2.4S.7 Ice Effects

The following site-specific supplement addresses COL License Information Item 2.16.

2.4S.7.1 Ice Conditions and Historical Ice Formation

The potential impact of ice effects on the STP 3 & 4 site was analyzed by evaluating air and water temperature data in the vicinity of the site. A review of historical air temperature data indicates that the climate in the vicinity of the site is temperate. There is also no record of ice formation that could affect the safety-related facilities at the site.

Water temperature data recorded at three Lower Colorado River Authority (LCRA) stations on the Lower Colorado River were analyzed to determine minimum water temperatures in the river. These LCRA stations include Bay City (Site #12284), Wharton (Site #12286), and Columbus (Site #12290) and they are located approximately 14, 37, and 71 miles from the STP 3 & 4 site, respectively (Reference 2.4S.7-1). This data covers the period from 1982 through 2006 for the river reach below Mansfield Dam, which is located upstream of the STP site, approximately 156 miles northwest of the site. The recorded surface water temperatures at the selected LCRA stations show that the water temperature has remained above the freezing point during this period as shown on Figure 2.4S.7-1. The minimum recorded daily water temperature at these stations was 41.2ºF (5.1ºC), which occurred on February 6, 1985. The recorded daily water temperature in the Main Cooling Reservoir (MCR) of the STP site was also analyzed to evaluate the potential ice effects at the site. Based on data collected during the 1997–2005 period, the water temperatures in the MCR, measured at the intake, ranged from 51.1º to 92.1ºF (10.6 to 33.4ºC), remaining well above the freezing point. The recorded intake water temperatures between 1997 and 2005 are shown in Figure 2.4S.7-2. Thus, it is concluded that there is no risk of ice formation and that flooding due to ice effects is not a potential hazard at the STP site.

Long-term air temperature records available at the STP site and the Bay City climate station show that the air temperature at the plant site rarely drops below the water freezing point. When freezing temperatures do occur they do not persist for long periods of time. Daily data from the STP site for the period 1990 to 2006 show that there was only one instance where the daily average air temperature was below the water freezing point for three consecutive days (see Table 2.4S.7-1). Daily data from the Bay City climate station for the period 1942 to 2006 show that over this 65-year period, there was only one instance where the daily average air temperature was below the water freezing point for five consecutive days, two instances that the daily average air temperature was below the water freezing point for four consecutive days, and four instances that it was below the water freezing point for three consecutive days (see Table 2.4S.7-2). This data suggests that conditions conducive to ice formation rarely occur, and when they do occur, they do not persist for more than a few days.

2.4S.7.2 Ice Jam Events

There are no records of ice jams on the Lower Colorado River based on a search of the “Ice Jam Database” of the U.S. Army Corps of Engineers (Reference 2.4S.7-2).

As shown in Figure 2.4S.7-1, the water temperatures in the Lower Colorado River never approached freezing during the 1982–2006 period of record. Therefore, the formation of frazil and anchor ice at the river intake to the Reservoir Makeup Pumping Facility is highly unlikely. In addition, the large dams and reservoirs on the Colorado River located upstream of the STP site reduce the possibility of any surface ice or ice flows moving downstream.

2.4S.7.3 Effect of Ice on Cooling Water Systems

The ultimate heat sink (UHS) for STP 3 & 4 consists of a storage basin and mechanical draft cooling towers. The basin contains adequate inventory to meet the cooling requirements for 30 days following a design basis accident without receiving any makeup water. The UHS and Reactor Service Water (RSW) systems are designed to remove heat from the closed loop Reactor Building Cooling Water system and dissipate the gained heat to the atmosphere during normal; hot standby, normal shutdown, startup, loss of preferred power, and emergency shutdown operating modes. The UHS is designed with a provision to bypass the cooling tower during cold weather operation. Ice formation in the basin is not expected to occur since the system is in service during the above operating modes and the climate in the vicinity of the site is temperate.

If conditions were to occur that could lead to ice formation in the storage basin, operational controls together with system design features would prevent any potential ice formation in the tower basins as discussed in Subsection 9.2.5.

2.4S.7.4 References

2.4S.7-1 Lower Colorado River Authority (LCRA), website on water quality information for the entire Colorado River Basin. Available at http://waterquality.lcra.org/, accessed February 15, 2007.

2.4S.7-2 “Ice Jam Database,” U.S. Army Corps of Engineers, Cold Region Research and Engineering Laboratory (CRREL). Available at http://www.crrel.usace.army.mil/ierd/ijdb/, accessed February 10, 2007.

Table 2.4S.7-1 Lowest Average Daily Temperature and Number of Days with Average Daily Temperature below Freezing at STP Site

Year	Lowest Average Daily Temperature		Date Lowest Average Daily Temperature Occurred	No. of Consecutive Freezing Days	Total No. of Freezing Days
	°F	°C			
1990	27.2	-2.6	12/21/90	2	2
1991	35.6	2.0	12/15/91	0	0
1992	42.1	5.6	7/11/92	0	0
1993	35.9	2.2	10/25/93	0	0
1994	39.7	4.3	12/1/94	0	0
1995	37.3	3.0	11/8/95	0	0
1996	26.4	-3.1	1/8/96	3	4
1997	30.9	-0.6	1/13/97	0	1
1998	35.5	1.9	12/25/98	0	0
1999	36.3	2.4	1/4/99	0	0
2000	36.6	2.5	12/12/00	0	0
2001	34.3	1.3	1/3/01	0	0
2002	35.5	1.9	1/2/02	0	0
2003	37.4	3.0	2/24/03	0	0
2004	32.6	0.4	12/24/04	0	0
2005	42.2	5.7	1/22/05	0	0
2006	38.6	3.7	2/18/06	0	0
			Average (days)	0.3	0.4

Table 2.4S.7-2 Lowest Average Daily Temperature and Number of Days with Average Daily Temperature below Freezing at Bay City Climate Station

Year	Lowest Average Daily Temperature		Date Lowest Average Daily Temperature Occurred	No. of Consecutive Freezing Days	Total No. of Freezing Days
	°F	°C			
1942	40.5	4.7	12/28/1942	0	0
1943	31.5	-0.3	1/26/1943	0	1
1944	35.5	1.9	1/14/1944	0	0
1945	35.5	1.9	12/20/1945	0	0
1946	34.5	1.4	12/30/1946	0	0
1947	28	-2.2	1/4/1947	1	2
1948	25.5	-3.6	1/29/1948	3	5
1949	25.5	-3.6	1/30/1949	0	1
1950	28.5	-1.9	12/7/1950	0	1
1951	20	-6.7	2/2/1951	3	5
1952	42	5.6	11/30/1952	0	0
1953	30.5	-0.8	12/24/1953	0	1
1954	30	-1.1	1/22/1954	0	1
1955	36	2.2	3/27/1955	0	0
1956	34	1.1	2/4/1956	0	0
1957	33	0.6	1/17/1957	0	0
1958	30	-1.1	2/13/1958	0	1
1959	29.5	-1.4	1/5/1959	0	1
1960	33	0.6	2/25/1960	0	0
1961	34.5	1.4	1/29/1961	0	0
1962	22.5	-5.3	1/11/1962	1	2
1963	24.5	-4.2	1/13/1963	3	7
1964	29.5	-1.4	1/14/1964	0	1
1965	34.5	1.4	2/25/1965	0	0
1966	28.5	-1.9	1/30/1966	0	1
1967	33.5	0.8	2/7/1967	0	0
1968	34	1.1	1/8/1968	0	0
1969	36	2.2	1/5/1969	0	0
1970	31	-0.6	1/7/1970	0	1

Table 2.4S.7-2 Lowest Average Daily Temperature and Number of Days with Average Daily Temperature below Freezing at Bay City Climate Station (Continued)

1971	31.5	-0.3	1/8/1971	0	1
1972	32	0.0	1/5/1972	0	0
1973	25.5	-3.6	1/12/1973	4	5
1974	27	-2.8	1/4/1974	0	1
1975	27.5	-2.5	1/13/1975	0	1
1976	29.5	-1.4	11/29/1976	0	1
1977	31.5	-0.3	1/19/1977	0	1
1978	28	-2.2	1/21/1978	1	2
1979	26	-3.3	1/2/1979	1	3
1980	31	-0.6	3/2/1980	0	1
1981	30.5	-0.8	2/12/1981	0	1
1982	27	-2.8	1/14/1982	0	3
1983	20.5	-6.4	12/25/1983	5	6
1984	31	-0.6	1/20/1984	1	2
1985	23.5	-4.7	2/2/1985	3	6
1986	36.5	2.5	2/12/1986	0	0
1987	56.5	13.6	2/10/1987	0	0
1988	42.5	5.8	12/17/1988	0	0
1989	16.5	-8.6	12/23/1989	4	6
1990	23	-5.0	12/23/1990	1	2
1991	35	1.7	1/1/1991	0	0
1992	36.5	2.5	11/27/1992	0	0
1993	34	1.1	11/27/1993	0	0
1994	34	1.1	2/2/1994	0	0
1995	40	4.4	1/5/1995	0	0
1996	31.5	-0.3	1/8/1996	0	1
1997	31.5	-0.3	1/14/1997	0	1
1998	35.5	1.9	12/24/1998	0	0
1999	36	2.2	1/3/1999	0	0
2000	37.5	3.1	12/13/2000	0	0
2001	34.5	1.4	1/2/2001	0	0
2002	35	1.7	2/27/2002	0	0

Table 2.4S.7-2 Lowest Average Daily Temperature and Number of Days with Average Daily Temperature below Freezing at Bay City Climate Station (Continued)

2003	40.5	4.7	1/18/2003	0	0
2004	33.5	0.8	12/26/2004	0	0
2005	33	0.6	12/9/2005	0	0
2006	40.5	4.7	2/19/2006	0	0
			Average (days)	0.5	1.2

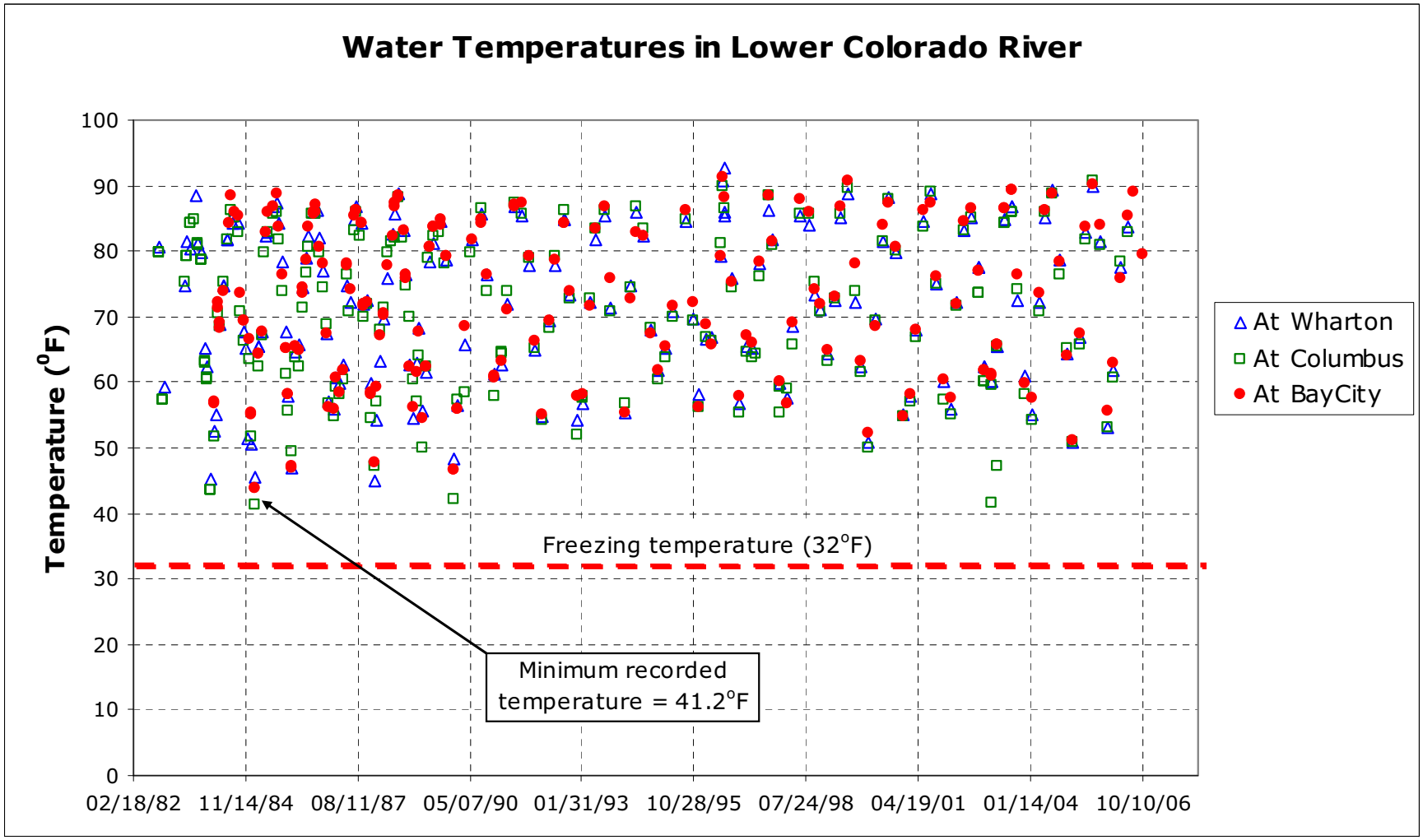

Figure 2.4S.7-1 Recorded Water Temperatures in Lower Colorado River

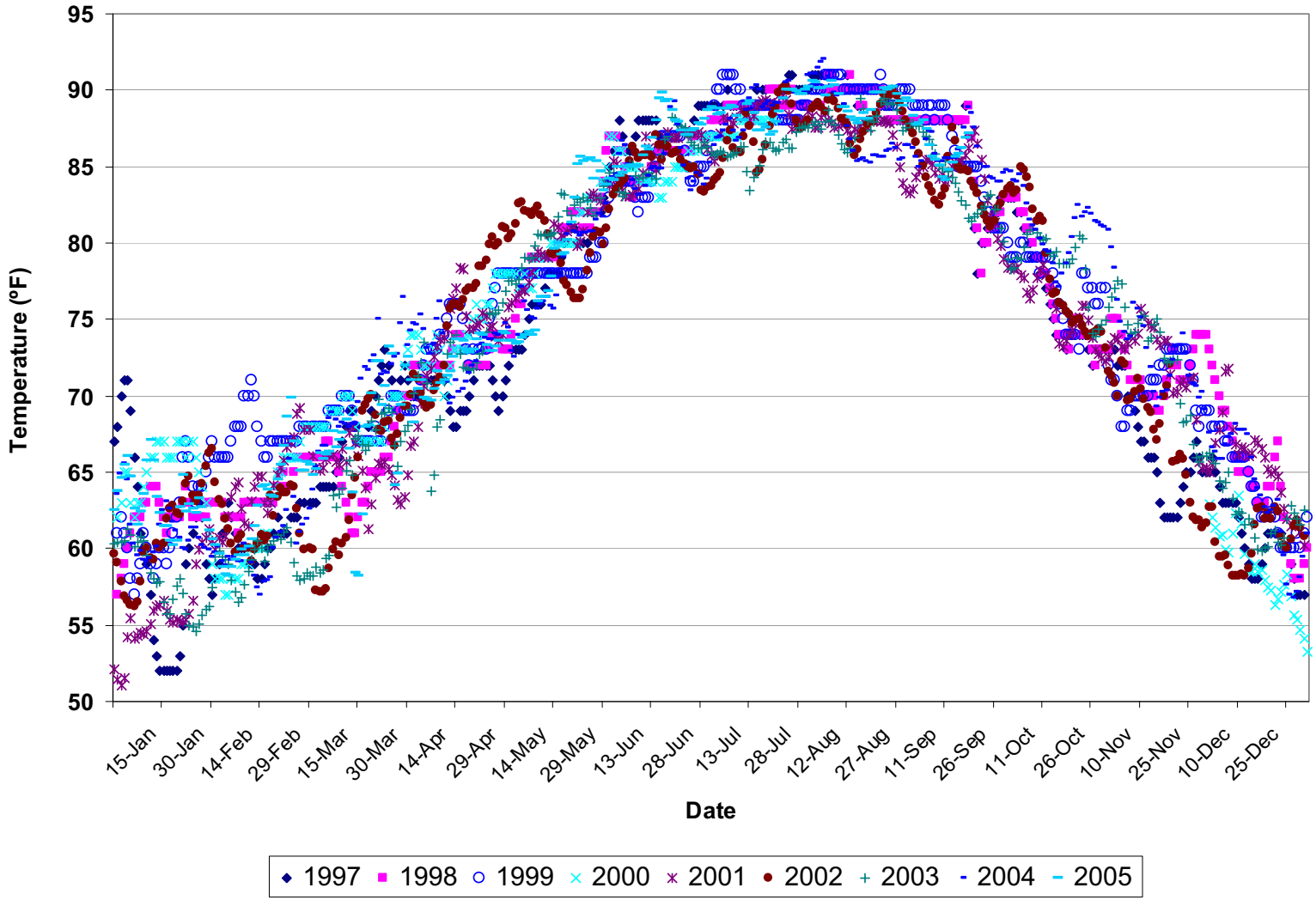

Figure 2.4S.7-2 Recorded Water Temperatures at the MCR Intake