Subsection 2.4.2 Table of Contents

Subsection 2.4.2 List of Tables

Subsection 2.4.2 List of Figures

2.4.2 Floods

This section examines historical flooding at the VCS site and summarizes the individual types and combinations of flood-producing phenomena considered in establishing the flood design basis for the power block area. The minimum finished site grade at the power block area is 95.0 feet (29.0 meters) NAVD 88. Local intense precipitation estimated for the VCS site is also described in this subsection.

2.4.2.1 Flood History

The major credible natural events that may cause flooding near the VCS site are stream flooding from the Guadalupe and San Antonio Rivers along with Coleto Creek, hurricane-induced storm surges from the Gulf of Mexico, and the effects of local intense precipitation on the site. There have been no historical records of flooding in the nearby region from ice-related events, tsunami-generated surges, channel diversions, or dam break incidences.

As mentioned in Subsection 2.4.1, stream gage records are available for the Guadalupe and San Antonio Rivers and Coleto Creek near the site and are most representative of flood flows in the vicinity of the VCS site. The nearest gage with a long and reliable record of flood discharge data on the Guadalupe River is located at Victoria, Texas (USGS gage number 08176500) (see Subsection 2.4.1). For the San Antonio River, the nearest gage with a long and reliable record is located at Goliad, Texas (USGS gage number 08188500). Similarly, the closest gage on Coleto Creek is located near Victoria, Texas (USGS gage number 08177500). The annual peak discharges and corresponding gage heights for the period of record for each of these stream gages are listed in Tables 2.4.2-1 through 2.4.2-3 (References 2.4.2-1 through 2.4.2-3). Plots of the annual peak discharges are shown in Figures 2.4.2-1 through 2.4.2-3. The data presented in these tables and figures are the annual maximum peak discharges by water year. A water year begins on October 1 of the calendar year preceding the water year and ends on September 30 of the water year (e.g., water year 2006 begins on October 1, 2005 and ends September 30, 2006). Figure 2.4.1-6 depicts the locations of selected stream gages on the Guadalupe and San Antonio Rivers.

From the above tables and figures on annual peak discharges of the three nearby stream gages, it is evident that the floods of record for both the San Antonio River and Coleto Creek occurred in 1967. It should be noted that the 1967 historical peak flow for Coleto Creek occurred outside the period of record for the stream gage and is estimated based on high water marks (Reference 2.4.2-3).

The flood of record for the Guadalupe River at Victoria occurred in October 1998, with a peak discharge of 466,000 cfs (13,196 cubic meters per second). This event corresponds with severe flooding for much of southeastern Texas. The flood of record for many gaging stations in the region occurred in October of 1998, and much damage was attributed to this flooding event in Victoria and other towns in southeastern Texas (Reference 2.4.2-3). USGS records indicate that at the time of the event, new peak discharges were established at 11 gaging stations on the San Antonio and

Guadalupe Rivers with the most historically significant peaks occurring at Cuero and Victoria. The peak discharge at Victoria during the October 1998 flood was approximately 2.6 times the previously recorded peak discharge. Rainfall records in the Guadalupe River Basin indicate that the storm was centered downstream of Canyon Dam with significantly more rainfall occurring on the watershed downstream of the dam (Reference 2.4.2-4).

Even though the 1998 flood was not considered the flood of record for the San Antonio River at Goliad, the October 1998 flood produced the third highest flow on record at this gage, with the second highest occurring in July of 2002. For the 1998 storm, USGS data indicates that the largest rainfall in the San Antonio River basin occurred in the upstream areas. However, flood peaks on the lower San Antonio River exceeded the 100-year recurrence interval at Elmendorf and Falls City (Reference 2.4.2-4).

Flow data at all three stream gages are affected by upstream flow regulation. This is especially true for flow data on Coleto Creek near Victoria. The Coleto Creek near Victoria stream gage is located a short distance downstream of Coleto Creek Dam and Reservoir, and its stream flow record reflects primarily the discharge from the dam (Reference 2.4.2-3). The Coleto Creek Reservoir serves as a cooling pond for the Coleto Creek Power coal-fired power plant.

A stream gage also exists on the Guadalupe River near Bloomington, Texas, which is the closest gage to the site (USGS gage number 08177520). This gage only records water levels and does not have corresponding stream flow data. Verified daily water level data exist for water years 1999 through 2007. However, none of these years has a complete set of data records, and annual peak water levels have not been established for any of these years by the USGS with the exception of water year 1999. A summary of the maximum recorded water level for each water year based on a partial (incomplete) record is provided in Table 2.4.2-4. (Reference 2.4.2-5)

Stream gages also exist on the Guadalupe River at Tivoli, Texas (USGS gage number 08188800) and on the San Antonio River at McFaddin, Texas (USGS gage number 08188570). The USGS record at the Tivoli gage does not provide annual peak stream flow data (Reference 2.4.2-6). The stream flow period of record at McFaddin is less than 2 years in length (Reference 2.4.2-7). Thus, neither of these gages provides sufficient nor reliable flooding information at this time and their data is not presented in this subsection.

Because the site is located approximately 36 miles (58 km) inland from the Texas coastline, there are no records of flooding from hurricane surges at the VCS site. However, the coastal areas near the site have recorded flood levels as a result of hurricane-induced surges. A detailed description of historical hurricane events and storm surges along the Texas coast is presented in Subsection 2.4.5.

The most intense hurricane to strike the Texas coastline was the Indianola hurricane in August 1886 with landfall in Calhoun County, Texas (References 2.4.2-8 and 2.4.2-9). Hurricane Carla was the most severe hurricane along the Texas coast near the VCS site in recent history. Landfall for this hurricane was on Matagorda Bay with a maximum surge water level of about 16.6 feet (5.1 meters) above MSL at Port Lavaca (Reference 2.4.2-10), which is approximately 17.3 feet NAVD 88 based on the vertical datum conversion factor at Rockport, Texas (Reference 2.4.2-11). The five highest water levels at National Oceanic and Atmospheric Administration (NOAA) tide gage stations at Corpus Christi, Texas (Reference 2.4.2-12) and Freeport, Texas (Reference 2.4.2-13) are shown in Table 2.4.2-5. These water levels are well below the minimum finished site grade of 95.0 feet (29.0 meters) NAVD 88 for the power block area.

There are no records of any ice sheet formation, wind-driven ice ridges, or ice jams on any of the rivers, creeks, or estuaries near the VCS site as described in Subsection 2.4.7. Neither are there any records of dam break flooding nor landside-induced tsunami or distant tsunami source-induced flooding events near the VCS site as described in Subsections 2.4.4 and 2.4.6, respectively.

2.4.2.2 Flood Design Considerations

The design basis flooding elevation for the VCS site is determined by considering a number of different flooding scenarios. The potential flooding scenarios applicable and investigated for the site include:

- Probable maximum flood (PMF) on streams and rivers
- Potential dam failures
- Probable maximum surge and seiche flooding
- Probable maximum tsunami
- Flooding due to ice effects
- Potential flooding caused by channel diversions.

The flooding scenarios were postulated to occur in conjunction with other flooding and meteorological events as applicable, such as wind-generated waves and tidal levels, as recommended in the guidelines presented in ANSI/ANS-2.8-1992 (Reference 2.4.2-14). Detailed assessments of the flooding impacts on the safety functions of VCS from each of these postulated flooding events are described in Subsections 2.4.3 through 2.4.7 and Subsection 2.4.9.

The estimation of the PMF water level on the Guadalupe River is described in Subsection 2.4.3. Different combinations of parameters including probable maximum precipitation (PMP) storm events

and antecedent water levels, contributing catchment areas, upstream reservoir releases, and base flow conditions are considered in estimating the PMF streamflow magnitude. The maximum PMF water level for the Guadalupe River at the VCS site has been determined to be at elevation 65.9 feet (20.1 meters) NAVD 88. Because the power block minimum finished site grade is at 95.0 feet (29.0 meters) NAVD 88, the PMF elevation would not cause a flooding risk to the power block.

The impacts of postulated dam failures on the VCS power block area are described in Subsection 2.4.4. Two aspects of flooding are considered. First, the flood elevation at the site is investigated as a result of dam failure in the Guadalupe River basin and its tributaries upstream of the site. The resulting water level at the site, including coincidental wind setup and wave run-up is predicted to be 68.4 feet (20.8 meters) NAVD 88. Second, the flood elevation at the site due to the failure of the cooling basin embankment is investigated. A maximum flood elevation of 91.0 feet (27.7 meters) NAVD 88 was determined at the VCS site as a result of the postulated cooling basin embankment breach. This flood level of 91.0 feet (27.7 meters) NAVD 88 also constitutes the design basis flooding elevation at the VCS site. As noted above, the power block minimum finished site grade is 95.0 feet (29.0 meters) NAVD 88, which is greater than the predicted maximum flood level.

Probable maximum surge and seiche flooding as a result of the probable maximum hurricane in the Gulf of Mexico is presented in Subsection 2.4.5. The maximum water level at the VCS site including the effects of wind setup and wave run-up is estimated to be elevation 69.6 feet (21.2 meters) NAVD 88. This predicted flood elevation is much lower than the minimum finished site grade of the power block (95.0 feet or 29.0 meters NAVD 88).

Subsection 2.4.6 describes the estimation of the probable maximum tsunami water level and includes the effects of landslide induced tsunami events. The maximum water level associated with a probable maximum tsunami at the VCS site is 11.4 feet (3.47 meters) NAVD 88. Therefore, the probable maximum tsunami would not be a flood risk to the VCS site.

As described in Subsections 2.4.7 and 2.4.9, it is unlikely that ice effects and channel diversions, respectively, would pose any flood risk to the VCS site.

2.4.2.3 Effects of Local Intense Precipitation

The basis for the local intense precipitation at the VCS site is the all-season, 1 square mile or point PMP as obtained from the U.S. National Weather Service Hydrometeorological Reports No. 51 and 52 (HMR 51 and HMR 52) (References 2.4.2-15 and 2.4.2-16). The estimated PMP depths presented in HMR 51 are for durations ranging from 6 to 72 hours, and for drainage areas ranging from 10 to 20,000 square miles. Using these depths, HMR 52 provides procedures for estimating short duration point (or 1 square mile) PMP depths for durations up to 1 hour. Figures 24 and 36 in HMR 52 provide point PMP depths of 19.4 inches (493 mm) for a 1-hour duration and 6.2 inches (157 mm) for a 5-minute duration. For flood assessment, more conservative values obtained by applying

the coefficients in Figure 23 of HMR 52 to the values shown in Figure 18 of HMR 51 can be considered for point PMP depths. Table 2.4.2-6 and Figure 2.4.2-4 present the more conservative 1-square-mile PMP depths and intensities for various durations at the VCS site. The 5-minute and 1-hour PMP depths are estimated to be 6.4 and 19.8 inches (163 and 503 mm), respectively.

The site layout and facilities at the VCS site, including the stormwater drainage system, have not been finalized for the ESP. The design of the stormwater drainage system would be conducted at the COL application stage to divert the runoff away from the power block area so that the peak discharges from the PMP would not flood or adversely impact safety-related facilities in the power block area. In addition, the stormwater drainage system will be designed in accordance with the applicable federal, state, and local stormwater management regulations.

2.4.2.4 References

2.4.2-1 U.S. Geological Survey, *Stream Gage Data, Stream Flow Records, Gage 08176500, Guadalupe River at Victoria, Texas*. Available at http://nwis.waterdata.usgs.gov/tx/nwis/nwisman/?site_no=08176500&agency_cd=USGS, accessed April 2008.

2.4.2-2 U.S. Geological Survey, *Stream Gage Data, Stream Flow Records, Gage 08188500*, San Antonio River at Goliad, Texas. Available at http://nwis.waterdata.usgs.gov/tx/nwis/nwisman/?site_no=08188500&agency_cd=USGS, accessed April 2008.

2.4.2-3 U.S. Geological Survey, *Stream Gage Data, Stream Flow Records, Gage 08177500, Coleto Creek near Victoria*, Texas. Available at http://nwis.waterdata.usgs.gov/tx/nwis/nwisman/?site_no=08177500&agency_cd=USGS, accessed April 2008.

2.4.2-4 U. S. Geological Survey, Fact Sheet FS-147-99, *Floods in the Guadalupe and San Antonio River Basins in Texas*, October 1998, September 1999.

2.4.2-5 U.S. Geological Survey, *Stream Gage Data, Stream Flow Records, Gage 08177520, Guadalupe River near Bloomington, Texas*. Available at http://nwis.waterdata.usgs.gov/tx/nwis/nwisman/?site_no=08177520&agency_cd=USGS, accessed June 2008.

2.4.2-6 U.S. Geological Survey, *Stream Gage Data, Stream Flow Records, Gage 08188800, Guadalupe River near Tivoli, Texas.* Available at http://nwis.waterdata.usgs.gov/tx/nwis/nwisman/?site_no=08188800&agency_cd=USGS, accessed June 2008.

2.4.2-7 U.S. Geological Survey, *Stream Gage Data, Stream Flow Records, Gage 08188570, San Antonio River near McFaddin, Texas.* Available at http://nwis.waterdata.usgs.gov/tx/nwis/nwisman/?site_no=08188570&agency_cd=USGS, accessed June 2008.

2.4.2-8 Blake, E. S., et al., *The Deadliest, Costliest, and Most Intense United States Tropical Cyclones from 1851 to 2006 (and Other Frequently Requested Hurricane Facts)*, NOAA Technical Memorandum NWS TPC-5, National Weather Service, National Hurricane Center, NOAA, April 2007.

2.4.2-9 National Oceanic and Atmospheric Administration, *NHC Archive of Hurricane Seasons, National Weather Service*, National Hurricane Center. Available at http://www.nhc.noaa.gov/pastall.shtml, accessed April 5, 2008.

2.4.2-10 Pararas-Karayannis, G., *Verification Study of a Bathystrophic Storm Surge Model*, Technical Memorandum No. 50, U.S. Army Corps of Engineers, May 1975.

2.4.2-11 National Oceanic and Atmospheric Administration, *Tides & Currents: Data Retrieval — Station Information Rockport, Texas*. Available at http://tidesandcurrents.noaa.gov/station_info.shtml?stn=8774770 Rockport, TX, accessed February 4, 2008.

2.4.2-12 National Oceanic and Atmospheric Administration, *Tides & Currents: Data Retrieval — Station Information, Corpus Christi, Texas.* Available at http://tidesandcurrents.noaa.gov/station_info.shtml?stn=8775870 Corpus Christi, TX, accessed February 4, 2008.

2.4.2-13 National Oceanic and Atmospheric Administration, *Tides & Currents: Data Retrieval — Station Information, Freeport*, Texas. Available at http://tidesandcurrents.noaa.gov/station_info.shtml?stn=8772440 Freeport, TX, accessed February 4, 2008.

2.4.2-14 American National Standards/American Nuclear Society, *American National Standard for Determining Design Basis Flooding at Nuclear Reactor Sites*, (proprietary), ANSI/ANS-2.8-1992, 1992.

2.4.2-15 National Oceanic and Atmospheric Administration, U.S. National Weather Service, *Probable Maximum Precipitation Estimates, United States East of the 105th Meridian*, Hydrometeorological Report No. 51, June 1978.

2.4.2-16 National Oceanic and Atmospheric Administration, U.S. National Weather Service, *Application of Probable Maximum Precipitation Estimates — United States East of the 105th Meridian*, Hydrometeorological Report No. 52, August 1992.

2.4.2-17 U. S. National Geodetic Survey, *National Vertical Datum Conversion Utility.* Available at http://www.ngs.noaa.gov/TOOLS/Vertcon/vertcon.html, accessed May 2008.

Table 2.4.2-1 (Sheet 1 of 3)
Annual Peak Discharges in the Guadalupe River at Victoria, Texas (USGS 08176500)

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[(a)]	Stream-flow (cfs)
1935	06/20/1935	29.72	29.44	38,500
1936	07/03/1936	31.22	30.94	179,000
1937	10/04/1936	26.77	26.49	17,200
1938	04/30/1938	28.75	28.47	25,400
1939	06/06/1939	14.52	14.24	4,940
1940	07/03/1940	29.67	29.39	55,900
1941	05/03/1941	29.73	29.45	58,000
1942	07/09/1942	29.80	29.52	56,000
1943	10/21/1942	18.80	18.52	7,710
1944	06/01/1944	23.94	23.66	12,300
1945	04/06/1945	28.57	28.29	22,000
1946	09/03/1946	27.70	27.42	17,900
1947	10/17/1946	29.55	29.27	46,000
1948	05/28/1948	17.50	17.22	6,970
1949	04/30/1949	28.53	28.25	20,600
1950	10/28/1949	24.95	24.67	13,300
1951	06/08/1951	23.96	23.68	12,300
1952	09/16/1952	29.46	29.18	28,400
1953	05/04/1953	23.19	22.91	11,600
1954	10/26/1953	19.68	19.40	8,560
1955	05/22/1955	14.83	14.55	4,950
1956	05/18/1956	7.46	7.18	1,730
1957	05/02/1957	29.92	29.64	35,300
1958	02/26/1958	30.28	30.00	58,300
1959	04/15/1959	22.33	22.05	10,100
1960	07/ 01/1960	29.06	28.78	23,700
1961	06/22/1961	30.35	30.07	55,800
1962	11/17/1961	23.11	22.83	10,800
1963	02/21/1963	13.22	12.94	4,100
1964	11/11/1963	16.19	15.91	5,720
1965	02/21/1965	27.30	27.02	15,000
1966	12/08/1965	21.99	21.71	9,790
1967	09/21/1967	30.67	30.39	70,000
1968	01/25/1968	29.72	29.44	44,300
1969	04/13/1969	27.13	26.85	15,200

Table 2.4.2-1 (Sheet 2 of 3)
Annual Peak Discharges in the Guadalupe River at Victoria, Texas (USGS 08176500)

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[(a)]	Stream-flow (cfs)
1970	05/20/1970	21.70	21.42	9,190
1971	09/12/1971	22.48	22.20	9,740
1972	05/16/1972	30.37	30.09	58,500
1973	06/17/1973	29.33	29.05	33,100
1974	10/16/1973	28.98	28.70	25,200
1975	05/29/1975	29.24	28.96	30,200
1976	04/19/1976	26.54	26.26	14,100
1977	04/24/1977	30.09	29.81	54,500
1978	09/14/1978	25.64	25.36	12,700
1979	05/12/1979	28.36	28.08	19,300
1980	05/19/1980	24.68	24.40	11,600
1981	09/02/1981	31.10	30.82	105,000
1982	05/19/1982	28.20	27.92	18,500
1983	11/20/1982	23.95	23.67	10,900
1984	10/21/1983	11.70	11.42	3,280
1985	04/21/1985	23.85	23.57	10,600
1986	11/29/1985	26.29	26.01	13,700
1987	06/07/1987	30.45	30.17	83,400
1988	11/28/1987	13.24	12.96	3,900
1989	05/21/1989	13.89	13.61	4,280
1990	09/12/1990	15.61	15.33	5,230
1991	04/05/1991	27.83	27.55	17,000
1992	12/25/1991	30.13	29.85	61,500
1993	06/30/1993	27.87	27.59	17,700
1994	05/19/994	26.04	25.76	13,300
1995	10/19/1994	29.37	29.09	39,600
1996	09/22/1996	22.71	22.43	9,760
1997	04/04/1997	29.07	28.79	32,700
1998	10/13/1997	28.30	28.02	20,600
1999	10/20/1998	34.04	33.76	466,000
2000	06/12/2000	17.54	17.26	6,220
2001	09/03/2001	29.36	29.08	39,300
2002	07/10/2002	30.32	30.04	71,700
2003	11/08/2002	29.99	29.71	58,500
2004	06/15/2004	27.48	27.20	16,100
2005	11/26/2004	30.90	30.62	102,000

Table 2.4.2-1 (Sheet 3 of 3)
Annual Peak Discharges in the Guadalupe River at Victoria, Texas (USGS 08176500)

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[(a)]	Stream-flow (cfs)
2006	07/06/2006	13.73	13.45	4,290
2007	07/03/2007	29.33	29.05	38,600

(a) Conversion based on datum shift of -0.282 feet at Lat. 28° 47' 34", Lon. 97° 00' 46" (Reference 2.4.2-17).

Source: Reference 2.4.2-1

Table 2.4.2-2 (Sheet 1 of 3)
Annual Peak Discharges in the San Antonio River at Goliad, Texas (USGS 08188500)

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[a]	Stream-flow (cfs)
1914	10/02/1913	44.90	44.68	33,800
1925	07/13/1925	11.90	11.68	1,830
1926	04/25/1926	31.00	30.78	11,900
1927	04/16/1927	22.50	22.28	5,410
1928	05/16/1928	19.00	18.78	3,880
1929	01/11/1929	31.79	31.57	13,100
1935	06/15/1935	44.90	44.68	33,800
1939	07/12/1939	11.22	11.00	1,900
1940	07/02/1940	31.37	31.15	11,600
1941	05/01/1941	34.55	34.33	15,700
1942	07/09/1942	44.90	44.68	33,800
1943	10/08/1942	25.51	25.29	7,330
1944	05/30/1944	29.01	28.79	9,880
1945	04/03/1945	21.84	21.62	5,170
1946	09/01/1946	41.66	41.44	25,500
1947	10/02/1946	42.67	42.45	29,400
1948	08/28/1948	29.41	29.19	10,200
1949	04/28/1949	33.76	33.54	14,100
1950	10/27/1949	24.04	23.82	6,420
1951	09/14/1951	26.90	26.68	8,370
1952	09/14/1952	39.82	39.60	23,900
1953	05/20/1953	28.76	28.54	8,560
1954	05/27/1954	12.77	12.55	2,050
1955	09/02/1955	13.83	13.61	2,320
1956	05/16/1956	14.33	14.11	2,420
1957	05/02/1957	31.56	31.34	10,300
1958	02/25/1958	36.21	35.99	16,000
1959	11/01/1958	22.82	22.60	5,220
1960	06/29/1960	23.28	23.06	5,440
1961	10/29/1960	31.62	31.40	11,300
1962	06/03/1962	23.16	22.94	5,660
1963	04/30/1963	10.36	10.14	1,680
1964	08/10/1964	20.03	19.81	4,360
1965	05/24/1965	30.79	30.57	10,600
1966	12/06/1965	18.52	18.30	3,880

Table 2.4.2-2 (Sheet 2 of 3)
Annual Peak Discharges in the San Antonio River at Goliad, Texas (USGS 08188500)

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[a]	Stream-flow (cfs)
1967	09/23/1967	53.70	53.48	138,000
1968	01/24/1968	41.98	41.76	25,900
1969	02/17/1969	24.93	24.71	6,380
1970	06/02/1970	25.28	25.06	6,100
1971	08/09/1971	22.01	21.79	4,970
1972	05/15/1972	34.16	33.94	12,800
1973	07/24/1973	34.53	34.31	14,900
1974	10/02/1973	40.09	39.87	21,800
1975	05/28/1975	27.48	27.26	8,660
1976	04/18/1976	29.00	28.78	9,780
1977	04/25/1977	36.07	35.85	15,900
1978	11/05/1977	23.99	23.77	6,770
1979	04/23/1979	28.34	28.12	9,310
1980	09/09/1980	25.68	25.46	8,240
1981	06/21/1981	31.96	31.74	12,800
1982	10/31/1981	24.49	24.27	7,460
1983	09/21/1983	23.43	23.21	6,960
1984	11/08/1983	14.94	14.72	3,120
1985	07/07/1985	21.44	21.22	5,990
1986	06/10/1986	29.45	29.23	10,700
1987	06/07/1987	43.08	42.86	33,200
1988	07/24/1988	11.08	10.86	1,850
1989	06/17/1989	11.30	11.08	1,920
1990	07/21/1990	27.66	27.44	9,480
1991	04/06/1991	25.92	25.70	8,330
1992	12/25/1991	41.58	41.36	27,500
1993	06/30/1993	35.37	35.15	16,200
1994	05/18/1994	28.71	28.49	10,200
1995	10/18/1994	28.50	28.28	10,100
1996	09/26/1996	13.09	12.87	2,460
1997	06/28/1997	31.78	31.56	12,600
1998	03/19/1998	18.78	18.56	4,610
1999	10/22/1998	51.78	51.56	59,200
2000	06/14/2000	16.82	16.60	4,070
2001	09/02/2001	41.97	41.75	27,200
2002	07/09/2002	52.81	52.59	70,600

Table 2.4.2-2 (Sheet 3 of 3)
Annual Peak Discharges in the San Antonio River at Goliad, Texas (USGS 08188500)

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[a]	Stream-flow (cfs)
2003	10/28/2002	36.13	35.91	18,000
2004	06/14/2004	31.43	31.21	13,000
2005	11/27/2004	40.42	40.20	23,400
2006	05/08/2006	12.04	11.82	2,280
2007	08/23/2007	38.52	38.30	20,800

(a) Conversion based on datum shift of -0.217 feet at Lat. 28° 38' 58", Lon. 97° 23' 04" (Reference 2.4.2-17).

Source: Reference 2.4.2-2

Table 2.4.2-3 (Sheet 1 of 2)
Annual Peak Discharges in Coleto Creek near Victoria, Texas (USGS 08177500)

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[a]	Stream-flow (cfs)
1939	07/12/1939	11.40	11.11	8,820
1940	06/30/1940	22.05	21.76	39,200
1941	11/25/1940	24.25	23.96	48,200
1942	07/06/1942	20.75	20.46	34,300
1943	05/31/1943	6.76	6.47	2,530
1944	03/18/1944	13.08	12.79	12,200
1945	04/20/1945	7.09	6.80	2,700
1946	05/23/1946	12.02	11.73	10,000
1947	10/16/1946	31.64	31.35	89,000
1948	05/24/1948	8.78	8.49	4,260
1949	04/26/1949	6.89	6.60	2,700
1950	10/26/1949	6.43	6.14	2,290
1951	09/13/1951	11.60	11.31	9,440
1952	05/28/1952	15.18	14.89	17,300
1953	08/30/1953	13.73	13.44	14,400
1954	05/25/1954	3.33	3.04	731
1967	1967	42.00	41.71	236,000
1979	05/11/1979	N/A	N/A	15,500
1980	01/20/1980	15.72	15.43	8,550
1981	09/01/1981	19.73	19.44	16,500
1982	10/31/1981	27.02	26.73	39,100
1983	11/19/1982	19.50	19.21	15,900
1984	03/12/1984	18.82	18.53	14,400
1985	07/04/1985	16.35	16.06	9,590
1986	06/13/1986	8.17	7.88	1,090
1987	06/11/1987	19.15	18.86	15,100
1988	11/25/1987	5.32	5.03	231
1989	04/30/1989	4.23	3.94	37
1990	07/17/1990	20.86	20.57	19,200
1991	04/05/1991	28.00	27.71	37,000
1992	04/17/1992	27.68	27.39	41,700
1993	05/05/1993	23.27	22.98	25,900
1994	05/14/1994	14.00	13.71	6,020
1995	10/18/1994	28.41	28.12	44,700
1996	08/30/1996	4.95	4.66	23
1997	04/04/1997	32.05	31.76	50,100

Table 2.4.2-3 (Sheet 2 of 2)
Annual Peak Discharges in Coleto Creek near Victoria, Texas (USGS 08177500)

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[(a)]	Stream-flow (cfs)
1998	10/13/1997	26.03	25.74	28,500
1999	10/18/1998	23.25	22.96	22,400
2000	06/12/2000	6.75	6.46	504
2001	09/01/2001	22.39	22.10	20,200
2002	12/02/2001	17.97	17.68	11,500
2003	10/25/2002	19.97	19.68	15,800
2004	05/14/2004	18.52	18.23	13,200
2005	11/21/2004	28.93	28.64	41,700
2006	06/01/2006	4.94	4.65	117
2007	07/02/2007	21.67	21.38	19,300

(a) Conversion based on datum shift of -0.217 feet at Lat. 28° 43' 51", Lon. 97° 08' 18" (Reference 2.4.2-17).

Source: Reference 2.4.2-3

Table 2.4.2-4
Annual Maximum Recorded Water Levels in Guadalupe River near Bloomington, Texas (USGS 08177520) Based on Incomplete Records

Water Year	Date	Gage Height (ft NGVD 29)	Gage Height (ft NAVD 88)[a]
1999	10/20/1998[b]	33.92	33.51
2000	06/14/2000	23.11	22.70
2001	09/01/2001	26.81	26.40
2002	07/10/2002	27.26	26.85
2003	11/09/2002	27.31	26.90
2004	05/15/2004	26.66	26.25
2005	11/26/2004	28.75	28.34
2006	06/02/2006	21.41	21.00
2007	07/03/2007	27.03	26.62

(a) Conversion based on datum shift of -0.407 feet at Lat. 28° 39' 43", Lon. 96° 57' 55" (Reference 2.4.2-17).
(b) Annual peak water level and historical peak water level.
Source: Reference 2.4.2-5

Table 2.4.2-5
Recorded Maximum Water Surface Elevations at Corpus Christi, Texas and Freeport, Texas Tide Gage Stations

	Corpus Christi, Texas				Freeport, Texas			
		Water Level		Coincident		Water Level		Coincident
Rank	Date	Station Datum[a] (ft)	NAVD 88[b] (ft)	Hurricane[c]	Date	Station Datum[a] (ft)	NAVD 88[b] (ft)	Hurricane[c]
1	09/10/1998 10:00	25.80	4.51	Tropical Storm Frances	07/15/2003 12:00	10.76	6.85	Hurricane Claudette
2	09/24/2005 04:30	25.73	4.44	Hurricane Rita	09/11/1998 02:42	9.95	6.04	Tropical Storm Frances
3	09/11/1998 00:00	25.60	4.31	Tropical Storm Frances	09/10/1998 10:42	9.27	5.36	Tropical Storm Frances
4	09/09/1998 23:54	25.57	4.28	Tropical Storm Frances	08/09/1980 00:00	9.00	5.09	Hurricane Allen
5	09/16/1988 18:18	25.52	4.23	Hurricane Gilbert	09/10/1971 00:00	8.59	4.68	Hurricane Edith

(a) In Station Datum.
(b) NAVD 88 Datum at Corpus Christi, Texas is 21.29 feet above the Station Datum. NAVD 88 Datum at Freeport, Texas is approximately 3.91 feet above the Station Datum.
(c) Coincident hurricanes are identified from NOAA historical hurricane database.
Source: References 2.4.2-9, 2.4.2-11, and 2.4.2-12

Table 2.4.2-6
VCS Site Short Duration Local PMP Depths

PMP Duration & Area	6-hour, 10 mi^2 Ratio	1-hour, Point Location Ratio	PMP Depth (in)	Intensity (in/hr)
6 hr, 10 mi^2			32.0	5.33
1 hr, point location	0.62		19.8	19.78
30 min, point		0.73	14.5	29.03
15 min, point		0.50	9.9	39.55
5 min, point		0.32	6.4	76.41

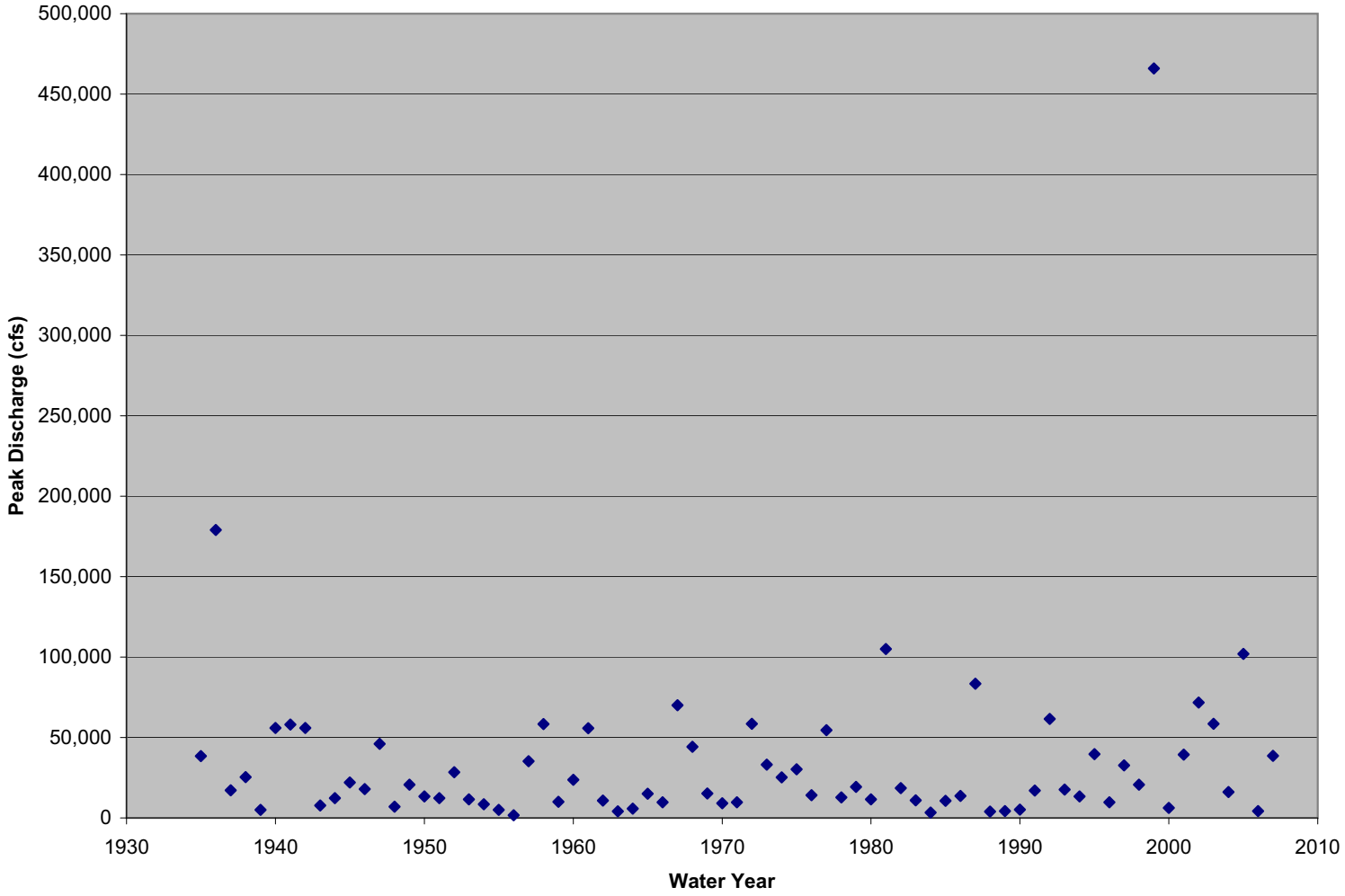

Figure 2.4.2-1 Annual Peak Discharges in the Guadalupe River at Victoria, Texas (USGS 08176500)

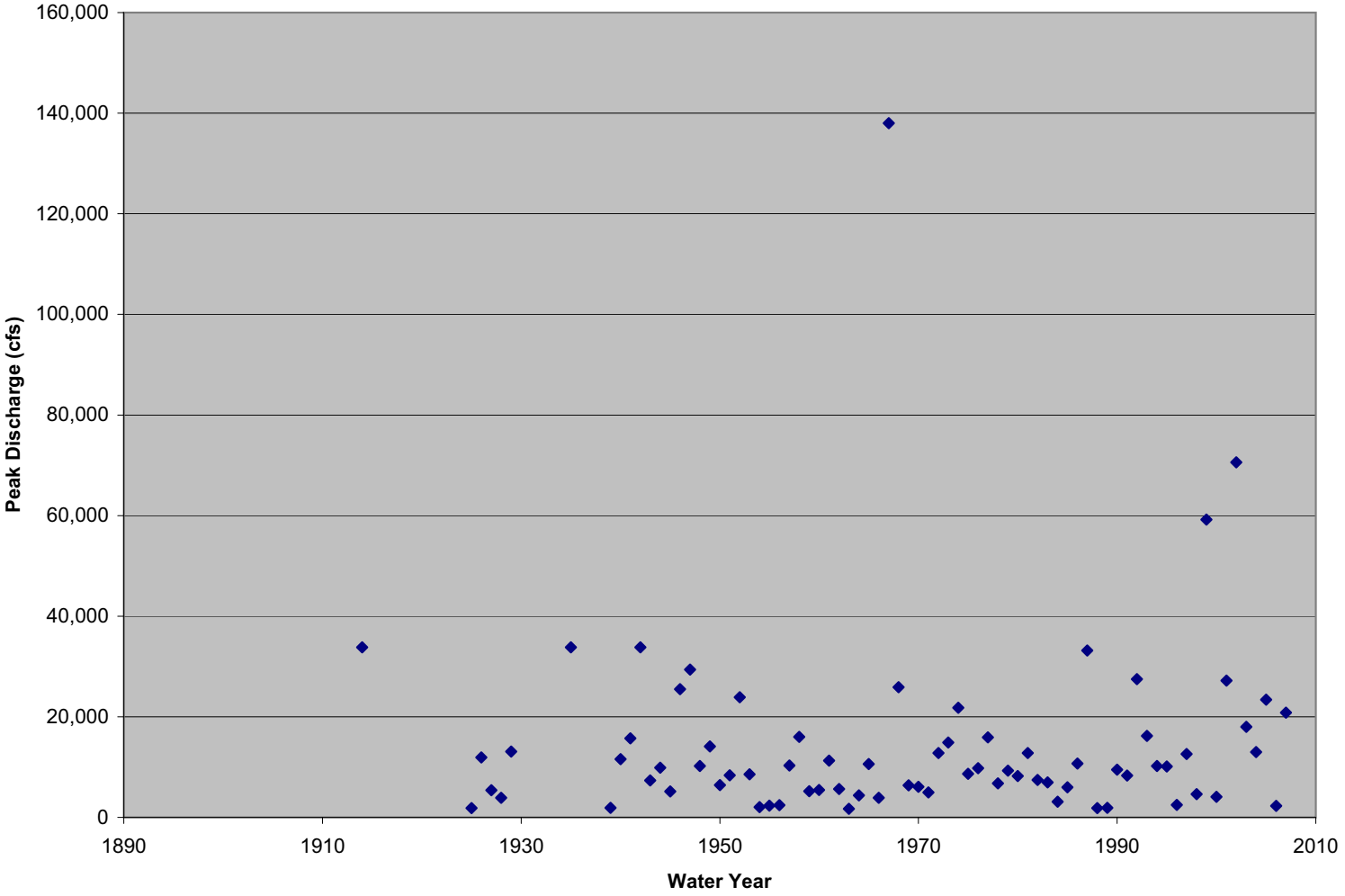

Figure 2.4.2-2 Annual Peak Discharges in the San Antonio River at Goliad, Texas (USGS 08188500)

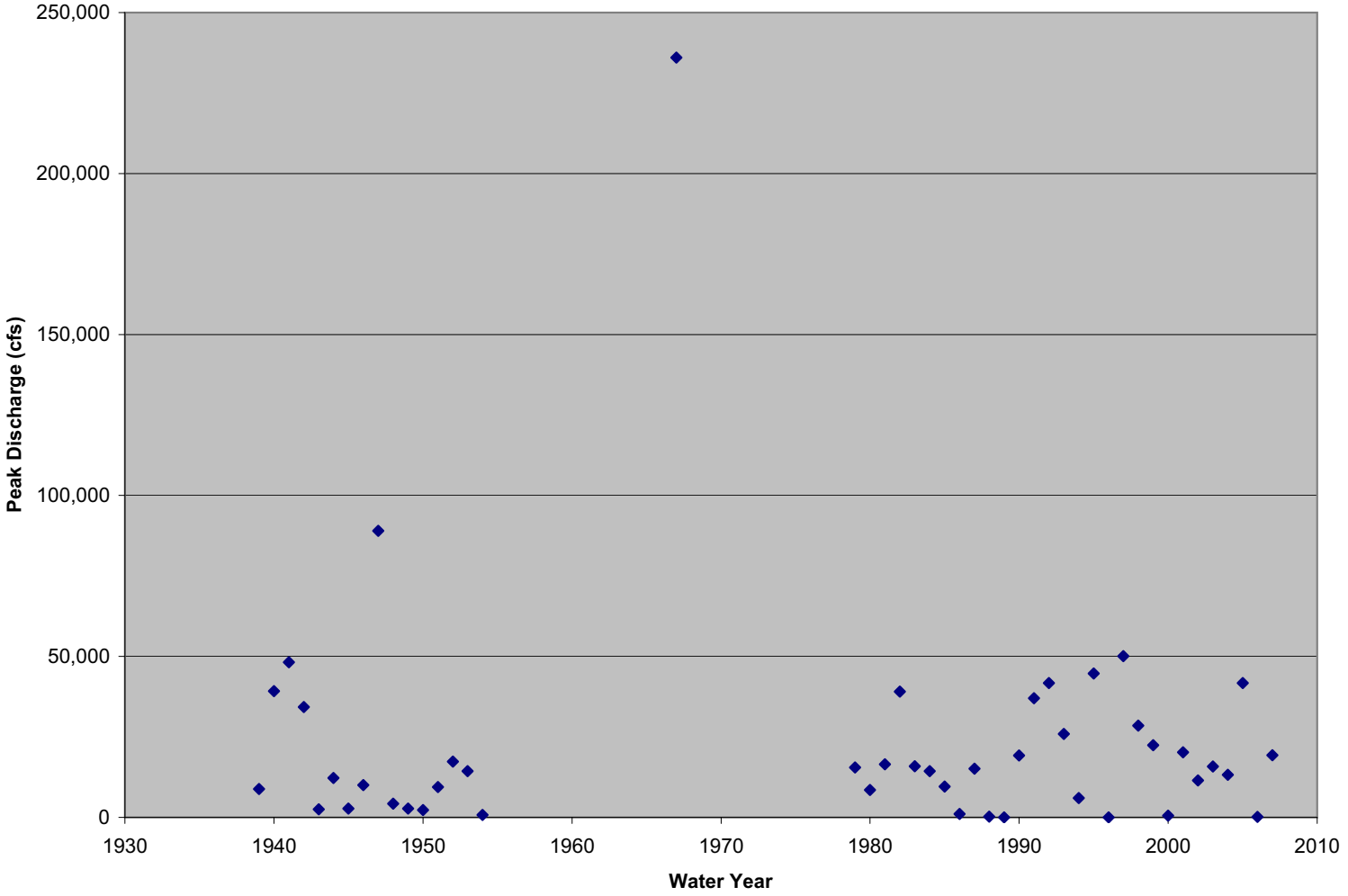

Figure 2.4.2-3 Annual Peak Discharges in Coleto Creek near Victoria, Texas (USGS 08177500)

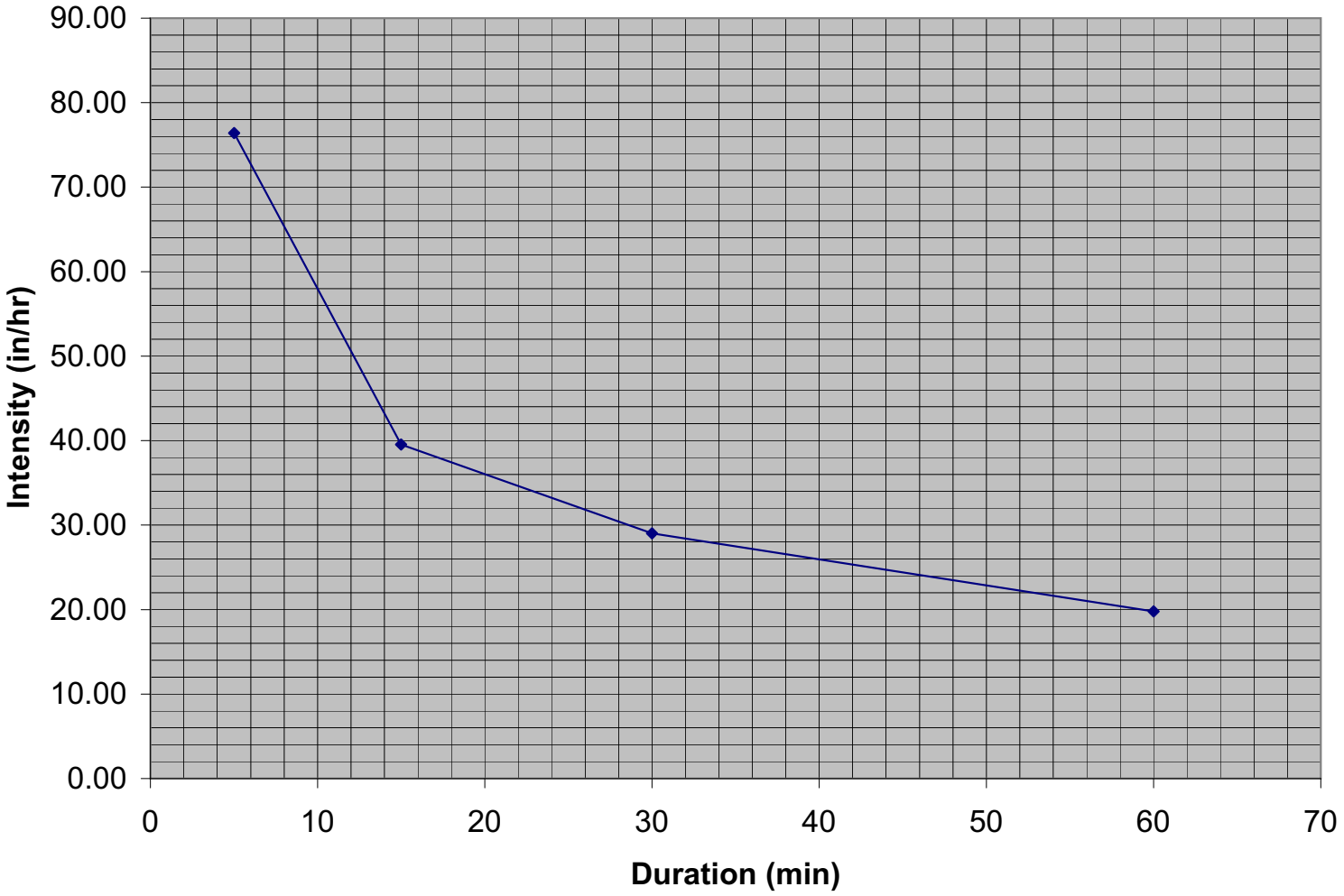

Figure 2.4.2-4 VCS Site Local PMP Intensity-Duration