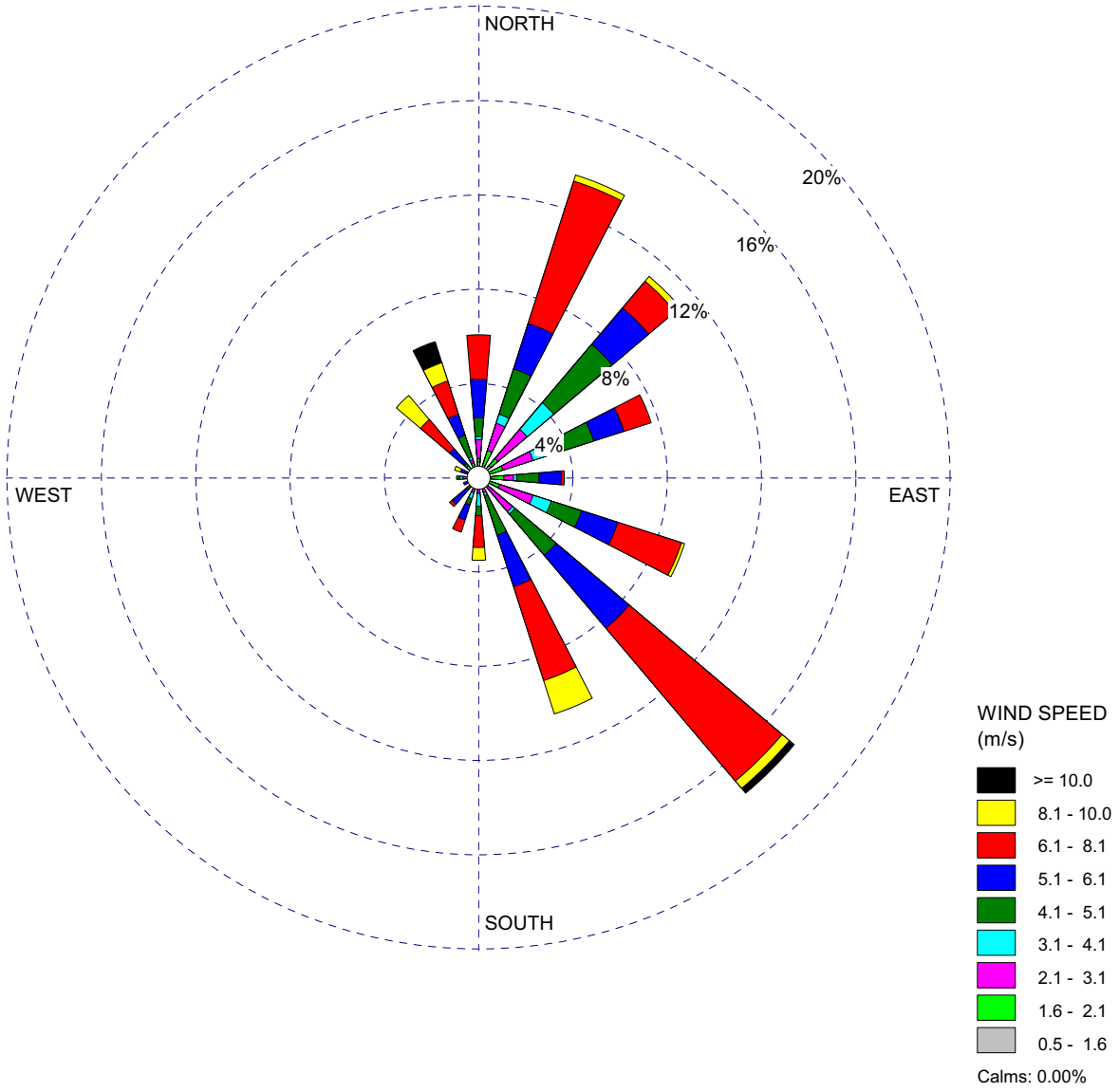

Figure 2.7-13 (Sheet 10 of 12) 60-Meter Level Wind Rose—October VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

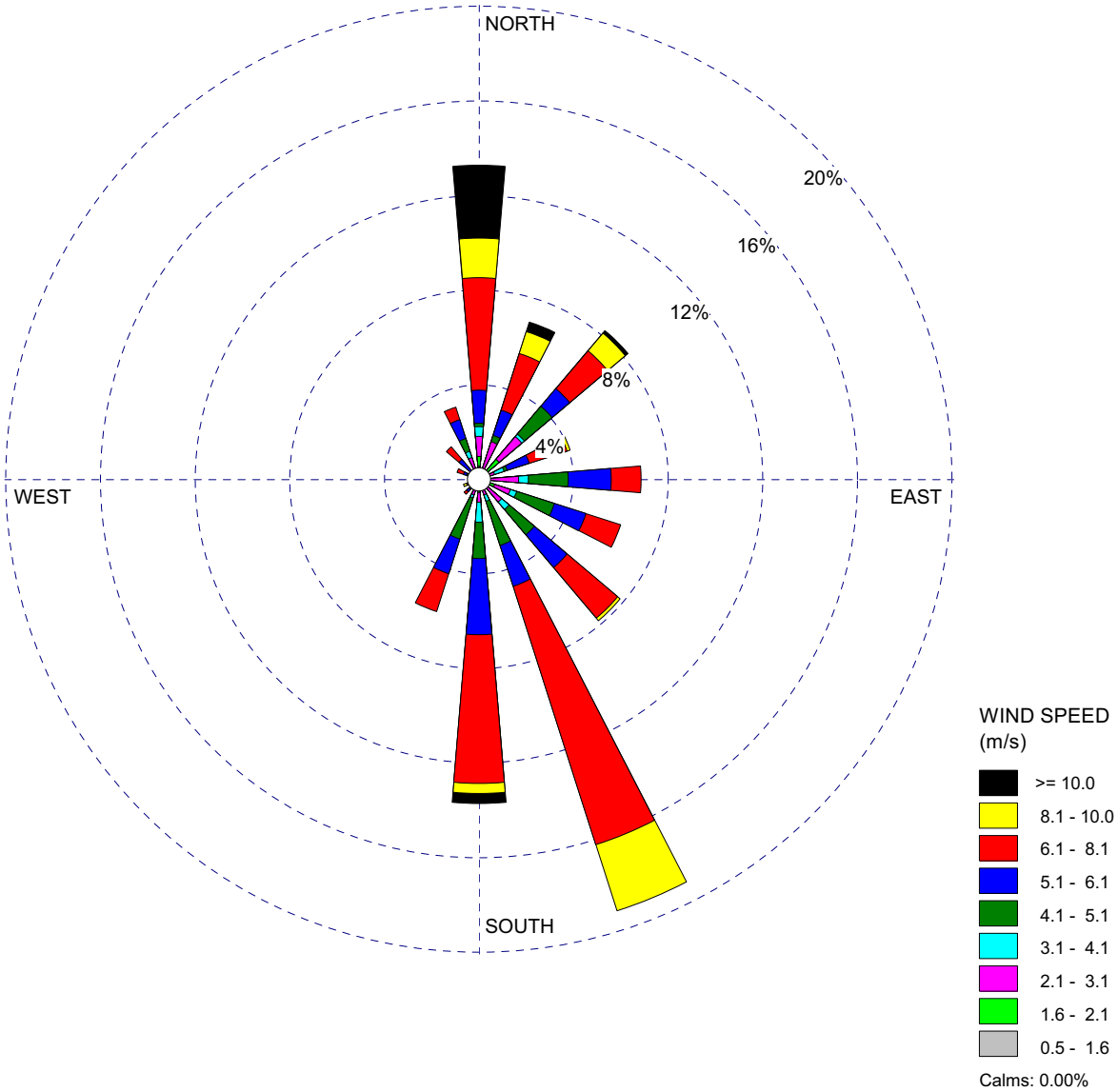

Figure 2.7-13 (Sheet 11 of 12) 60-Meter Level Wind Rose—November VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

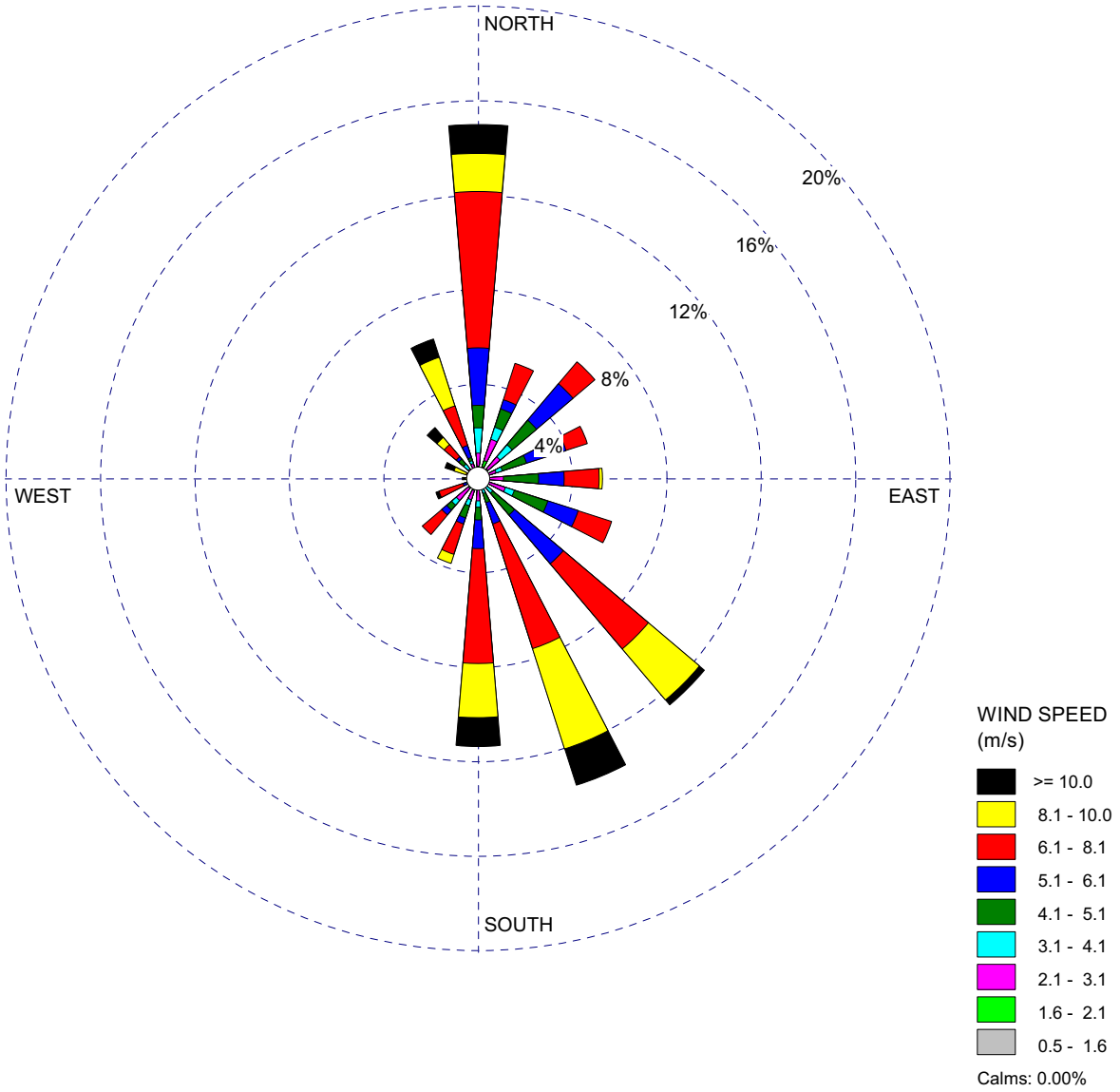

Figure 2.7-13 (Sheet 12 of 12) 60-Meter Level Wind Rose—December VCS Pre-Application Monitoring Program (July 1, 2007 through June 30, 2008)

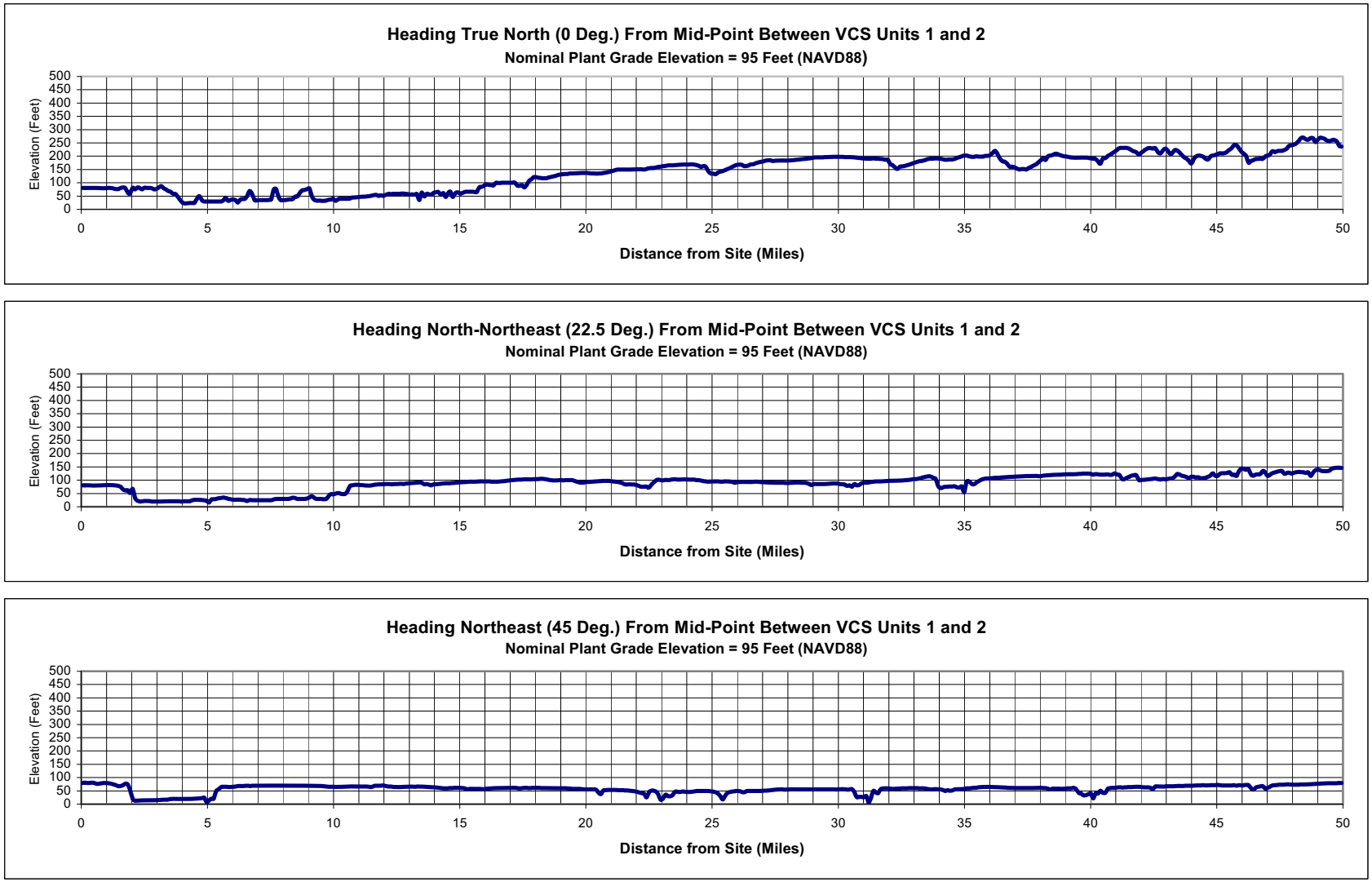

Figure 2.7-14 Terrain Elevation Profiles within 50 Miles of the VCS Site (Sheet 1 of 6)

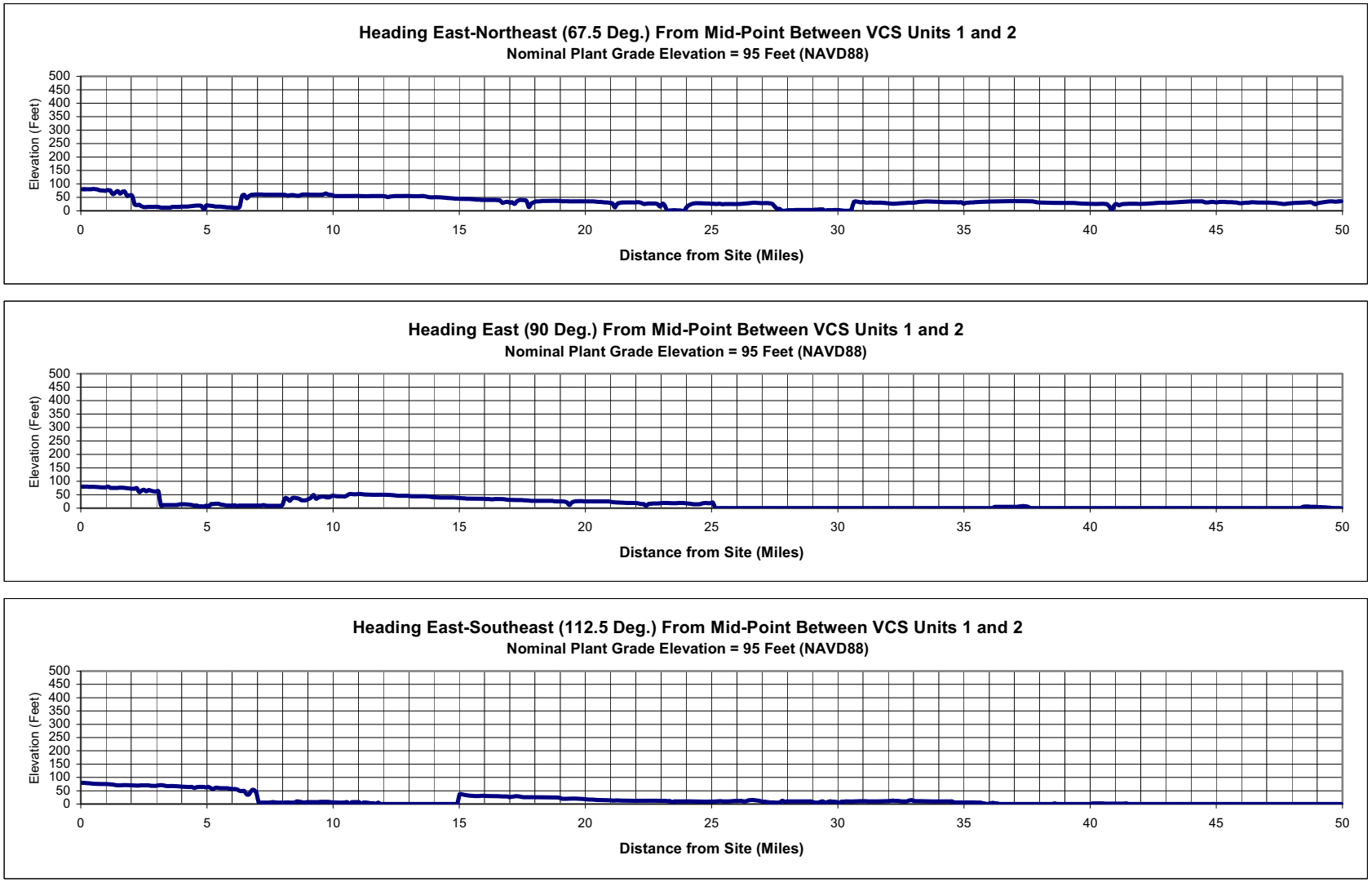

Figure 2.7-14 Terrain Elevation Profiles within 50 Miles of the VCS Site (Sheet 2 of 6)

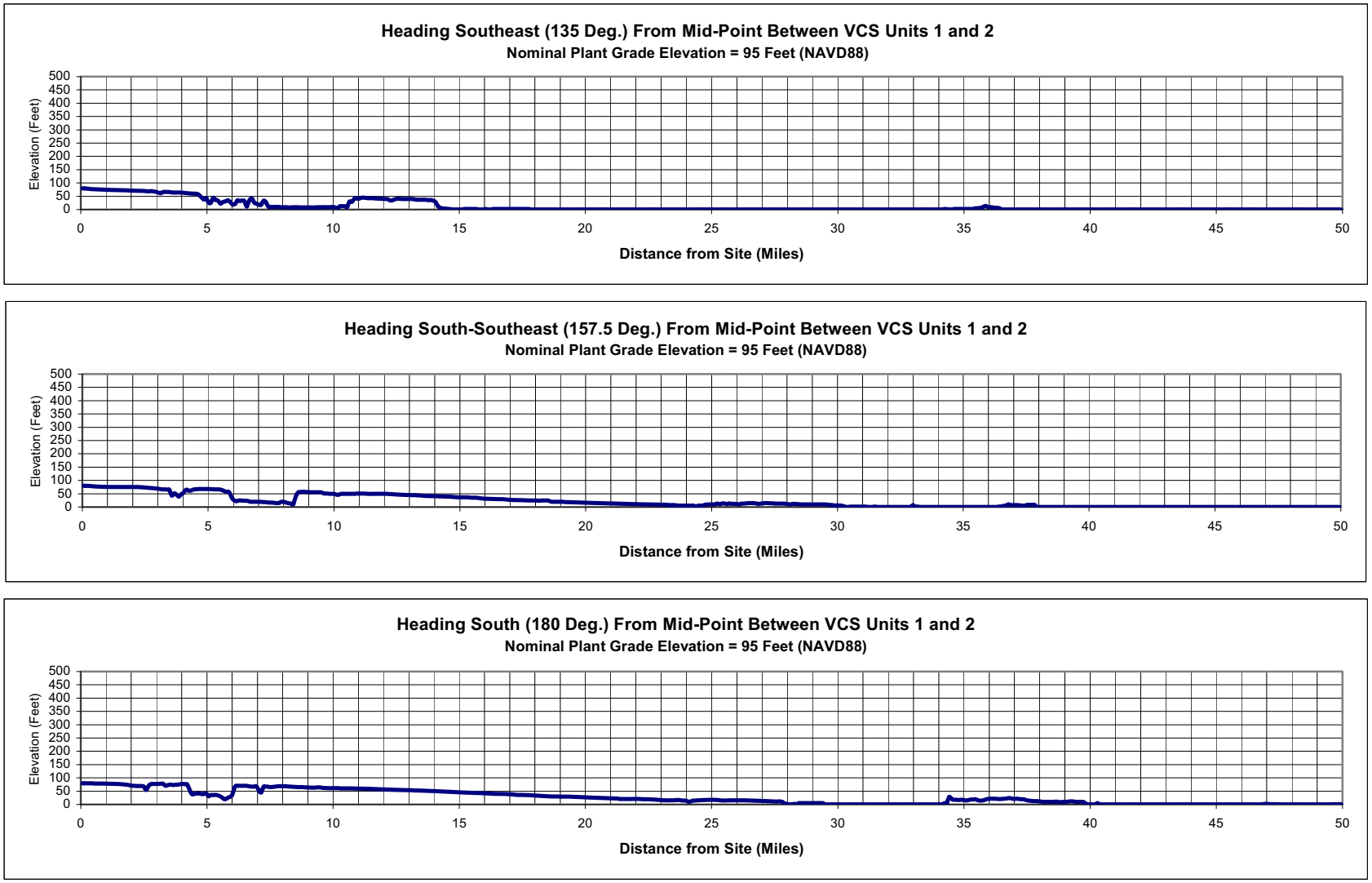

Figure 2.7-14 Terrain Elevation Profiles within 50 Miles of the VCS Site (Sheet 3 of 6)

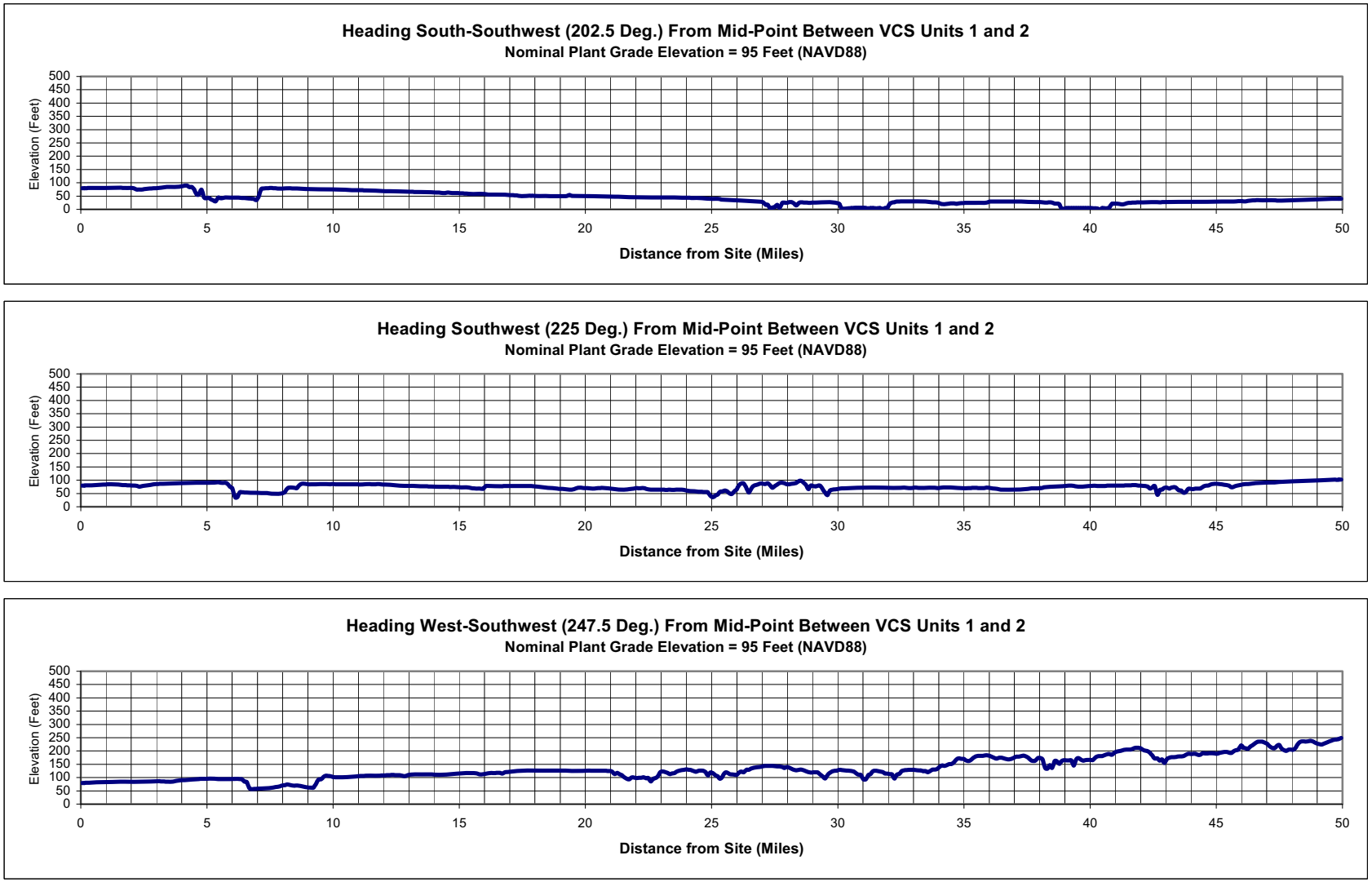

Figure 2.7-14 Terrain Elevation Profiles within 50 Miles of the VCS Site (Sheet 4 of 6)

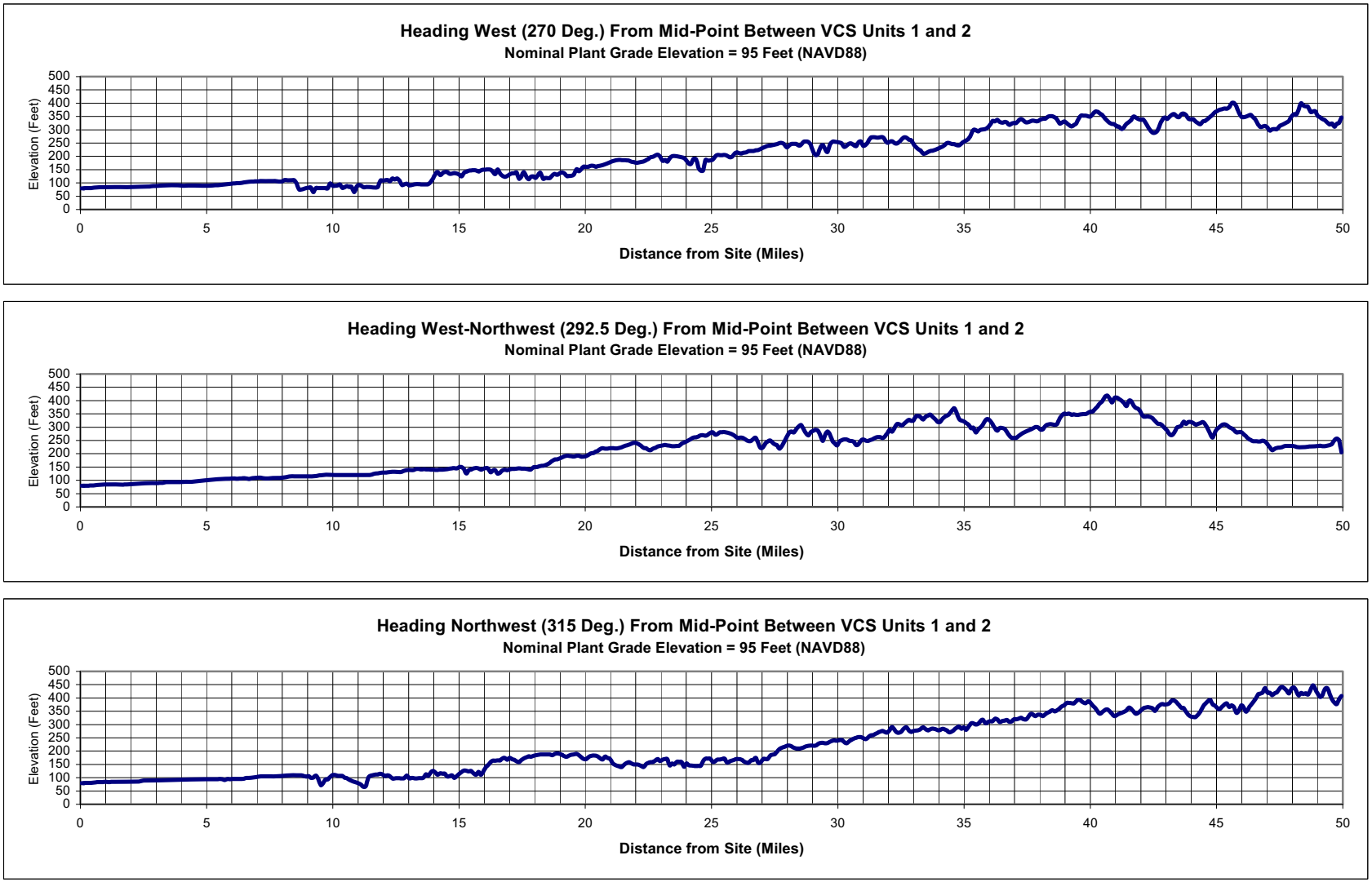

Figure 2.7-14 Terrain Elevation Profiles within 50 Miles of the VCS Site (Sheet 5 of 6)

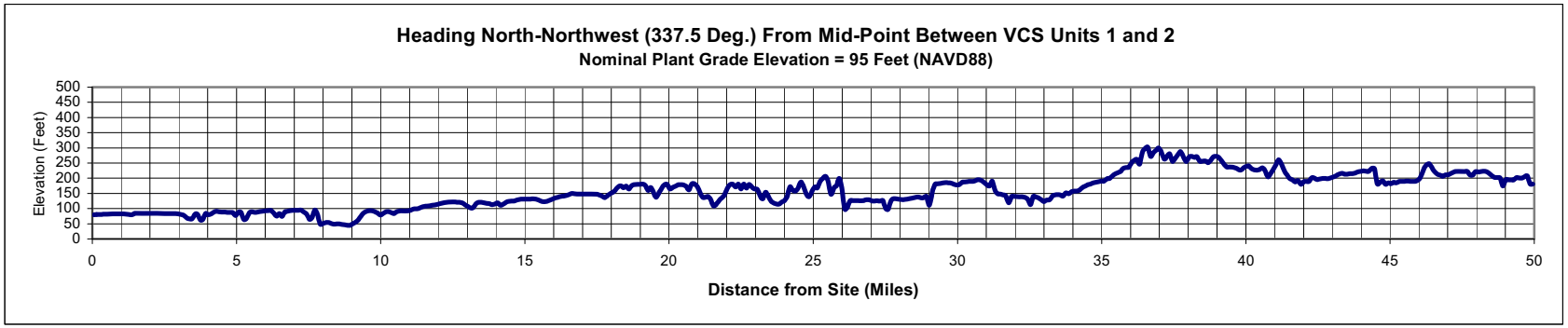

Figure 2.7-14 Terrain Elevation Profiles within 50 Miles of the VCS Site (Sheet 6 of 6)

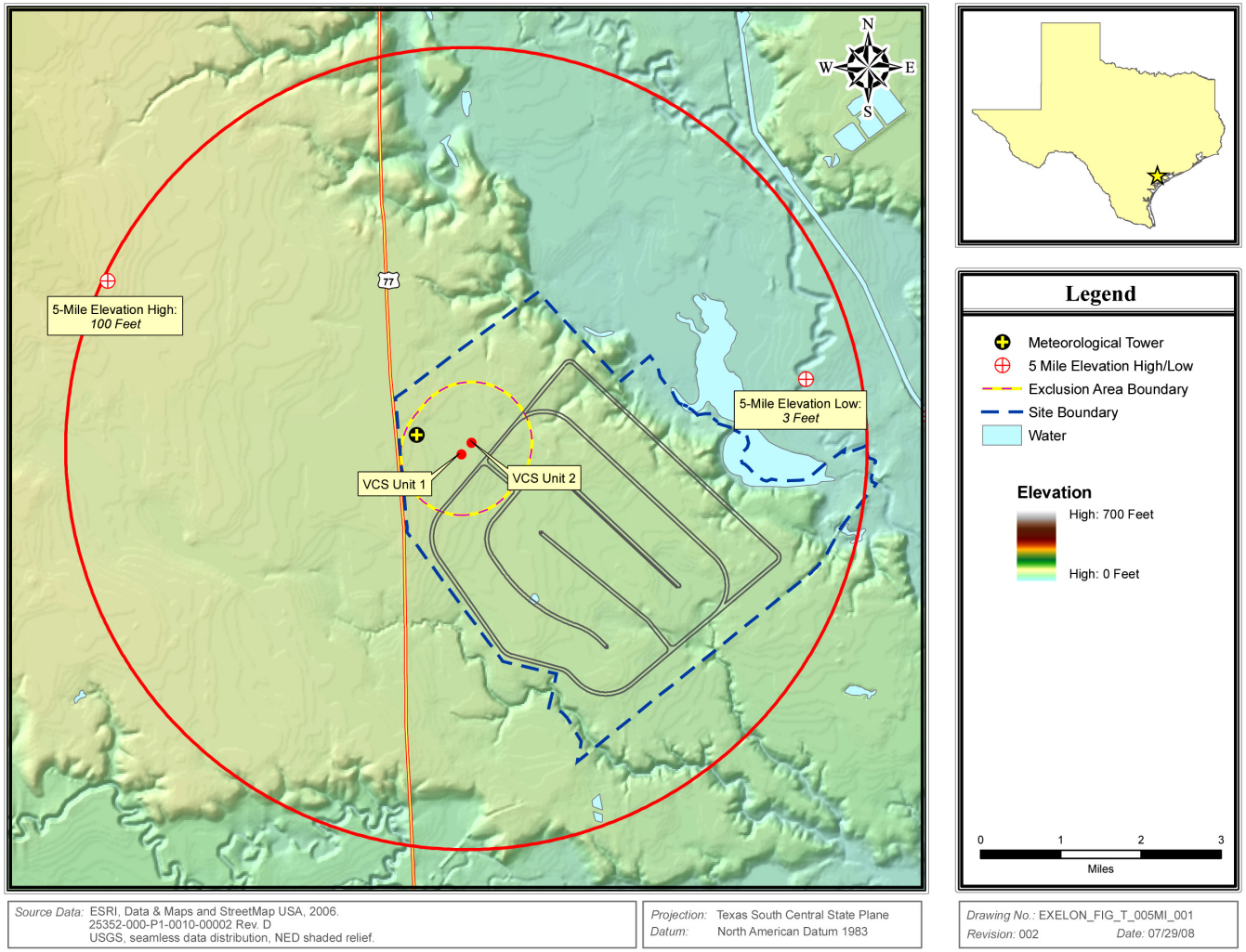

Figure 2.7-15 Site and Vicinity Map (5-Mile Radius)

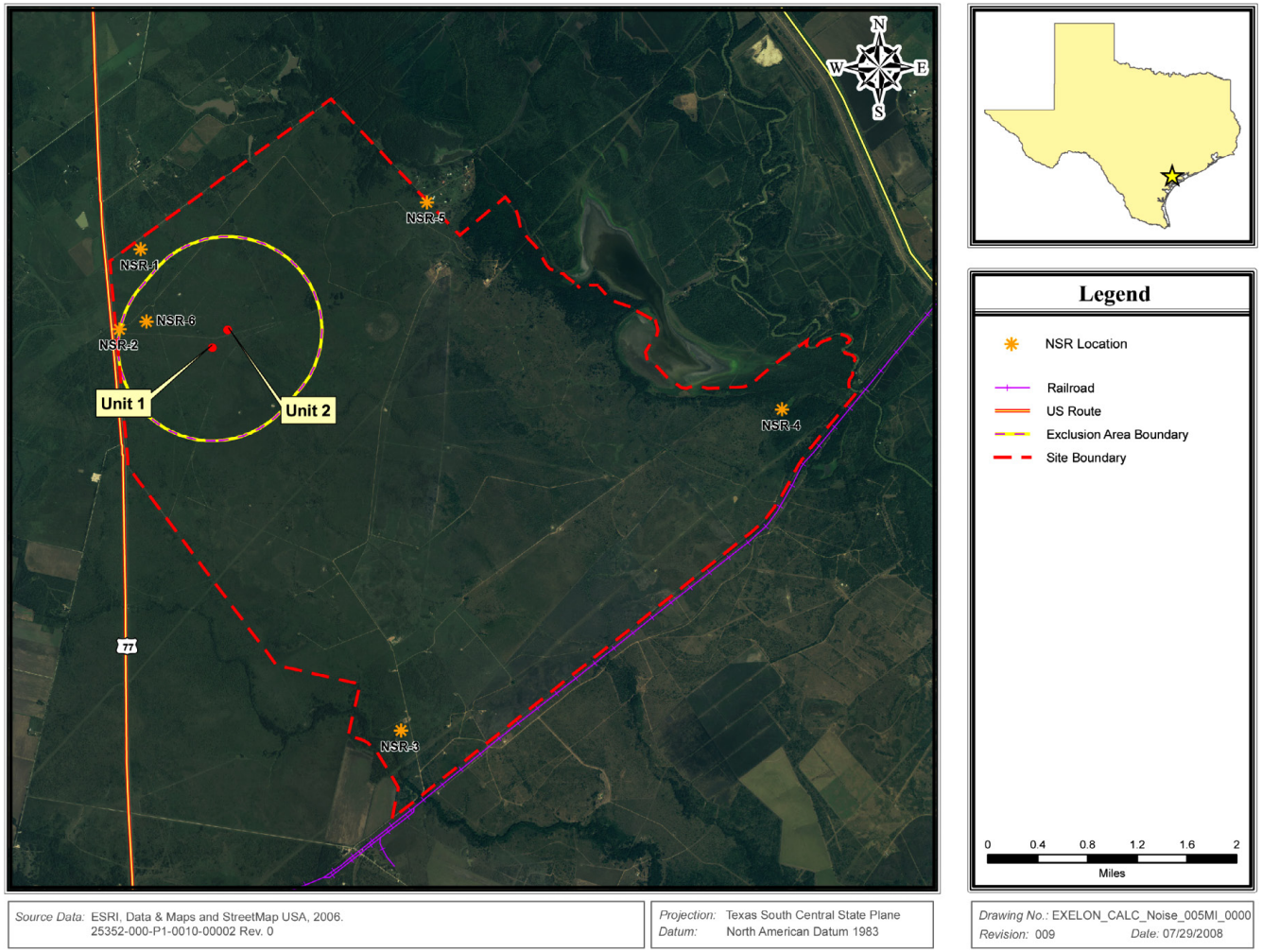

Figure 2.7-16 Noise Monitoring Locations

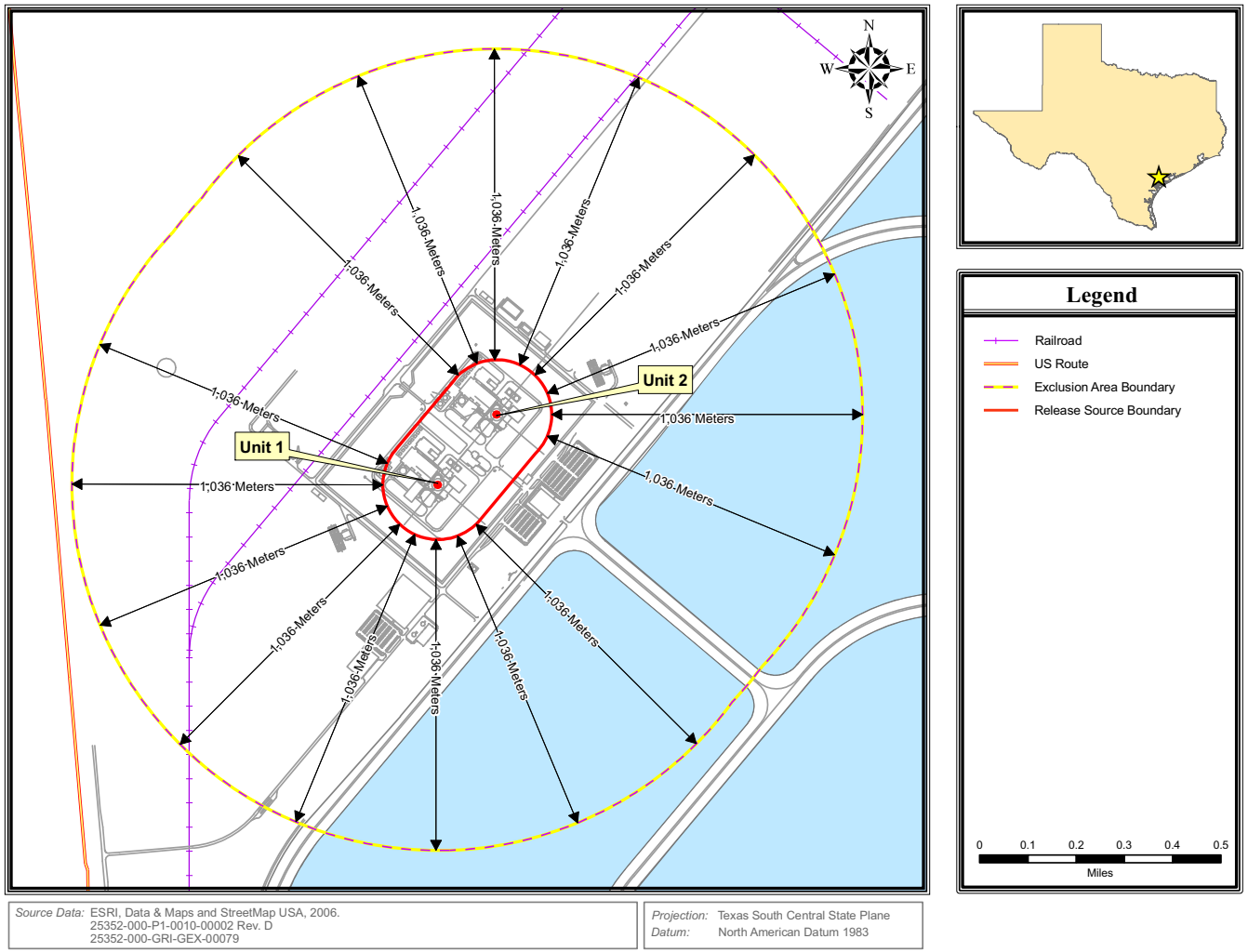

Figure 2.7-17 Distance to EAB from the Source Boundary for PAVAN Modeling

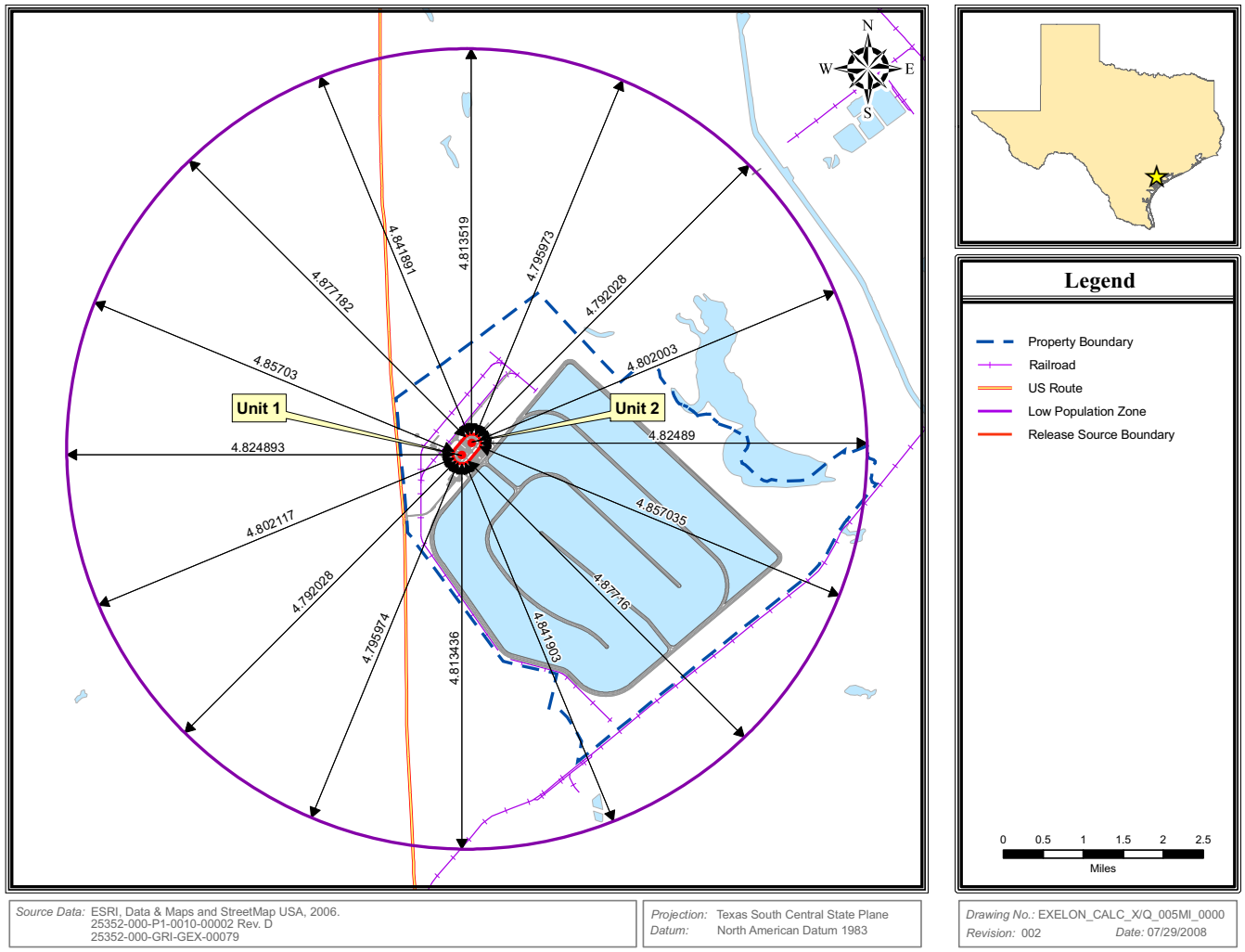

Figure 2.7-18 Distance to LPZ from the Source Boundary for PAVAN Modeling

2.8 Related Federal Project Activities

2.8.1 Overview

This section of the Environmental Report identifies and describes federal activities related to the proposed VCS Units 1 and 2. The purpose of this assessment is to identify the possible need for other federal agencies to participate in the preparation of the Environmental Impact Statement (EIS) as a cooperating agency. Upon request of the lead agency, which at the VCS would be the U.S. NRC, any other federal agency that has jurisdiction by law shall be a cooperating agency for preparation of the EIS.

The National Environmental Policy Act (NEPA) [42 U.S.C. 4321 et seq.], signed into law on January 1, 1970, requires federal agencies to consider the environmental impacts of proposed actions and identify reasonable alternatives to those actions. As a result, federal agencies prepare an EIS, which the U.S. EPA reviews.

Cooperating agencies will participate in the NEPA process with the U.S. NRC if their activities could have connected, cumulative, and/or similar environmental impacts defined by 40 CFR 1508.25 (U.S. EPA July 2007) and 10 CFR 51.14 (U.S. NRC Jan 2007) as follows:

- Connected actions are closely related and should be discussed in the same EIS. They are defined as actions that can automatically trigger other actions, which may require an EIS; as actions that cannot or will not proceed unless other actions are taken either previously simultaneously to the larger action; and/or as actions that are interdependent parts of a larger action and, therefore, depend on the larger action for their justification.
- Cumulative actions are those that, when viewed with other proposed actions, have cumulatively significant impacts and therefore should be discussed in the same impact statement.
- Similar actions are those that, when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography.

Actions related to the granting of licenses, permits, or approvals by other federal agencies are not considered in this section. The scope of this section is centered on federal project activities that may affect the proposed plant siting, transmission line routing, plant water supply, or the need for power.

2.8.2 Acquisition of Land and Use of Transmission Corridors

2.8.2.1 Federal Actions Associated With Land Acquisition and/or Use

Federal lands within 50 miles (80 kilometers) of the site were reviewed for activities that might impact the construction or operation of the VCS Units 1 and 2. Distances were measured from the midpoint between Units 1 and 2 to the closest edge of each location using ArcGIS software v9.2, ESRI Data & Maps, and StreetMap USA, 2006.

There is one national wildlife refuge, the Aransas National Wildlife Refuge, which is 22.1 miles south of the site and managed by the U.S. Fish and Wildlife Service (USFWS). Within the Aransas National Wildlife Refuge, the 3440-acre Myrtle Foester Whitmire Unit is located at the end of the Guadalupe-Blanco River Authority's (GBRA) canal system. It provides food, water, and shelter for up to 20% of the waterfowl population migrating to the Texas Gulf Coast. One U.S. Department of Interior hydroelectric generating project, the Palmetto Bend Dam, is on Lake Texana, and is operated and maintained by the Lavaca-Navidad River Authority.

There are no designated national forests or grasslands within 50 miles (80 kilometers) of the proposed plant. There are no lands protected under the National Wilderness Preservation System within 50 miles (80 kilometers) of the proposed VCS Units 1 and 2, and no federally designated wild and scenic rivers or Native American Reservations. Chase Field Naval Air Station is within 50 miles (80 kilometers) of the VCS Units 1 and 2, but it has been closed since 1993 and offers no impacts, potential or otherwise, to construction or operation of the plant. No activities at these identified federal locals will result in environmental impacts affecting preparation of the VCS EIS.

In 1998, the USFWS reviewed its files of the McCan property, where the proposed VCS is now being considered for development. The files coupled with onsite investigations resulted in a declaration by USFWS that the land harbored no federally listed or proposed threatened or endangered species (USFWS 1998). There are no known federal agency actions, other than those of the U.S. NRC, associated with the acquisition or use of the proposed site.

2.8.2.2 Federal Actions Associated With Land Acquisition for Transmission Corridors

The proposed site will connect to the Electrical Reliability Council of Texas (ERCOT) grid. ERCOT is an independent, not-for-profit corporation dedicated to ensuring electricity transmission reliability throughout most of Texas by managing the incoming and outgoing supply of electricity over the grid. ERCOT monitors the flow of power and issues instruction to generation and transmission companies to maintain balance (ERCOT 2007). The ERCOT electrical service region is contained completely within the borders of Texas. As further discussed in Chapter 8, it has only a few ties across state lines to import or export power with neighboring reliability regions. As a result, ERCOT is considered "intrastate" and not under jurisdiction of the Federal Energy Regulatory Commission except for reliability oversight (ERCOT 2006).

American Electric Power (AEP) is one of many transmission service providers for ERCOT. AEP delivers electric service for ERCOT to consumers in the major cities of Corpus Christi, Abilene, McAllen, Harlingen, San Angelo, Vernon, Victoria, and Laredo (AEP 2008). AEP is responsible for acquisition and ownership of transmission corridors; consequently, there will be no federal actions associated with land acquisition for transmission corridors.

2.8.3 Cooling Water Source and Supply

A cooling basin with a nominal surface area of approximately 4820 acres will serve as the heat sink for the two ESBWR units. The basin also will supply makeup flow to the plant service water cooling towers during normal plant operations. Makeup water to replenish water losses in the cooling basin will be supplied by the GBRA via a new pump station located on the Calhoun Canal. A new cooling water supply pipeline system will be constructed to deliver the makeup water to the cooling basin from this new pump station. The existing GBRA diversion and distribution canal system will be improved to increase its hydraulic capacity to accommodate the cooling water needs for the VCS Units 1 and 2 and to supply future GBRA customers.

All work related to the cooling water supply and source will be the responsibility of either the GBRA or Exelon. No federal involvement is anticipated for construction of the cooling system. However, some collaboration with federal agencies may result due to the need for permits, authorizations, and consultations associated with construction or operation of the proposed plant. Permits, authorizations, and consultations are discussed in Section 1.2.

Victoria County lies in the South Central Texas Regional Water Planning Area, which is comprised of the Guadalupe-Blanco, Nueces, and San Antonio river authorities, and the Edwards Aquifer Authority (Caldwell, Hays, Comal, Guadalupe, Bexar, Medina, and Uvalde counties) and the Evergreen Underground Water Conservation District (Frio, Atascosa, Karnes, and Wilson counties). Additional details about water usage in the area are provided in Subsection 2.3.2,Sections 4.2 and 5.2. Cumulative impacts from water usage during construction and operation of the proposed station are discussed in Sections 4.7 and 5.11, respectively. There are no other known planned federal projects that will be required either to provide an adequate source of plant cooling water or to ensure an adequate supply of cooling water over the operating lifetime of the new VCS Units 1 and 2.

2.8.4 Other Federal Actions Affecting Construction or Operation

There are no known planned federal projects or activities that must be completed as a condition for construction or operation of the VCS Units 1 and 2. Cumulative socioeconomic impacts may result from the construction and operation of the two proposed new nuclear units at the South Texas Project, approximately 60 miles east-northeast of the proposed VCS Units 1 and 2. These impacts are addressed in Section 4.7 and 5.11 for cumulative impacts due to construction and operation, respectively.

A major roadway project, the I-69 Trans-Texas Corridor (TTC), will, if completed within the next 10 years, impact U.S. Highway 77. U.S. Highway 77 runs north-south approximately 1 mile west of the proposed plant site, and will provide access to and egress from it. U.S. Highway 77 is also the primary route for transporting commodities between Corpus Christi and Houston. Proposed I-69 TTC would overlay the southern portion of U.S. Highway 77, adjacent to VCS.

Interstate 69 is a planned 1600-mile national highway connecting Mexico, the United States and Canada. Eight states are involved in the project. In Texas, I-69 will be developed under the TTC master

plan (TxDOT 2008a). A study performed for the Corpus Christi Local Emergency Planning Commission concluded the I-69 TTC would facilitate increased movement of freight from Corpus Christi to Houston (Olivarri 2004). This would also impact traffic moving by the proposed Victoria County Station. The decision to connect I-69 TTC to U.S. 77 has been deferred until the second phase of the I-69 TTC Study is completed (TxDOT 2008b).

2.8.5 Federal Agency Plans Used To Justify the Need for Power

There are no known federal agency plans or commitments that will result in significant new power purchases that would be applicable to the analysis used to justify the need for power associated with the VCS Units 1 and 2. The need for power is discussed in detail in ER Section 8.0.

2.8.6 Planned Federal Projects Contingent on Plant Construction or Operation

There are no known planned federal projects that are contingent on construction and operation of the VCS Units 1 and 2.

2.8.7 Cooperating Agencies

There are no cooperating agencies identified to participate in the preparation of the EIS. Some collaboration with federal agencies may result due to the need for permits, authorizations, and consultations associated with construction or operation of the proposed plant. Permits, authorizations, and consultations are discussed in Section 1.2.

2.8.8 References

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