

### 3. Centerville Lake

Centerville Lake is located in both the City of Lino Lakes and the City of Centerville. It has a surface area of approximately 495 acres, and a relatively small drainage area of 799 acres. The ordinary high water level, as recorded by the Minnesota DNR is 885.0 (NGVD 29). Centerville Lake's primary inlet and outlet is a 48-inch equalizing culvert it shares with Peltier Lake at elevation 876.01 NGVD 29 or 876.16 NAVD 88. In 1896, the St. Paul Water Utility constructed the Centerville Pumping Station which pumped water to Deep Lake as part of the of the City of St. Paul water supply system until 1984.

The DNR Lake Finder website provided lake level data for a spotty period of record from 1989-1996. The City of St. Paul provided daily lake level data from February 1988 to December 1999 (see **Figure 3a1**). The City of St. Paul uses a factor of 694.1 feet to convert from the City datum to NGVD 1929. The DNR uses 693.7 feet. In order to compare the data between the two sources, 693.7 feet was subtracted from the DNR data, and 694.1 was added back in. On 298 days, lake level data is available from both sources. The DNR data is consistently higher than the City of St. Paul data, mostly by 0.27 feet, but the difference ranges, varying up to 0.5 feet throughout 1989. For these overlapping 298 data points, the City's data was adopted for this study.

In the 1981 FIS, records from 1948 to 1979 obtained from the St. Paul Water Utility were used for the exceedance probability of each of the annual high water elevations. The measured data is no longer available, but the selected annual maximums are provided in the report (see **Figure 3a2**). One very low value from 1959, which is over 3 feet lower than any other value, was excluded from this study because the measurement was taken in December and because there is no longer any data available to verify that this was truly the annual maximum. The 1981 FIS analysis also excluded this point when creating the stage-frequency curve.

The following information regarding pumping of Centerville Lake for the City of St. Paul water supply system is found in the 1980 hydrologic report<sup>1</sup> used in the 1981 FIS study:

"....Its largest inflow is through the culverts connecting it to Peltier Lake. Flowing wells along the south shore of the lake and runoff from the immediate area provide additional inflow. In 1896 the St. Paul Water Utility constructed the Centerville Pumping Station on the south shore of the lake and began pumping water from Centerville Lake to Deep Lake where it flows by gravity to the St. Paul Filter Plant and Pump Station located on Rice Street in the City of Maplewood. The Centerville Pump Station contains two pumps with a combined pumping rate of 40 million gallons daily. Pumping rates vary from month to month and from year to year. A review of pumping records from 1972 to 1979 showed yearly pumping rates to vary from 4,409 to 16, 964 acre-feet. Pumping has a significant effect on the level of Centerville Lake..."

Although the pumping, which ceased in the spring of 1984, would have affected daily lake levels, it is not conclusive to what extent it affected annual maximum lake levels. The City of St. Paul no longer has

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<sup>1</sup> "Final Hydrologic Report, City of Lino Lakes, Anoka County, Minnesota," from May 7, 1980 (prepared by Toltz, King, Duvall, Anderson and Associates).

pumping records available prior to 1981, so an accurate analysis of the effects of pumping on annual maximum lake level is not possible. **Figure 3a2** shows that the annual maximum lake levels listed in the 1981 FIS, as well as the maximum lake levels in those years after pumping ceased in 1984, generally lie between 885.0 and 886.0.

Because the data available does not indicate that the annual maximum lake levels are greatly affected by pumping, the maximum annual series including all of the 40 data points, from both the 1981 FIS and the City of St. Paul, as shown in **Figure 3a2**, was used for this analysis. **Figure 3b1** shows the data plotted on probability paper, and a polynomial line fit to the data to determine the elevations for the various recurrence intervals. **Figure 3b1** also demonstrates that if all of the 1981 FIS annual maximum lake levels (measured prior to 1984 when all pumping ceased) were excluded from the frequency analysis, there would be only 11 years of annual maximum values from the City which could be plotted. The 11 points do not appear to provide for a reliable curve, and if the data is extrapolated, a 100-year annual flood elevation of nearly 889.0 would result, over a foot higher than that estimated for Peltier Lake (See Section 9. Peltier Lake). The estimation made by plotting all annual maxima available appears to provide for a more reasonable result of 887.8.

The estimated flood elevations are shown in **Table 3a**. The 100-year flood elevation was estimated using the polynomial equation. Insufficient lake level data and information on potential overflow elevations are available to provide a reliable estimate of the 500-year flood elevation.

Both the maximum annual series used in the 1981 FIS analysis and the combined data (1981 FIS and City data) are plotted on **Figure 3b1**. The difference in results shown in **Table 3a**, are the result of both a different maximum annual series (length of data set) and the fact that in the 1981 study, a straight line was fitted through the points, as opposed to the graphically fitted line in this study.

A comparison between the annual maximums of the two lakes is worth consideration due to the 48-inch culvert between Centerville Lake and Peltier Lake, and the fact that both lakes are controlled by the dam on Peltier Lake (@ 884.93 NGVD 1929). **Figure 3b2** shows that the annual maximums for both lakes are, for the most part, within ½ foot of each other. If pumping records ever become available which show that pumping does indeed significantly affect Centerville Lake's annual maximum levels, an alternative estimate for Centerville Lake's flood elevations would be to assume those of Peltier Lake.

An additional component of this study consists of creating a non-exceedance frequency graph based on all daily measurements available (see **Figure 3c**). For Centerville Lake, the period of record consists of the data received from the City of St. Paul, which consists of 4,354 days of measurements, from 1988 to 1999 (see **Figure 3a**). The results are presented in **Table 3b**.

**Table 3a: Estimated Flood Elevations for Centerville Lake**

Return Period	Lake Level Data Source		
	1981 FIS (n = 28)	DNR (used in this study) (n = 40)	
	(NGVD 29)	(NGVD 29)	(NAVD 88)*
2	--	885.3	885.5
5	--	885.6	885.8
10	885.80	886.0	886.1
50	886.15	887.1	887.2
100	886.25	887.8	887.9
500	886.50	--	--

\*0.15 feet is added to NGVD 29 datum to convert to NAVD 88 datum

**Table 3b: Daily Non-Exceedance Frequency of Lake Levels for Centerville Lake**

Non-Exceedance Frequency	Lake Level	
	(NGVD 1929)	(NAVD 1988)
2.5%	881.6	881.8
10%	883.9	884.1
25%	884.6	884.7
50%	884.7	884.9
75%	884.9	885.0
90%	885.1	885.2
99.5%	887.1	887.3

## Centerville Lake Levels

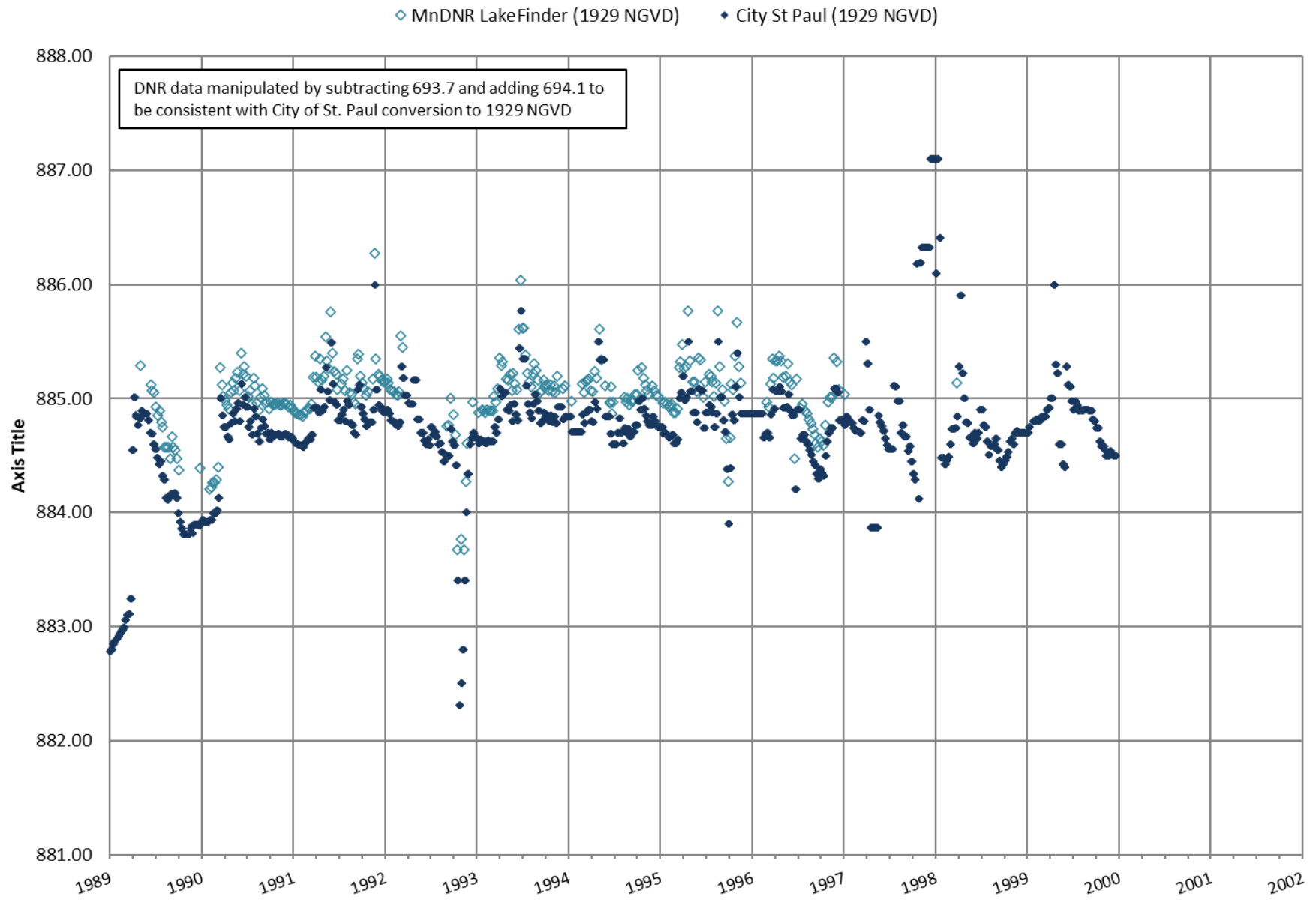


Figure 3a1

## Centerville Lake Levels

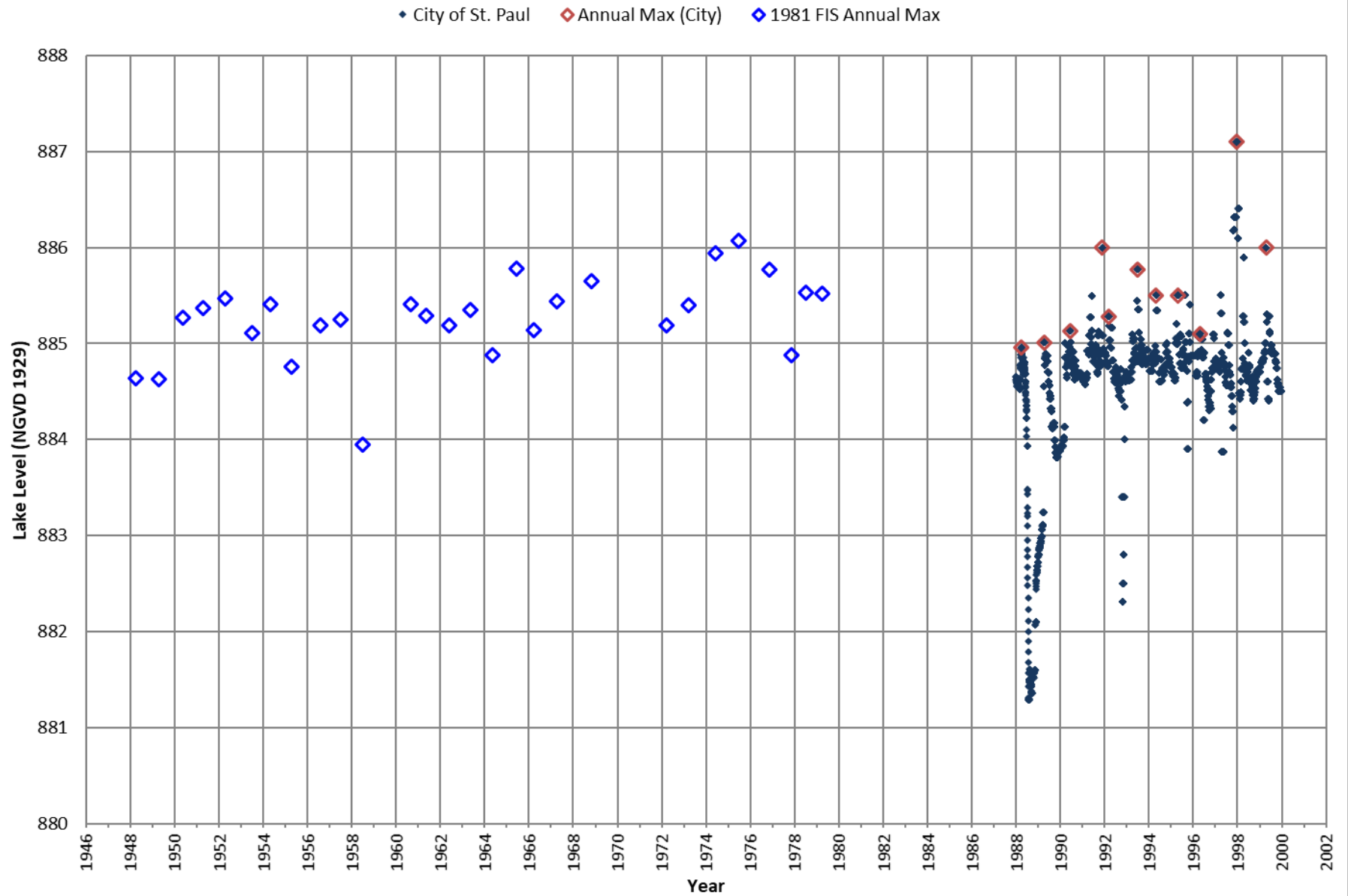
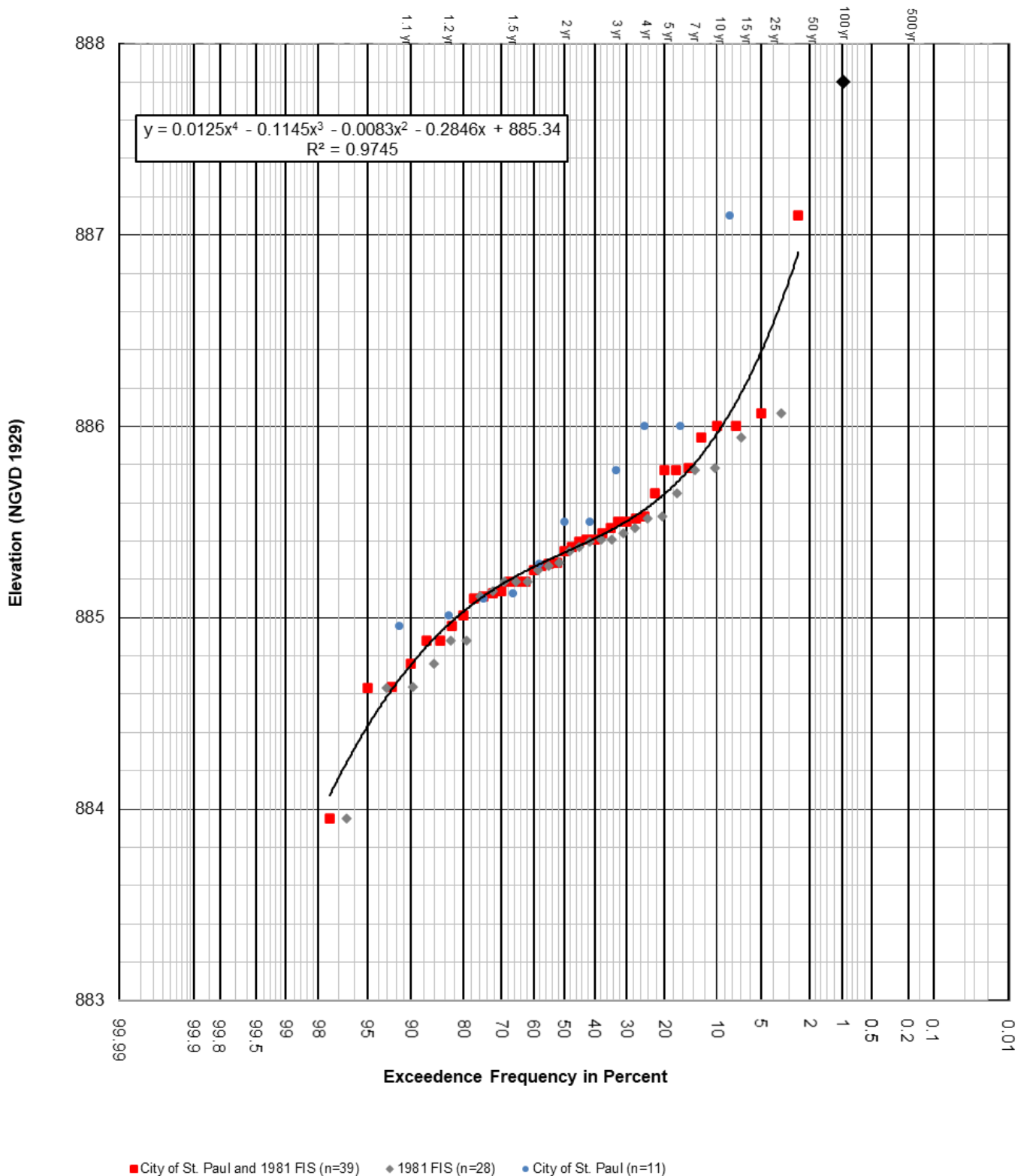


Figure 3a2

# **Centerville Lake Levels (NGVD 1929)** **Maximum Annual Series Frequency Curve** **(Weibull Plotting Positions)**



## **Outlet:**

48-inch RCP equalizing culvert to Peltier Lake @ 876.01 (NGVD 29), 876.16 (NAVD 88)  
Peltier Dam @ 884.63 (NGVD 29), 884.78 (NAVD 88)

**Figure 3b1**

## Annual Maximums for Peltier and Centerville Lake

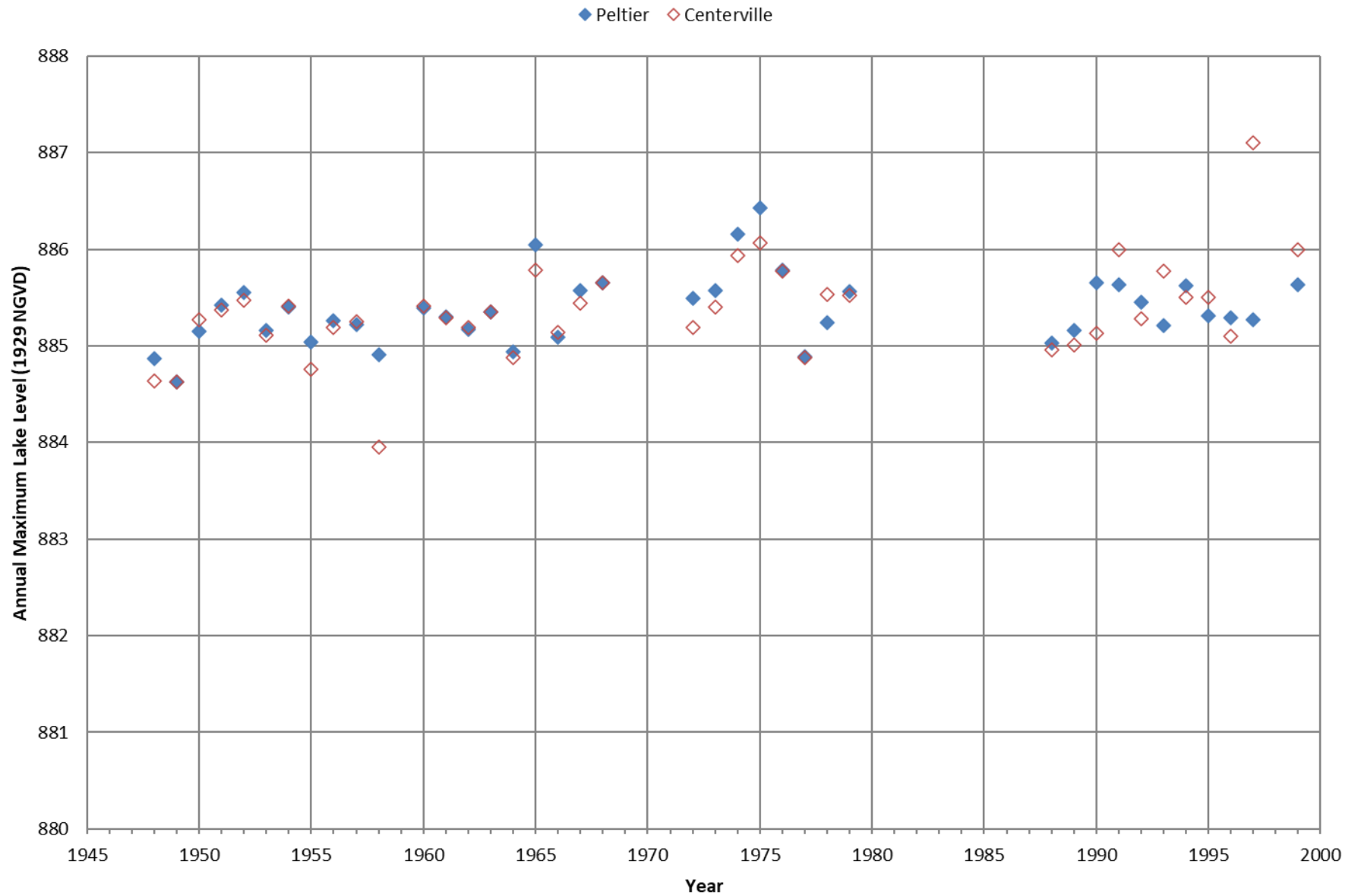


Figure 3b2

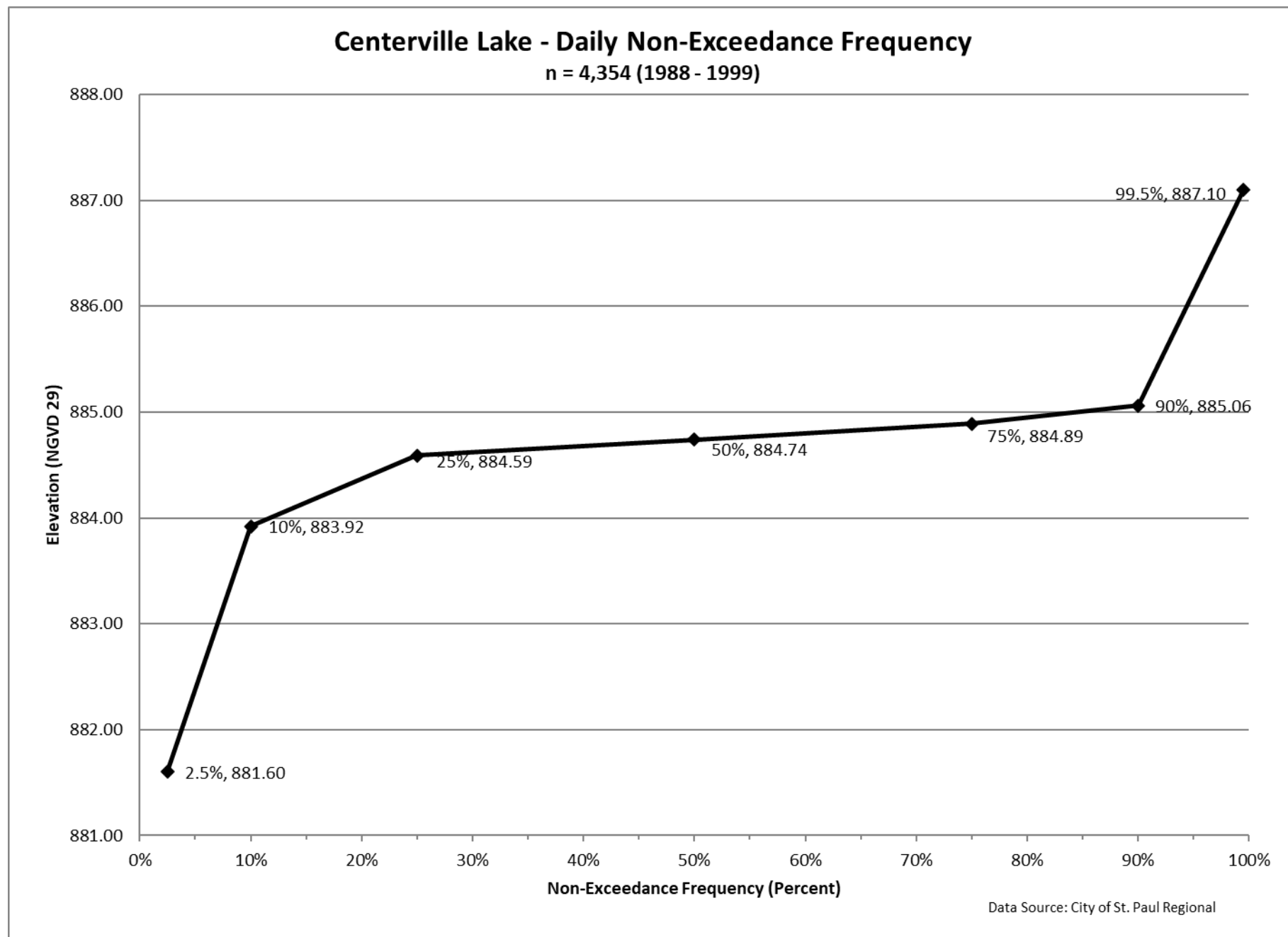


Figure 3c