# Exeter River Flooding Events 1996 - 2005

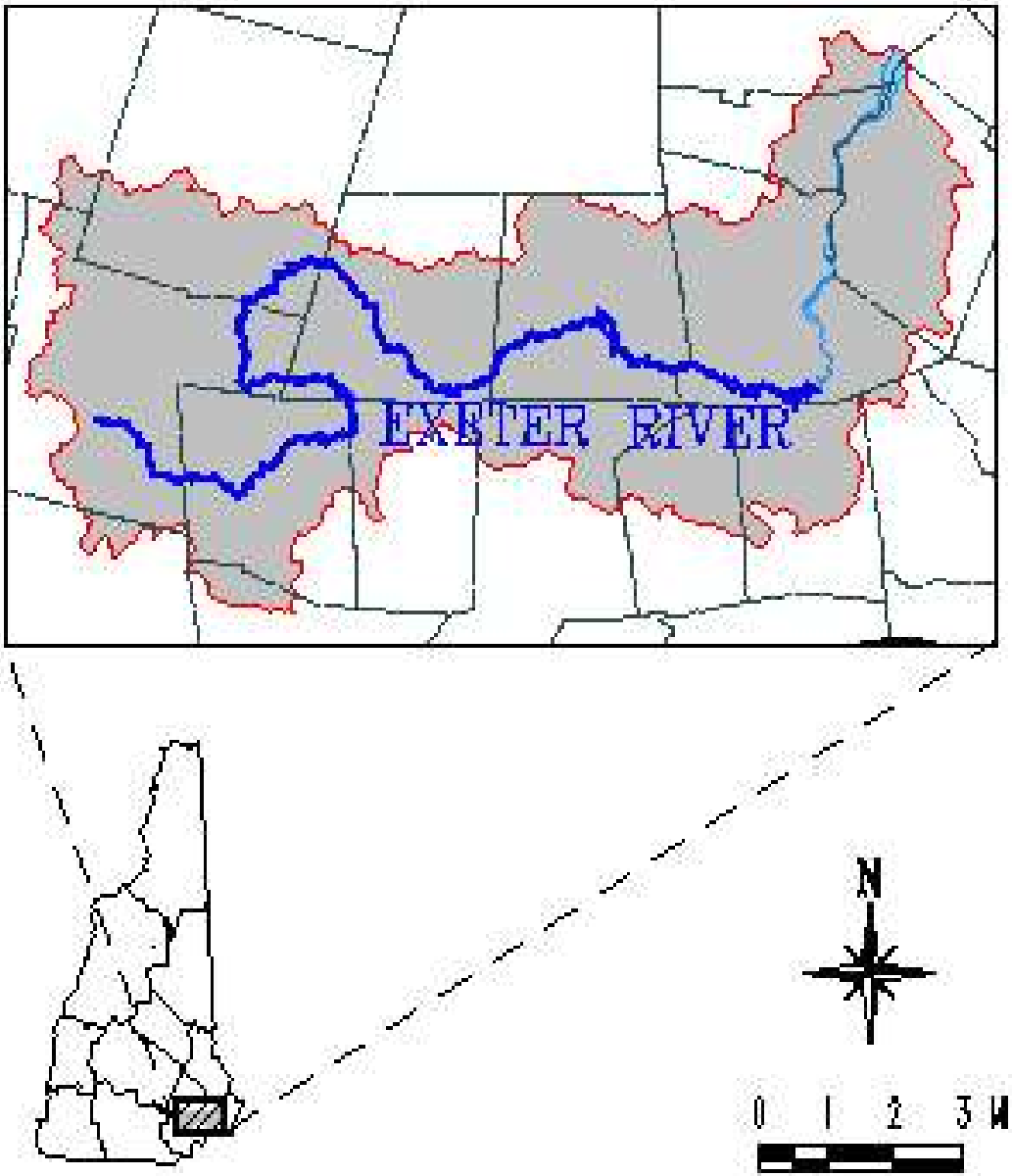
## A Brief Hydrometeorological Analysis

by
Jim Brewster
Meteorologist
Binghamton, New York

# Hydrologic Basins

126 Square Mile basin

- Larger Basin Divided into 8 sub-basins!
  - Dudley Brook
  - Fremont & Brentwood
  - Great Brook
  - Little River (different from the one we know)
  - Philbrick Hill
  - Fordaway Brook
  - Lily Pond
  - Towle Brook

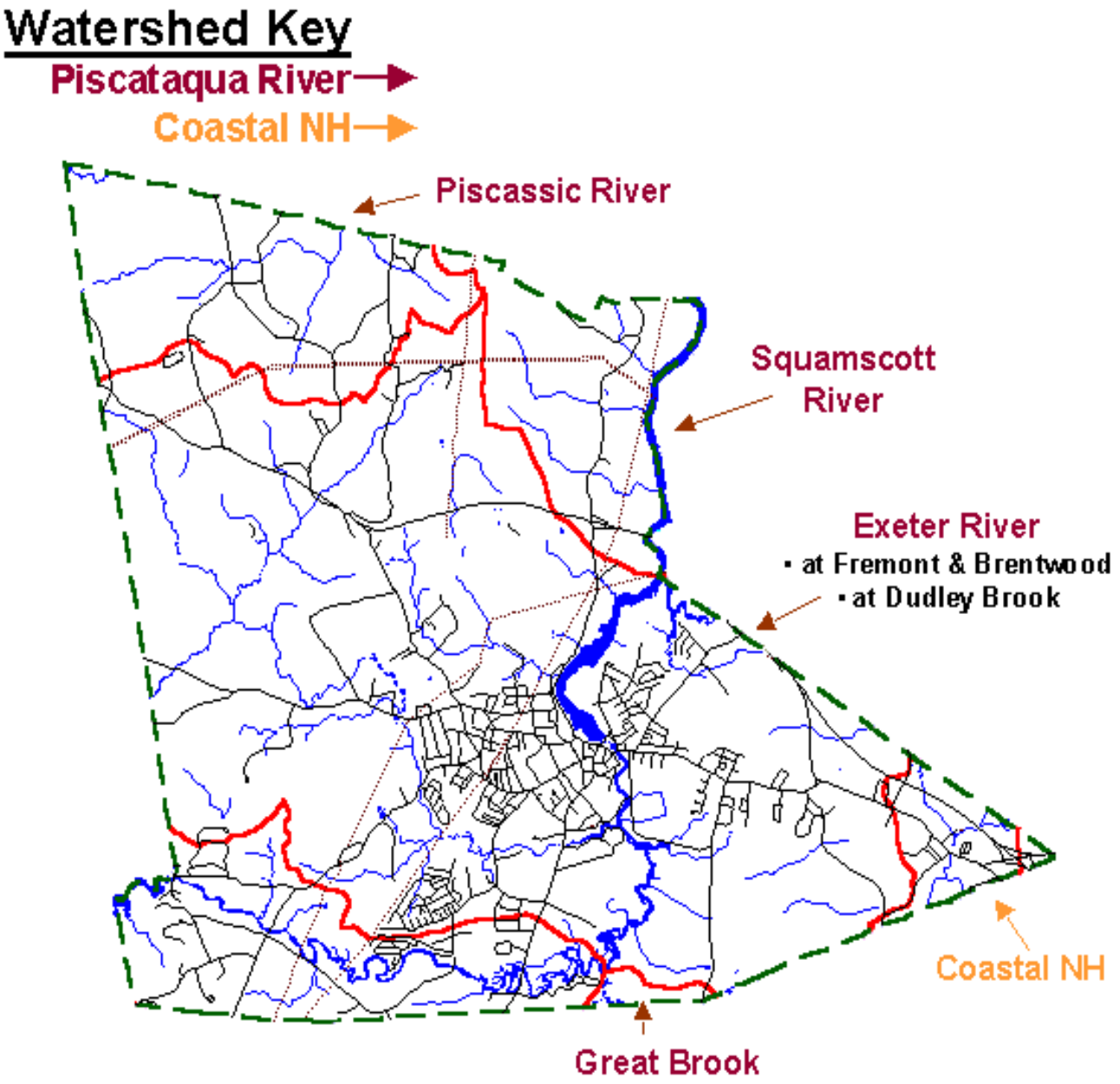



The Exeter River and its watershed.

·The first three of those basins contribute what is called "local runoff" which directly affects the flow of water in the river in Exeter at Great Dam.

Bottom line: Quite a bit of runoff can flow into this system.

# Local Basins




These are the "wildcards" in the hydrologic process of the Exeter River.

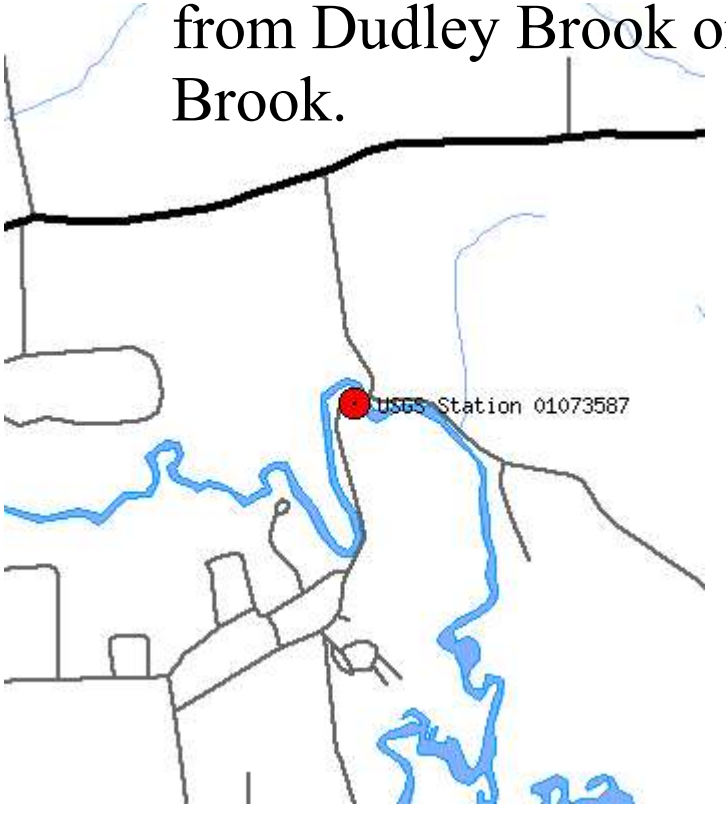
As far as I know... this part of the fluvial system is not measured directly except at Brentwood.

# USGS Monitoring Gauge on Exeter River


Located on Haigh Rd. in Brentwood

Well upstream of problem area, but still useful.

Does not account for input from Dudley Brook or Great Brook.



# Data

Nine years of daily mean flow data from USGS river gauge

Period of record climate data from:

NOAA Cooperative Observer at Epping
NOAA Cooperative Observer at Greenland

Miscellaneous meteorological data from private weather instrumentation at schools or local citizens.

Personal correspondence

# Methodology

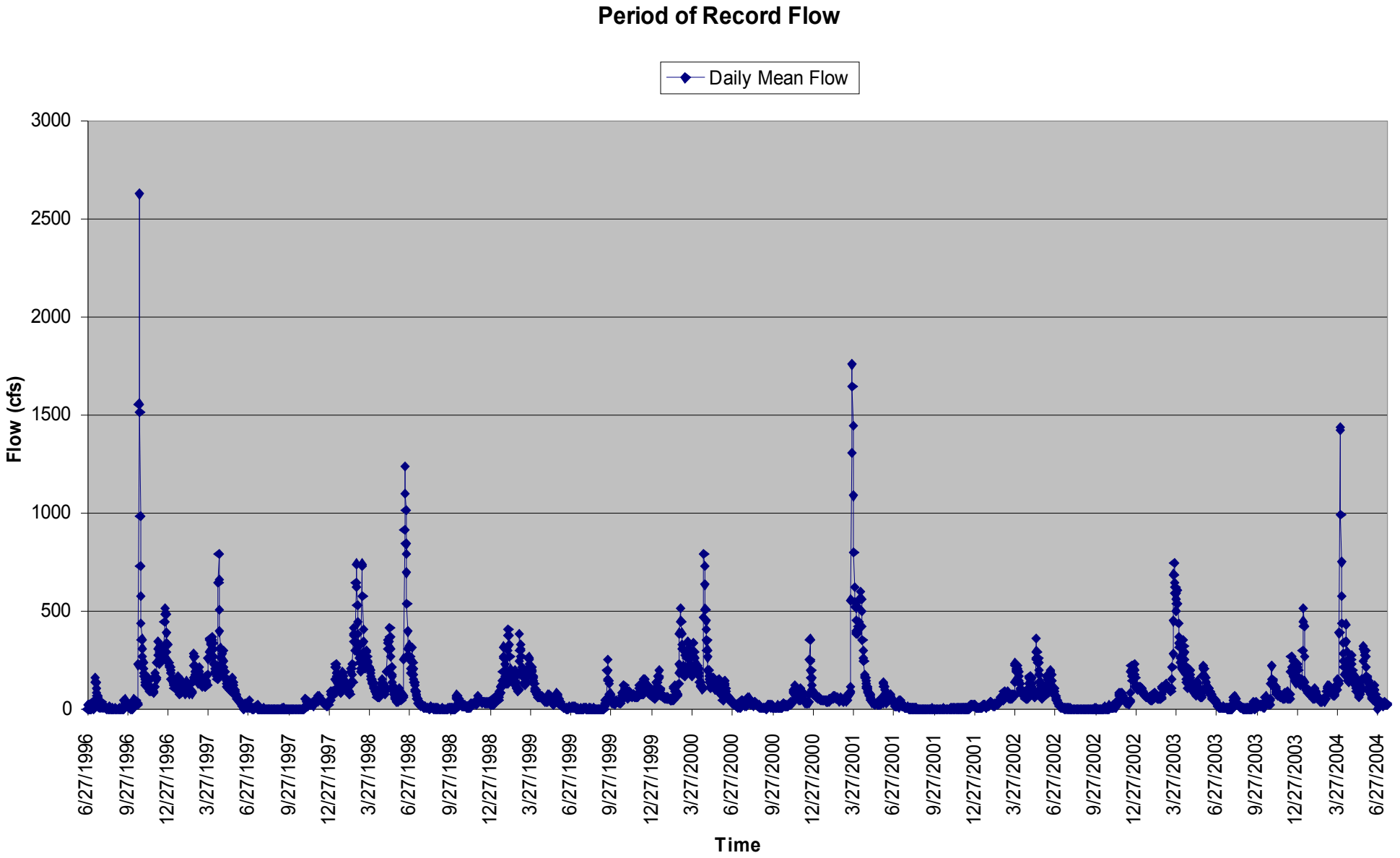
Plotted daily average mean flows to determine high and low water "seasons" and calculated annual average flow.

Found where frequency of highest flows averaged about 2 times above annual mean to determine most likely dates where any flooding made an impact. (admittedly not a rigorous statistical analysis here, but it seemed to be a good approximation)

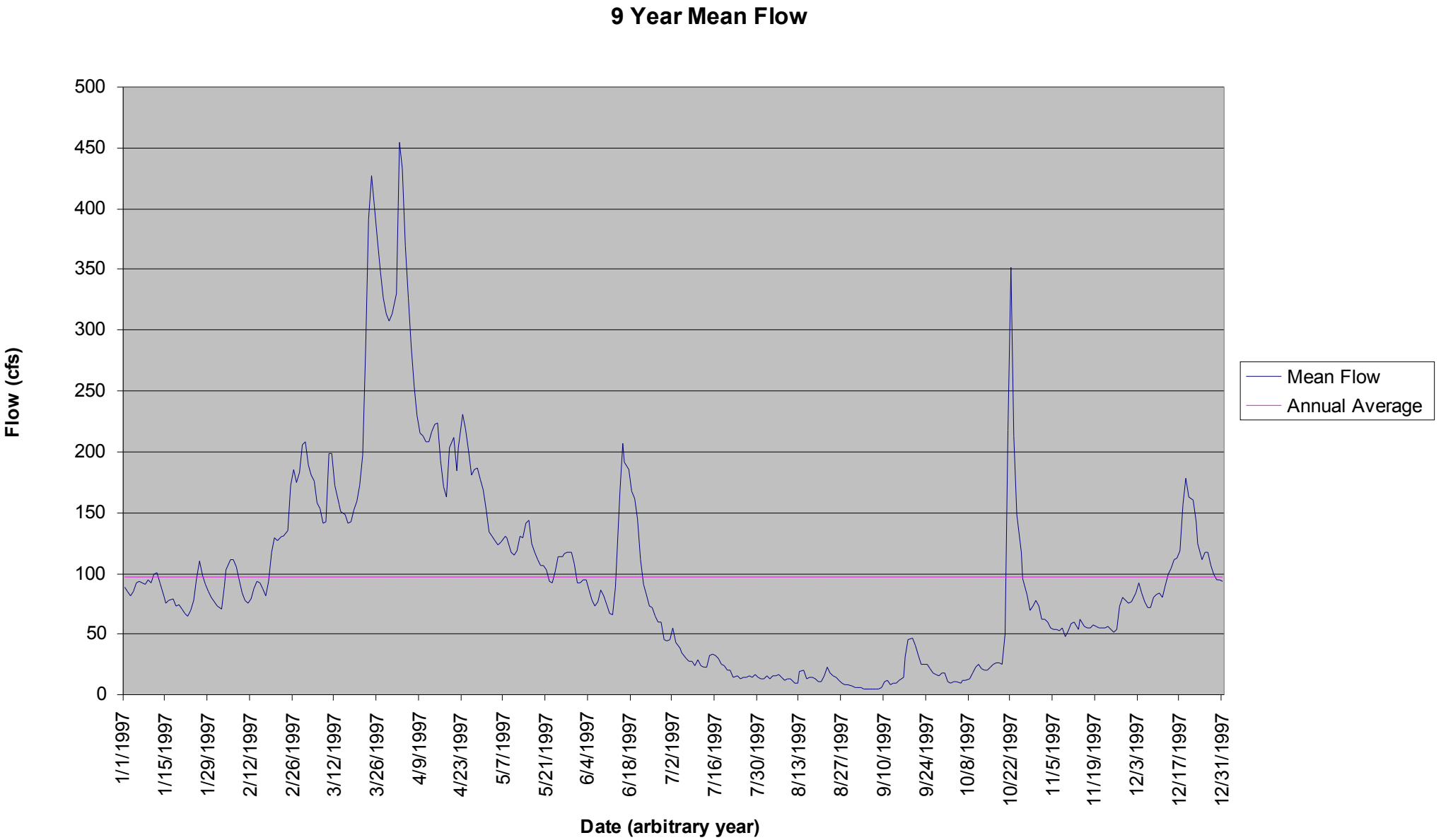
Read archived Exeter News Letter articles to find most "newsworthy" flood days. Determined nearly all stories were submitted when river flow was greater than 1000 cfs at gauge.

Divided high water events into two categories. Those greater than 1000 cfs and those between 500 cfs and 1000 cfs.

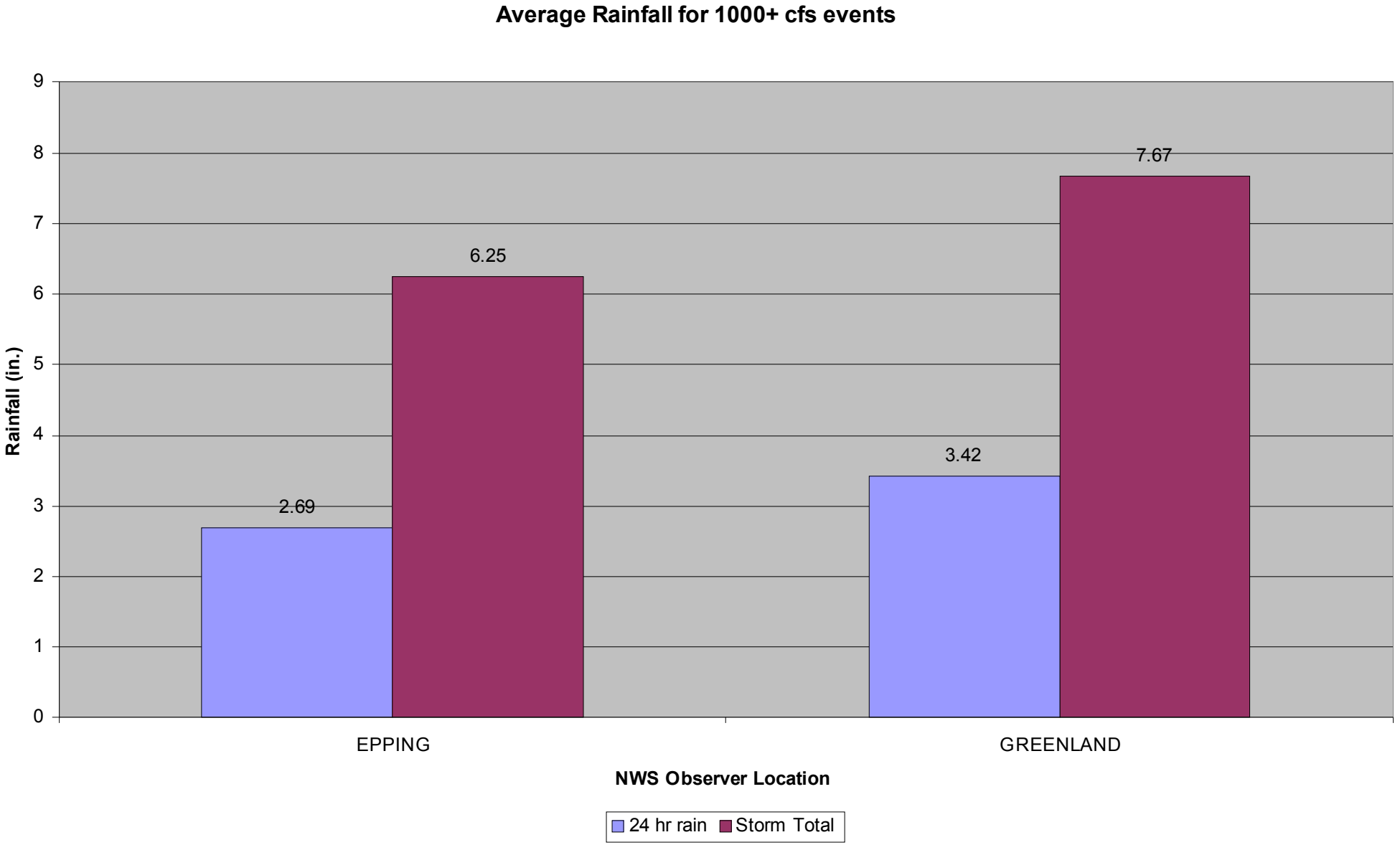
Examined rainfall data for cases within these classifications, and cursorily evaluated temperature and snow cover/snowmelt.



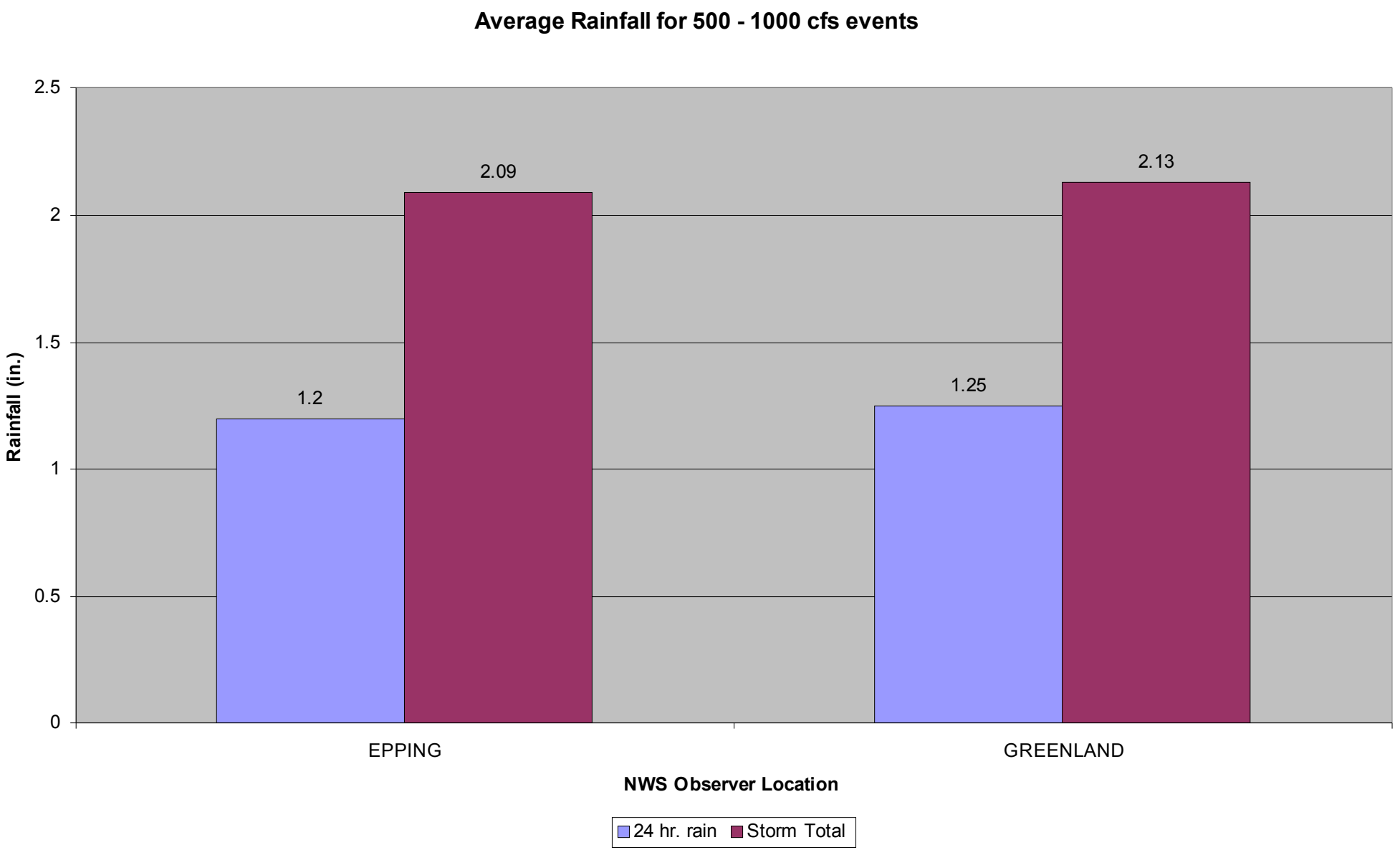

Graph depicting all days of daily mean flow. Significant peak flows easily noted. Gauge installed June 1996. Just in time! It captured what may be the flood of record for the area.




Average daily mean flow for period of record. Later winter/early spring high flow, and summer/early fall low flow seasons easily noted.

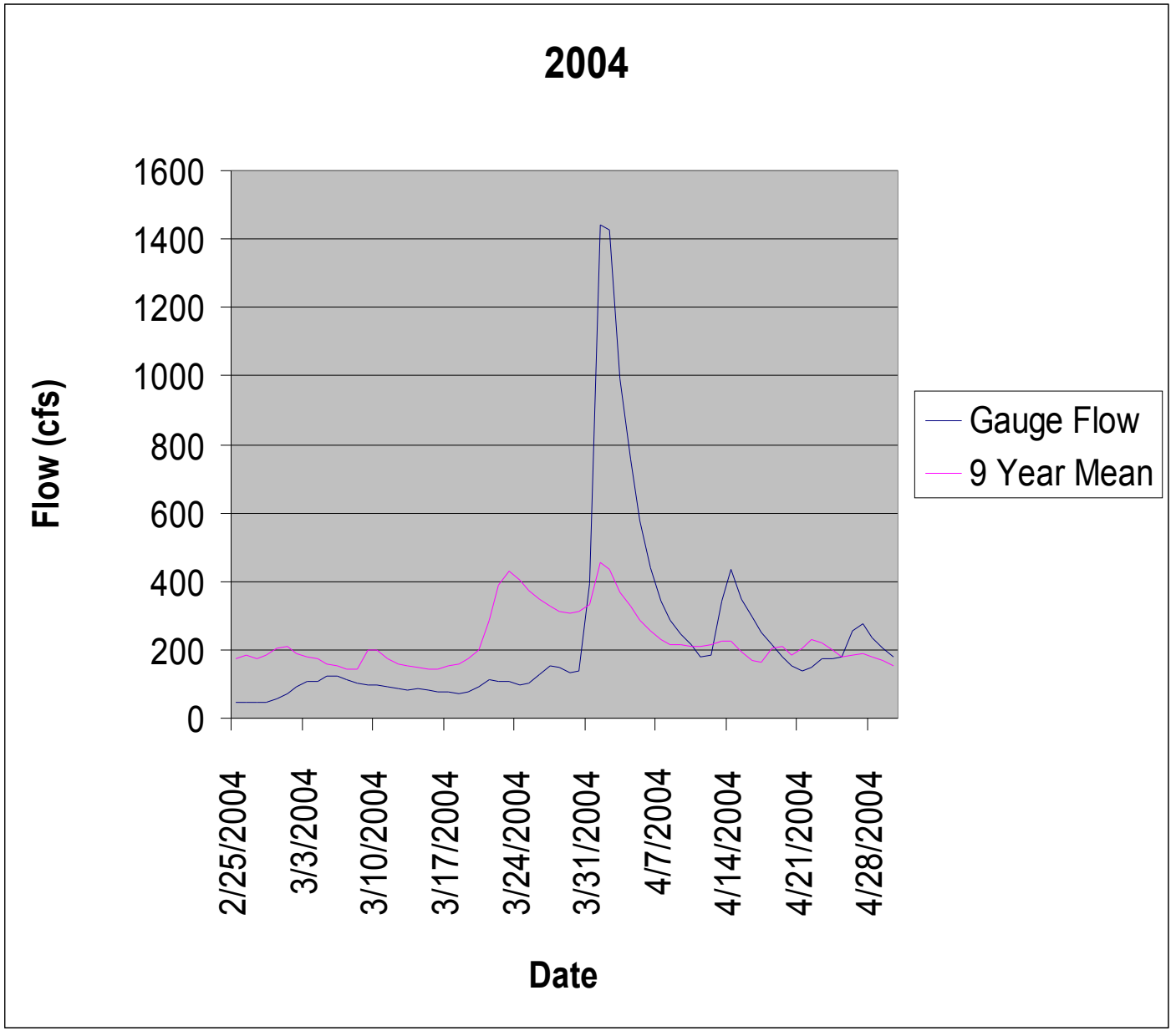



In general, 24 hour rainfall totals of 2.50” to 3.50+” that occur during peak high flow season have led to significant flooding. Storm total (typically 2 day) rainfall in excess of 5 inches has lead to major flooding at any time.




Lower, but still significant high flow events occur with less rainfall. Values between 1.50” to 2.50” should be monitored.

# April 2004 1000+ cfs Case




48 Hour Rainfall
Epping = 5.71”
Greenland = 4.51”

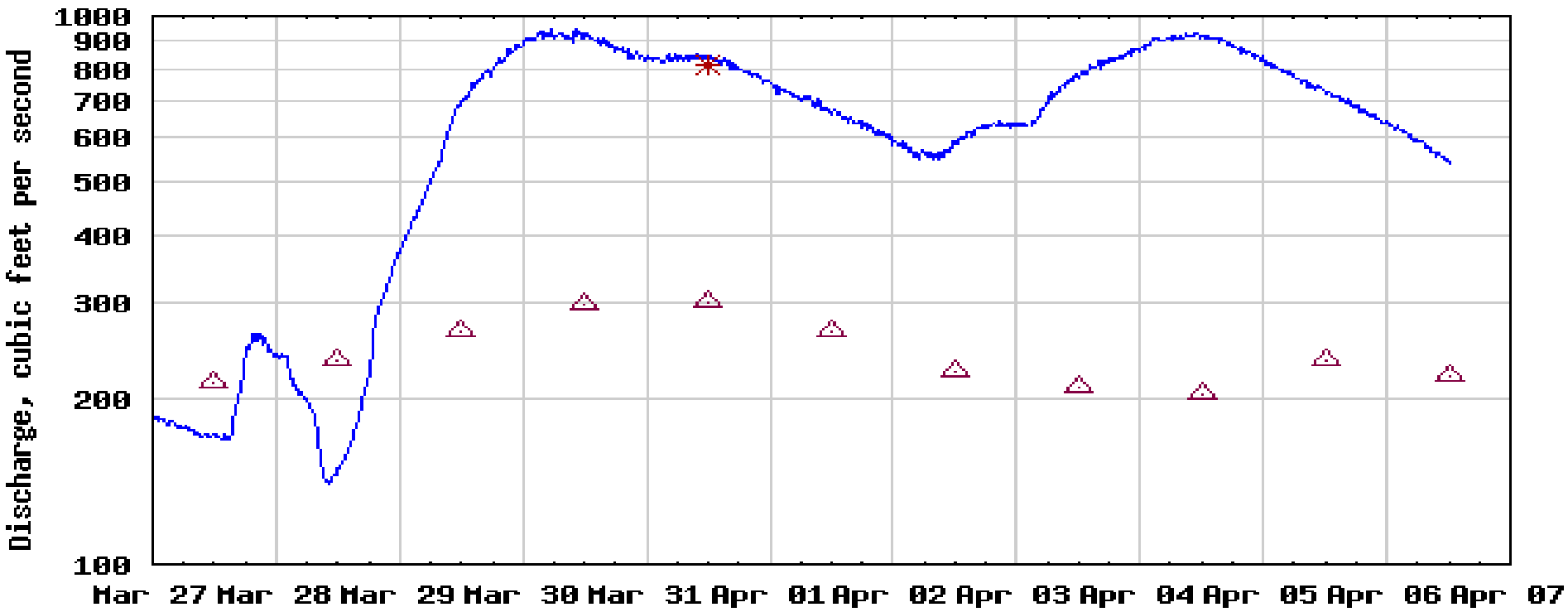
24 hour totals in 2.0 to 3.5” range both days.

Note that river responded fast to over 2” of rain in one day.

# April 2005 (500 to 1000 cfs) Case

USGS

USGS 01073587 EXETER RIVER AT HAIGH ROAD, NEAR BRENTWOOD, NH




Provisional Data Subject to Revision

USGS

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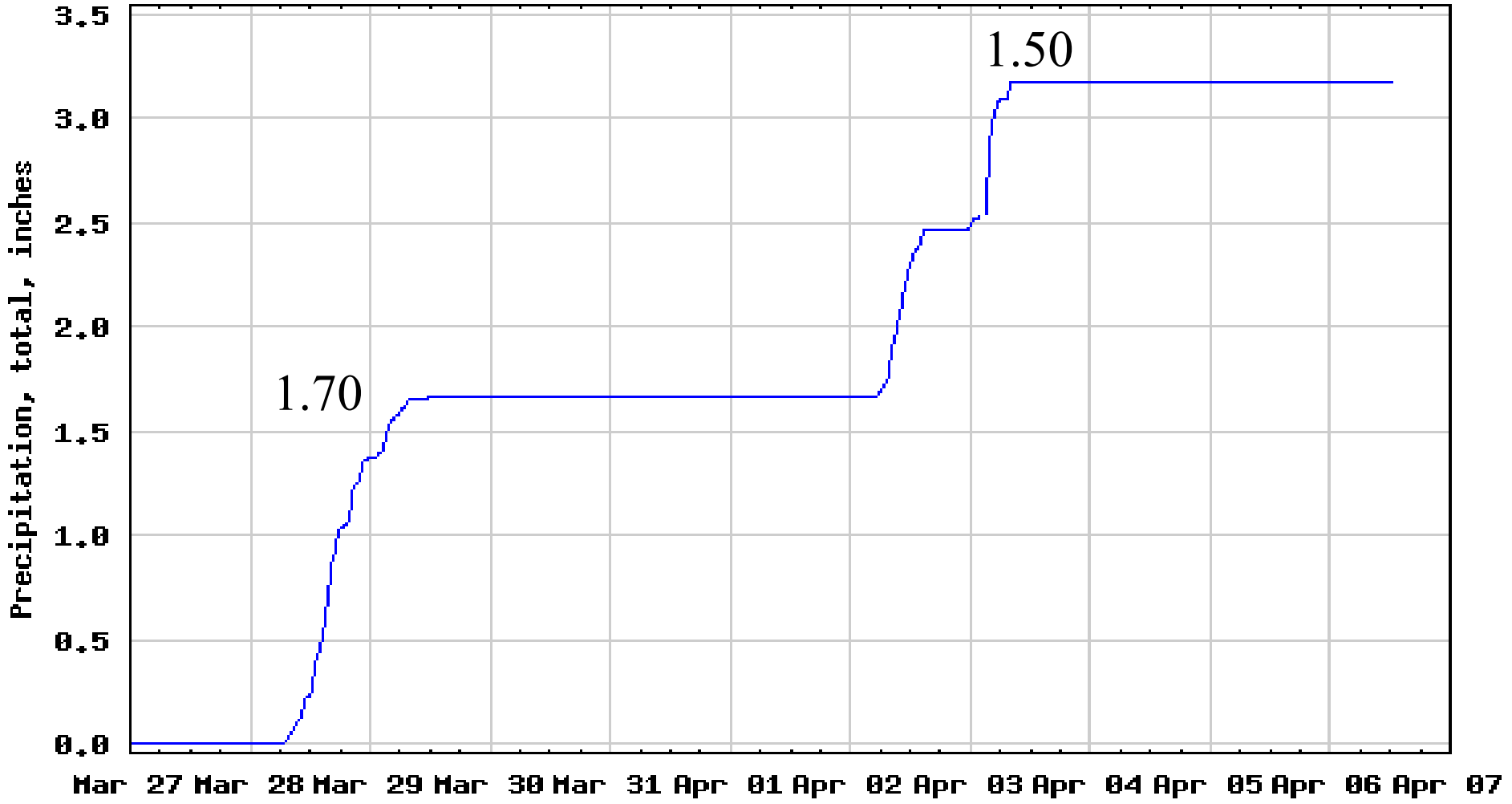


**Provisional Data Subject to Revision**

Epping NWS observer rainfall was 2.23” and 1.40”

# Findings and Comments

This is not a modeling study, however, I think this rudimentary data provides some useful guidance despite the complex, multi basin hydrology of Exeter River.

Flows at USGS gauge correlated well with high impact flooding in Exeter, especially during the seasonally normal high flows of late winter/early spring thaw.

Highest frequency of high water events occurs between Feb 25 and May 1

In general, rainfall averaging between 1.50 – 2.50” during normal to above normal antecedent flow was a good predictor of 500 – 1000 cfs flows. Rainfall averaging between 2.50 – 3.50+” was a good predictor of 1000+ cfs flows. More than 5” rainfall during any season is likely to lead to 1000+ cfs flows.

Many flood flows were noted when antecedent conditions were above the normal mean flow at the gauge. (e.g. Prolific snow melt and/or a “wet spring” caused above normal flow prior to a heavy rain event)

# Findings and Comments...continued

On the contrary, equivalent heavy rains during low flow season often did not cause high flows, except on two cases where rainfall exceeded 5”. This is likely due to antecedent low flows, green up, and spottier nature of convective summer rainfall.

Temperature and snow depth trend data often showed normal to above normal river flows during warm ups and melting, but no support for excessively high flows was noted by snow melt alone. (i.e. Melting snow without heavy rainfall probably did not cause significant flooding)

Ice jam information was not available, and may be a problem, but is beyond the scope of this study.

# Mitigation and Planning Ideas

Find ways to rigorously monitor hydrometeorological conditions (flow at USGS gauge, area snow depth, water equivalent of snow pack, rain and temperature forecasts) especially during high flow season. Many WWW links with good data.

Set up a volunteer rain gauge, snow measurement network to assist with above. May include other towns, or basin groups upstream?

Establish hydrologic monitoring points (e.g. staff gauges, wire weights, other?) on rivers within local basins that have a confluence with Exeter R. to develop a dataset down stream of river gauge.

# About

Jim Brewster is an Exeter native, and 1986 graduate of Exeter AREA High School. He holds a Bachelor of Science degree in Meteorology from Lyndon State College, Vermont.

Jim has been a NOAA meteorologist at various locations around the central and eastern United States for the past 12 years, and is currently stationed at the National Weather Service Forecast office in Binghamton, NY. He also has experience in the private meteorological and environmental industries.

*Jim undertook this project on an unsolicited volunteer basis to give back time, effort and expertise to his home community. No contract exists with the Town of Exeter. Work performed was on his own time, using his own personal computer equipment and internet service provider. Comments and opinions herin are solely derived from the experience of the author, and do not reflect that of NOAA, or superior departments of the U.S. Government.*