

## Annual Peak-Flow Frequency Analysis

For more information on the contents of this documentation, see Kessler and others (2013).

### Streamgauge number and name:

05078500 Clearwater River at Red Lake Falls, Minn.

### Peak-flow information:

|   |        |
|---|--------|
| Number of systematic peak flows in record | 85     |
| Systematic period begins                  | 1910   |
| Systematic period ends                    | 2011   |
| Length of systematic record               | 102    |
| Years without information                 | 17     |
| Number of historical peak flows in record | 1 1919 |

### Frequency analysis options:

|                                    |                                  |
|------------------------------------|----------------------------------|
| Method                             | Expected moments algorithm (EMA) |
| Skew option                        | Weighted                         |
| Generalized skew                   | -0.47                            |
| Standard error of generalized skew | 0.4266                           |
| Low-outlier method                 | Single Grubbs-Beck test          |

### EMA systematic record analysis results:

#### Moments of the common logarithms of the peak flows:

|        | Standard  |          |
|--------|-----------|----------|
| Mean   | deviation | Skewness |
| 3.5105 | 0.3233    | -0.301   |

#### Low-outlier information:

|                        |     |
|------------------------|-----|
| Number of low outliers | 0   |
| Low-outlier threshold  | 652 |

**Final analysis results:**

**Moments of the common logarithms of the peak flows:**

|        | Standard  |          |
|--------|-----------|----------|
| Mean   | deviation | Skewness |
| 3.5105 | 0.3233    | -0.351   |

**Annual frequency curve at selected exceedance probabilities:**

[WIE, Weighted independent estimate; --, not computed]

| Exceedance<br>probability | Peak<br>estimate | Lower-95<br>level | Upper 95<br>level | WIE<br>estimate | Lower-95<br>WIE level | Upper 95<br>WIE level |
|---------------------------|------------------|-------------------|-------------------|-----------------|-----------------------|-----------------------|
| 0.9950                    | 373              | 151               | 572               | --              | --                    | --                    |
| 0.9900                    | 474              | 223               | 688               | --              | --                    | --                    |
| 0.9500                    | 888              | 576               | 1,150             | --              | --                    | --                    |
| 0.9000                    | 1,220            | 887               | 1,520             | --              | --                    | --                    |
| 0.8000                    | 1,760            | 1,400             | 2,120             | --              | --                    | --                    |
| 0.6667                    | 2,440            | 2,010             | 2,900             | --              | --                    | --                    |
| 0.5000                    | 3,380            | 2,850             | 4,000             | 3,290           | 2,800                 | 3,860                 |
| 0.4292                    | 3,860            | 3,260             | 4,560             | --              | --                    | --                    |
| 0.2000                    | 6,120            | 5,190             | 7,300             | 5,960           | 5,080                 | 7,000                 |
| 0.1000                    | 8,140            | 6,850             | 10,100            | 7,920           | 6,640                 | 9,450                 |
| 0.0400                    | 10,900           | 8,900             | 14,400            | 10,500          | 8,460                 | 13,000                |
| 0.0200                    | 12,900           | 10,300            | 18,300            | 12,400          | 9,630                 | 16,100                |
| 0.0100                    | 15,100           | 11,500            | 22,700            | 14,400          | 10,700                | 19,400                |
| 0.0050                    | 17,300           | 12,600            | 27,700            | --              | --                    | --                    |
| 0.0020                    | 20,200           | 13,900            | 35,500            | 18,900          | 12,600                | 28,300                |

**Peak-flow data used in the analysis:**

Explanation of symbols and codes

-- none

H Historic, outside of systematic record

| Water                    | Peak  | Peak-flow | Water | Peak   | Peak-flow |
|--------------------------|-------|-----------|-------|--------|-----------|
| year                     | flow  | code      | year  | flow   | code      |
| 1910                     | 1,960 | --        | 1961  | 884    | --        |
| 1911                     | 793   | --        | 1962  | 8,600  | --        |
| 1912                     | 1,110 | --        | 1963  | 2,300  | --        |
| 1913                     | 3,320 | --        | 1964  | 3,050  | --        |
| 1914                     | 1,340 | --        | 1965  | 8,680  | --        |
| 1915                     | 3,320 | --        | 1966  | 8,920  | --        |
| 1916                     | 3,990 | --        | 1967  | 5,820  | --        |
| 1917                     | 1,250 | --        | 1968  | 3,550  | --        |
| Gap in systematic record |       |           | 1969  | 9,740  | --        |
| 1919                     | 6,700 | H         | 1970  | 5,630  | --        |
| Gap in systematic record |       |           | 1971  | 3,500  | --        |
| 1935                     | 696   | --        | 1972  | 6,720  | --        |
| 1936                     | 1,260 | --        | 1973  | 2,900  | --        |
| 1937                     | 1,010 | --        | 1974  | 6,920  | --        |
| 1938                     | 2,220 | --        | 1975  | 7,310  | --        |
| 1939                     | 830   | --        | 1976  | 3,120  | --        |
| 1940                     | 3,100 | --        | 1977  | 866    | --        |
| 1941                     | 3,290 | --        | 1978  | 9,890  | --        |
| 1942                     | 2,200 | --        | 1979  | 10,300 | --        |
| 1943                     | 2,780 | --        | 1980  | 1,910  | --        |
| 1944                     | 3,210 | --        | 1981  | 3,160  | --        |
| 1945                     | 2,680 | --        | 1982  | 4,160  | --        |
| 1946                     | 3,380 | --        | 1983  | 3,190  | --        |
| 1947                     | 5,430 | --        | 1984  | 5,450  | --        |
| 1948                     | 3,000 | --        | 1985  | 7,120  | --        |
| 1949                     | 3,360 | --        | 1986  | 3,720  | --        |
| 1950                     | 9,310 | --        | 1987  | 2,170  | --        |
| 1951                     | 2,880 | --        | 1988  | 2,270  | --        |
| 1952                     | 2,550 | --        | 1989  | 2,550  | --        |
| 1953                     | 1,120 | --        | 1990  | 652    | --        |
| 1954                     | 2,540 | --        | 1991  | 1,040  | --        |
| 1955                     | 3,660 | --        | 1992  | 1,640  | --        |
| 1956                     | 5,560 | --        | 1993  | 3,200  | --        |
| 1957                     | 6,840 | --        | 1994  | 5,350  | --        |
| 1958                     | 1,320 | --        | 1995  | 3,110  | --        |
| 1959                     | 1,060 | --        | 1996  | 9,400  | --        |
| 1960                     | 1,600 | --        | 1997  | 7,860  | --        |

| Water<br>year | Peak<br>flow | Peak-flow<br>code |
|---------------|--------------|-------------------|
| 1998          | 6,340        | --                |
| 1999          | 6,020        | --                |
| 2000          | 3,410        | --                |
| 2001          | 5,590        | --                |
| 2002          | 5,890        | --                |
| 2003          | 2,640        | --                |
| 2004          | 2,210        | --                |
| 2005          | 5,740        | --                |
| 2006          | 9,030        | --                |
| 2007          | 6,580        | --                |
| 2008          | 1,210        | --                |
| 2009          | 12,400       | --                |
| 2010          | 8,030        | --                |
| 2011          | 6,830        | --                |