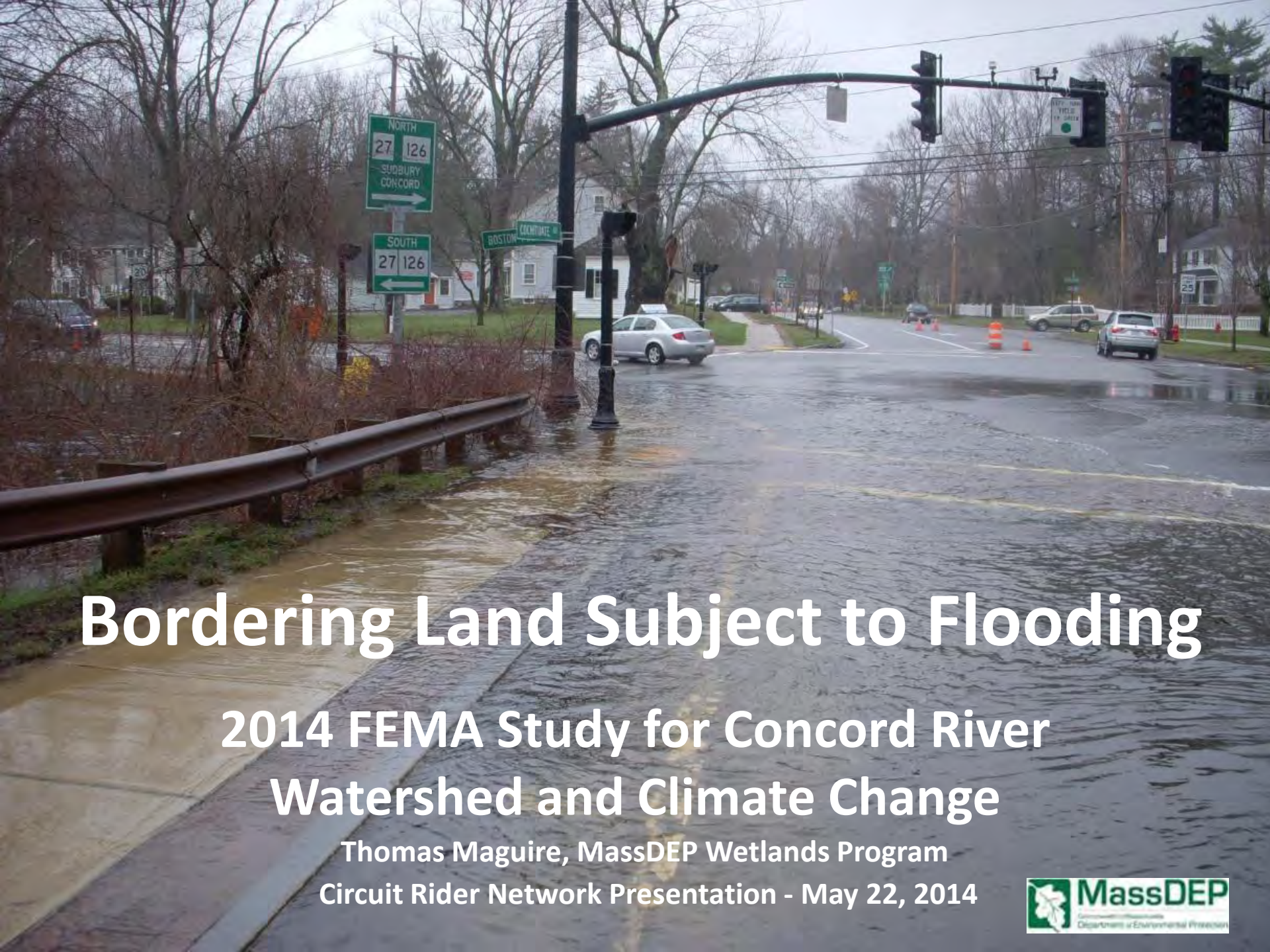


Bordering Land Subject to Flooding

2014 FEMA Study for Concord River Watershed and Climate Change

Thomas Maguire, MassDEP Wetlands Program

Circuit Rider Network Presentation - May 22, 2014

MassDEP
Department of Environmental Protection

Bordering Land Subject to Flooding

- **BLSF is a wetland resource area regulated by the Massachusetts Wetlands Protection Act and regulations (MGL Chapter 131 s. 40 and 310 CMR 10.57)**
- **Interests protected by the Act in BLSF are flood control, storm damage prevention, and wildlife habitat.**
- **A Notice of Intent is required to be filed when BLSF is proposed to be altered**

BLSF Boundary

310 CMR 10.57(2)(a)3 requires the BLSF boundary:

to be "determined by reference to the <u>most recently available flood profile data</u> … prepared … by the Federal Emergency Management Agency (FEMA)."

"Said [BLSF] boundary, so determined, shall be presumed accurate."

"This presumption may be overcome only by credible evidence from a registered professional engineer or other professional competent in such matters."

When no FEMA flood profile data is available, 310 CMR 10.57 specifies other procedures to be followed to locate the boundary

“Most recently available flood profile data” …

This means most recent data, including FEMA preliminary data, SHALL be used to determine BLSF boundary, unless overcome

FLOOD INSURANCE STUDY

VOLUME 1 OF 8

MIDDLESEX COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
ACTON, TOWN OF	250176
ARLINGTON, TOWN OF	250177
ASHBY, TOWN OF	250178
ASHLAND, TOWN OF	250179
AYER, TOWN OF	250180
BEDFORD, TOWN OF	255209
BELMONT, TOWN OF	250182
BILLERICA, TOWN OF	250183
BOXBOROUGH, TOWN OF	250184
BURLINGTON, TOWN OF	250185
CAMBRIDGE, CITY OF	250186
CARLISLE, TOWN OF	250187
CHELMSFORD, TOWN OF	250188
CONCORD, TOWN OF	250189
DRACUT, TOWN OF	250190
DUNSTABLE, TOWN OF	250191
EVERETT, CITY OF	250192
FRAMINGHAM, TOWN OF	250193
GROTON, TOWN OF	250194
HOLLISTON, TOWN OF	250195
HOPKINTON, TOWN OF	250196
HUDSON, TOWN OF	250197
LEXINGTON, TOWN OF	250198
LINCOLN, TOWN OF	250199
LITTLETON, TOWN OF	250200
LOWELL, CITY OF	250201
MALDEN, CITY OF	250202
MARLBOROUGH, CITY OF	250203
MAYNARD, TOWN OF	250204
MEDFORD, CITY OF	250205
MELROSE, CITY OF	250206
NATICK, TOWN OF	250207
NEWTON, CITY OF	250208
NORTH READING, TOWN OF	250209
PEPPERELL, TOWN OF	250210
READING, TOWN OF	250211
SHERBORN, TOWN OF	250212
SHIRLEY, TOWN OF	250213
SOMERVILLE, CITY OF	250214
STONEHAM, TOWN OF	250215
STOW, TOWN OF	250216
SUDBURY, TOWN OF	250217
TEWKSBURY, TOWN OF	250218
TOWNSEND, TOWN OF	250219
TYNGSBOROUGH, TOWN OF	250220
WAKEFIELD, TOWN OF	250221
WALTHAM, CITY OF	250222
WATERTOWN, TOWN OF	250223
WAYLAND, TOWN OF	250224
WESTFORD, TOWN OF	250225
WESTON, TOWN OF	250226
WILMINGTON, TOWN OF	250227
WINCHESTER, TOWN OF	250228
WOBURN, CITY OF	250229

Map Revised: July 7, 2014

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
25017CV001B

FEMA Study/Map Updates

- **Flood Insurance Studies (FIS) and Rate Maps (FIRMs) are periodically updated in Massachusetts**
  - **Municipal studies are being converted to County studies**
  - **Datums are being changed from NGVD29 to NAVD88**
  - **LiDar topography is being incorporated**
  - **Coastal areas are being restudied**
  - **Some watersheds are being restudied (e.g. Concord River)**
- **Having a new flood study/map does not always mean new hydrologic data and hydraulic analysis was incorporated**

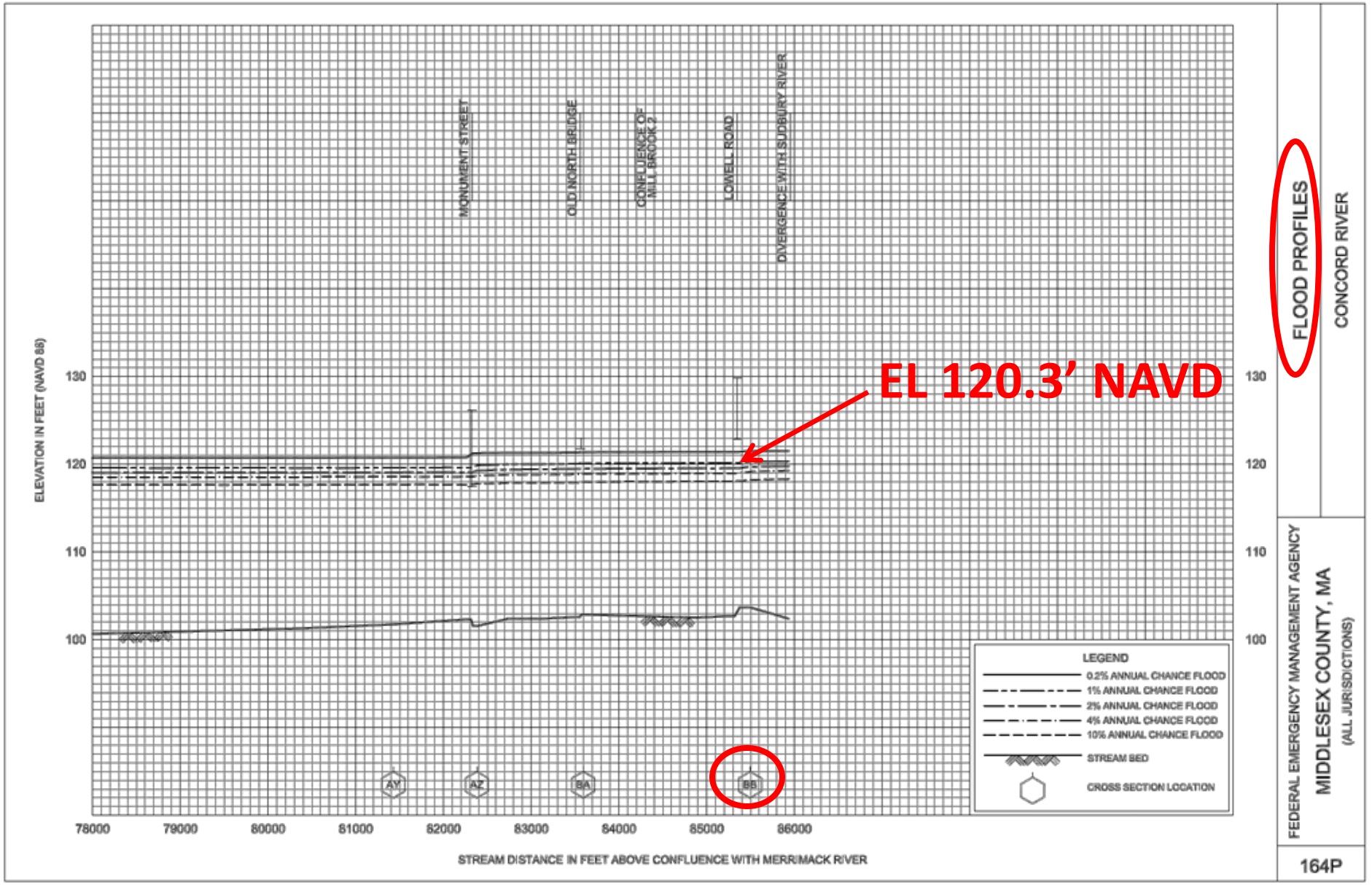
Concord River Watershed
Worcester County FEMA Update

- Revisions were made to incorporate new study of Concord River watershed
- Key dates:
  - **Preliminary FIRMs/Study Issued: January 10, 2013**
  - **New study and FIRMs Dated: July 16, 2014**
- Applicants and Issuing authorities *shall use most recent FEMA flood profiles*

Concord River Watershed Middlesex County FEMA Update

- Revisions were made to incorporate new study of Concord River watershed
- Key dates:
  - **Preliminary FIRMs/Study Issued: January 10, 2013**
  - **New study and FIRMs Dated: July 7, 2014**
- Applicants and Issuing authorities *shall use most recent FEMA flood profiles*

What Is A FEMA Flood Profile?



FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Concord River (continued)								
AR	60,443	320	5,904	1.0	119.4	119.4	120.2	0.8
AS	65,823	1,183	13,093	0.6	119.5	119.5	120.2	0.7
AT	67,500	905	11,719	0.6	119.5	119.5	120.2	0.7
AU	69,822	574	7,008	1.1	119.5	119.5	120.3	0.8
AV	71,553	540	7,668	0.8	119.6	119.6	120.3	0.7
AW	74,744	2,546	25,572	0.3	119.6	119.6	120.3	0.7
AX	77,896	2,004	20,261	0.3	119.6	119.6	120.3	0.7
AY	81,430	347	3,965	1.8	119.6	119.6	120.4	0.8
AZ	82,381	169	2,395	2.5	119.9	119.9	120.7	0.8
BA	83,593	844	7,841	1.3	120.1	120.1	120.9	0.8
BB	85,496	173	2,347	2.6	120.3	120.3	121.2	0.9
AR	60,443	320	5,904	1.0	119.4	119.4	120.2	0.8
AS	65,823	1,183	13,093	0.6	119.5	119.5	120.2	0.7
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AX	77,896	2,004	20,261	0.3	119.6	119.6	120.3	0.7
AY	81,430	347	3,965	1.8	119.6	119.6	120.4	0.8
AZ	82,381	169	2,395	2.5	119.9	119.9	120.7	0.8
BA	83,593	844	7,841	1.3	120.1	120.1	120.9	0.8
BB	85,496	173	2,347	2.6	120.3	120.3	121.2	0.9

[1] Feet above confluence with Merrimack River

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

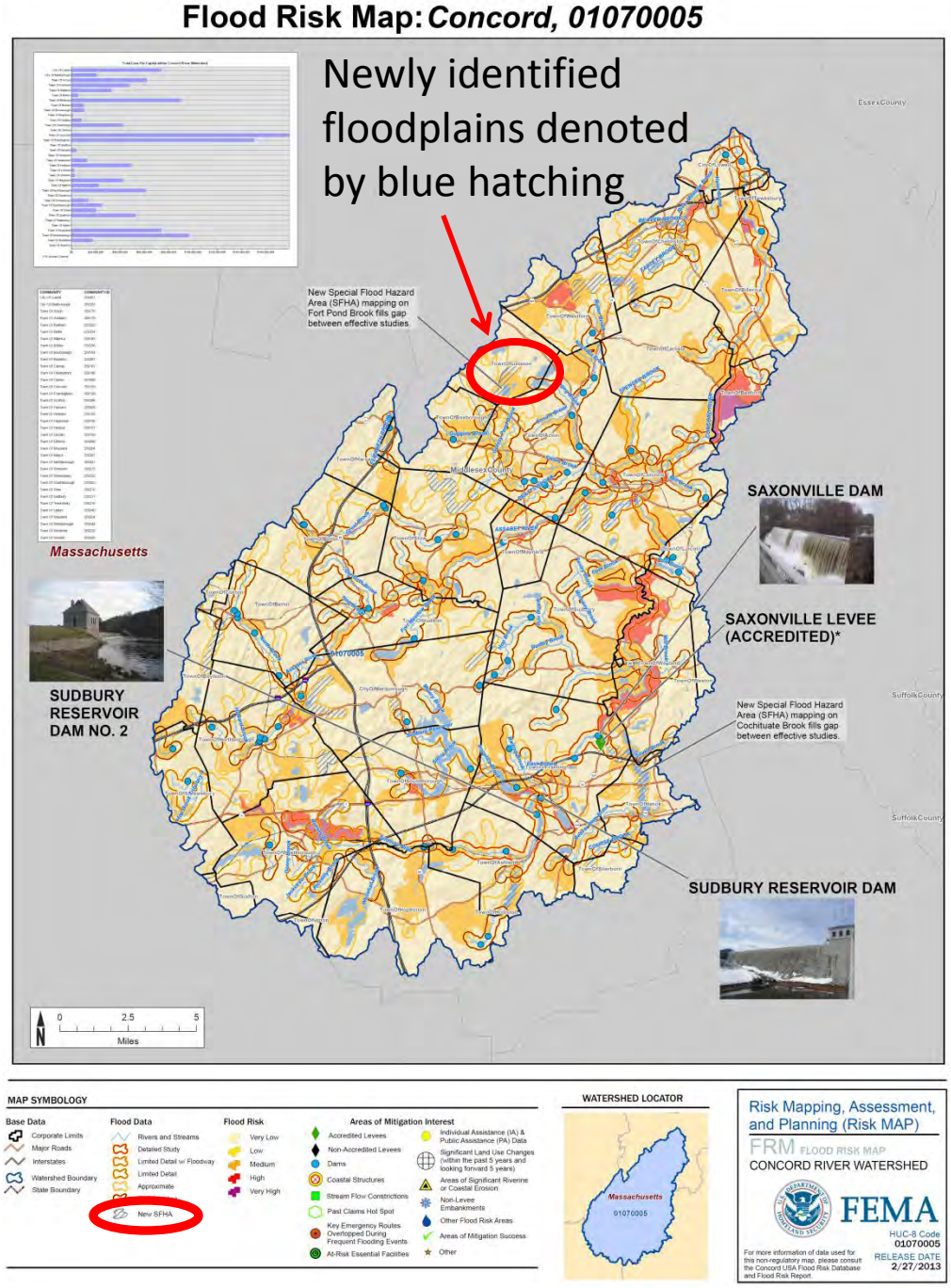
MIDDLESEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

CONCORD RIVER

What Methods Did FEMA Use to Update Flood Study in the Concord River Watershed?

- Hydrology:
  - 1983 USGS Regression Equations for MA rural areas (Water Supply Paper 2214 by S. William Wandle, Jr.)
  - 1983 USGS Regression Equation for U.S. urban areas (Water Supply Paper 2207 by V.B. Sauer and others)
  - Results compared to schematic HEC-HMS rainfall/runoff model
  - Results compared/calibrated to stream flow recorded at USGS gages in watershed
  - Discharges reduced below certain reservoirs to account for storage effects in Sudbury River sub-watershed
- Hydraulics:
  - New bridge/culvert surveys incorporated
  - LiDar topography incorporated (reported resolution 0.03 foot vertical).
  - New HEC-RAS model developed



2014 FEMA Flood Insurance Study

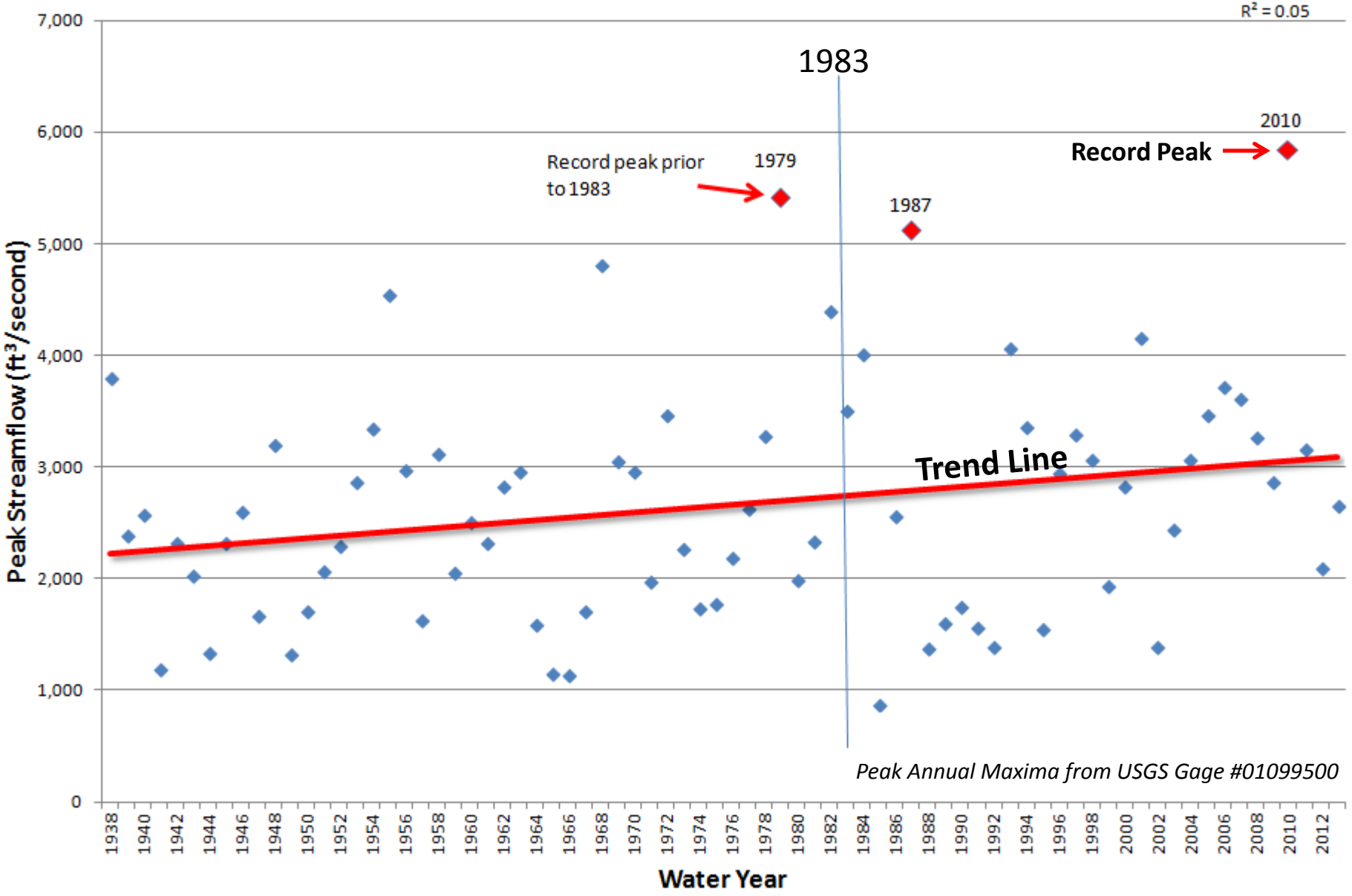
- **Concord River Watershed: Study reports that the 1% frequency discharge at USGS gages increased an average of 123% through 2010 above the gage discharges through 1983. (Vol. 1, p. 91)**
- **Assabet River discharges: Study reports they were increased by an average ratio of 1.22 (2010/1984, Vol. 1, p. 93)**

But…

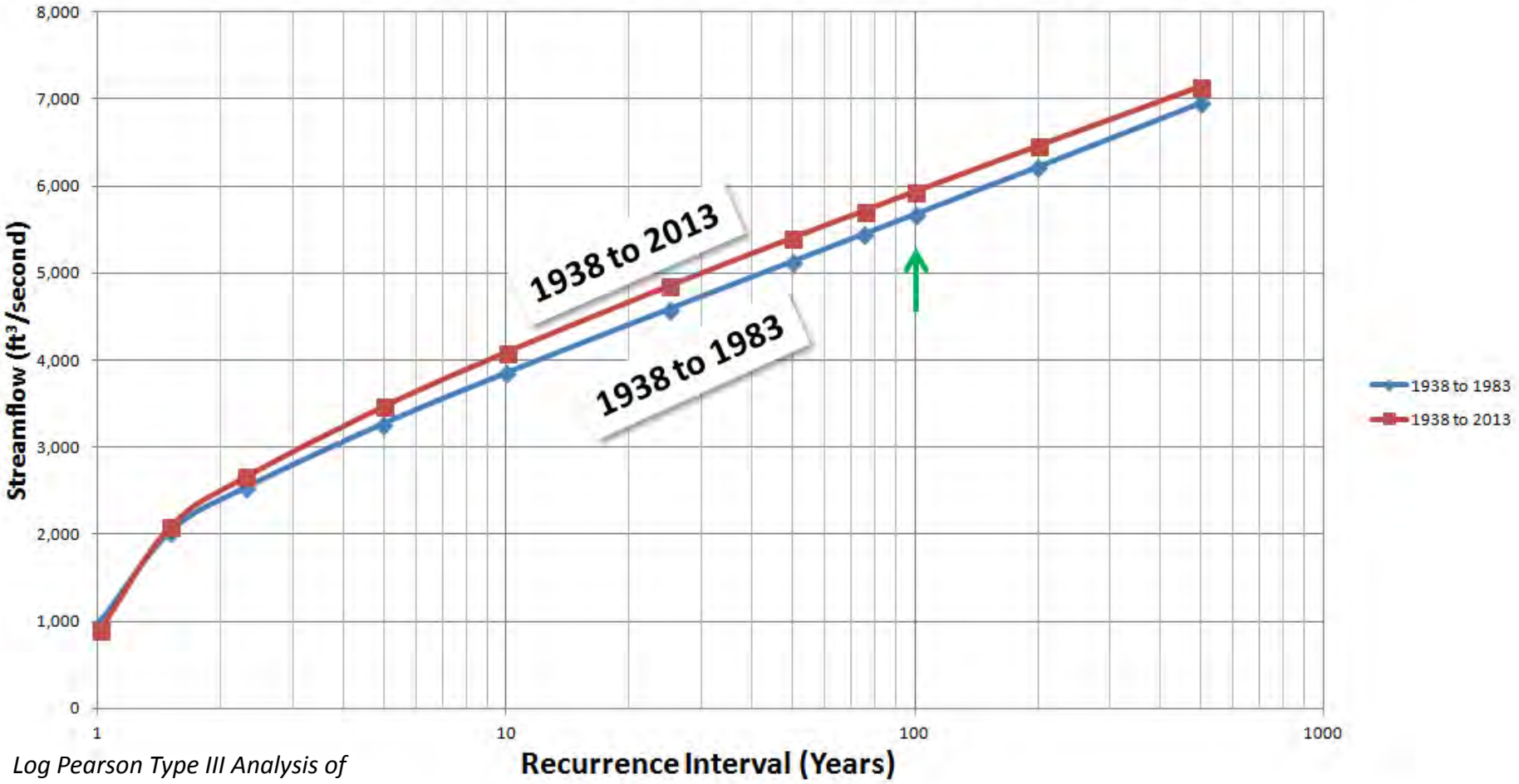
- **Concord River discharges used for hydrologic inputs in the 2014 FEMA study were not increased (Vol. 1, p. 93 reports average ratio of peak discharges through 2010 to peak discharges through 1983 studies was 1.00)**
- **Sudbury River discharges used for hydrologic inputs in the 2014 FEMA study were decreased (Vol. 1, p. 93 reports average ratio of peak discharges through 2010 to peak discharges through 1972 based on a NRCS model was 0.77)**

How do the findings in the 2014 FEMA study for Concord River watershed compare to actual data recorded at USGS gages in the watershed?

Concord River at Lowell, MA, USGS Gage, 1938 to 2013



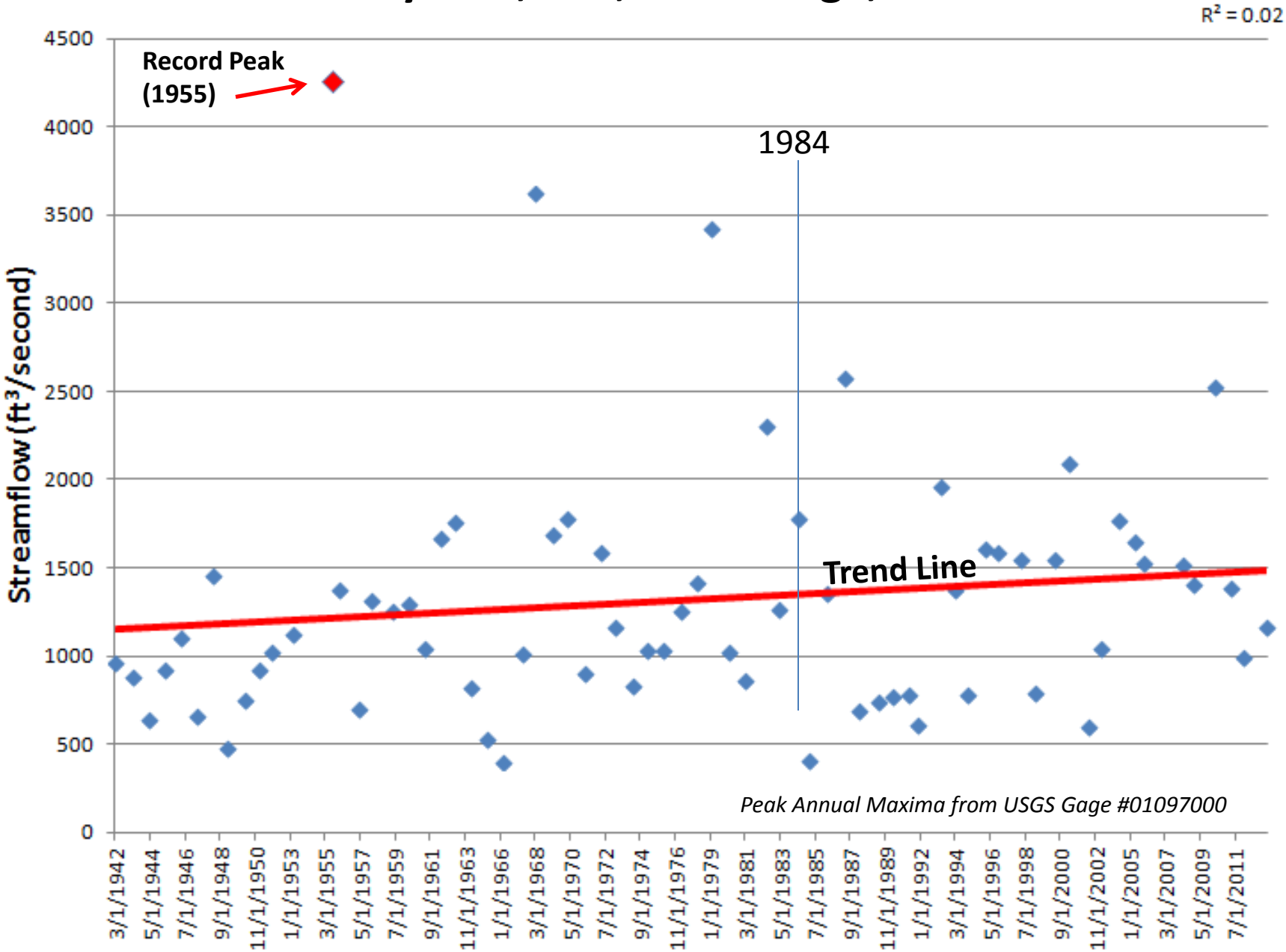
Concord River at Lowell, MA, USGS Gage, Recurrence Interval Comparison



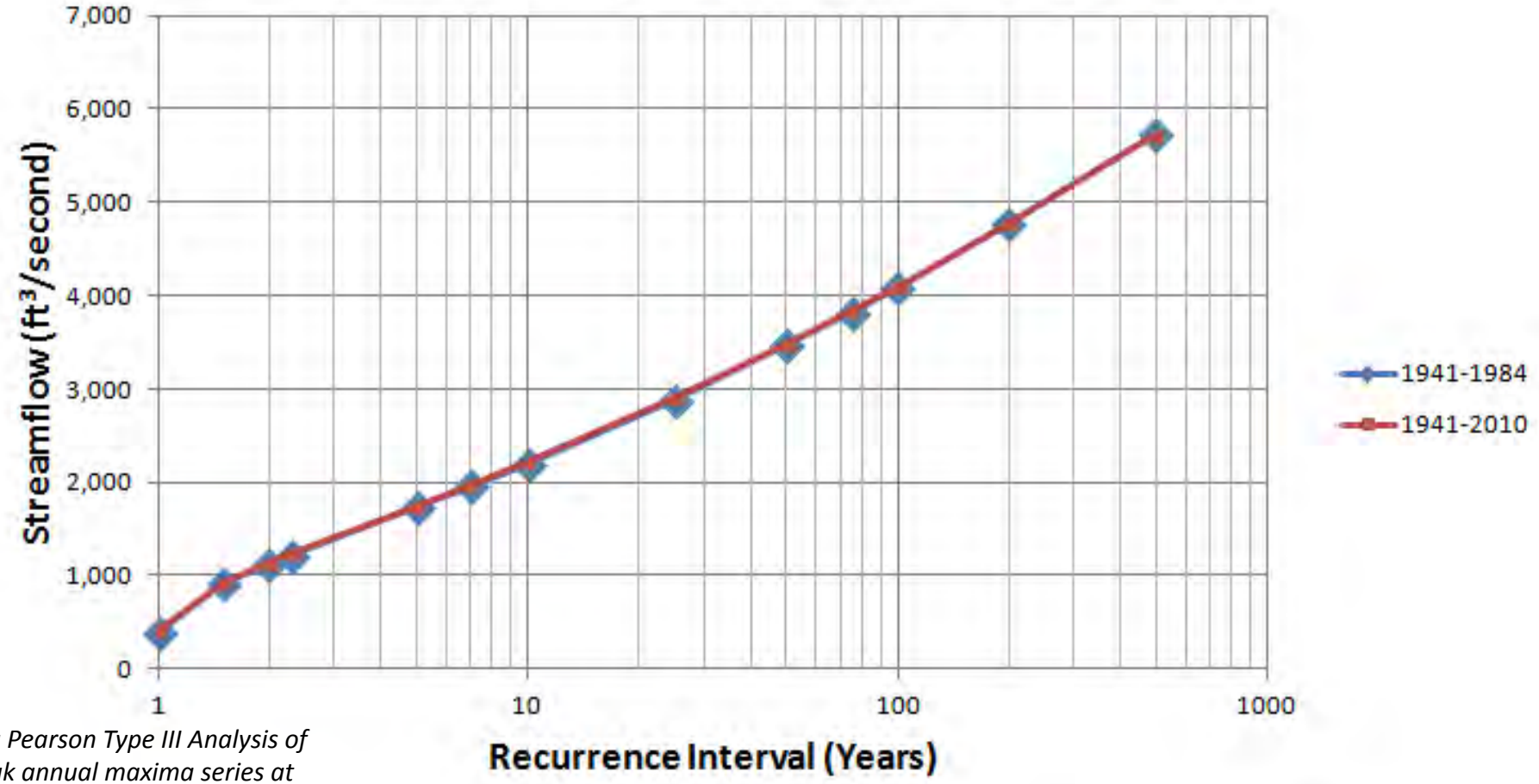
Log Pearson Type III Analysis of peak annual maxima series at USGS Gage #01099500 Data

FEMA 2014 Ratio Listed in Study (2010/1983)	Gage 2010/FEMA 1992 Q Ratio	Gage Ratio Actual (2010/1983)
1.00	1.01	1.06

Assabet River at Maynard, MA, USGS Gage, 1938 to 2013



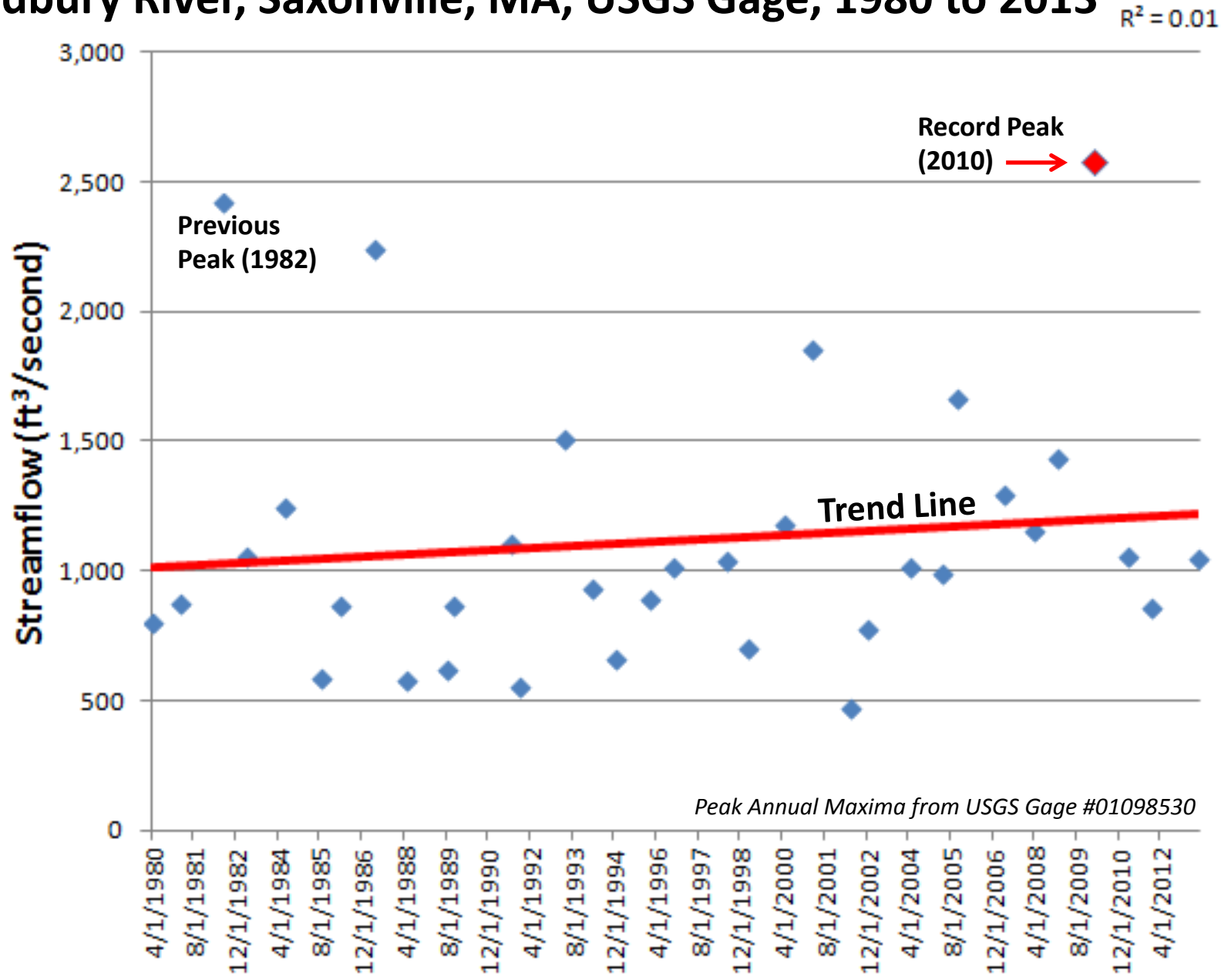
Assabet River at Maynard, MA, USGS Gage, Recurrence Interval Comparison



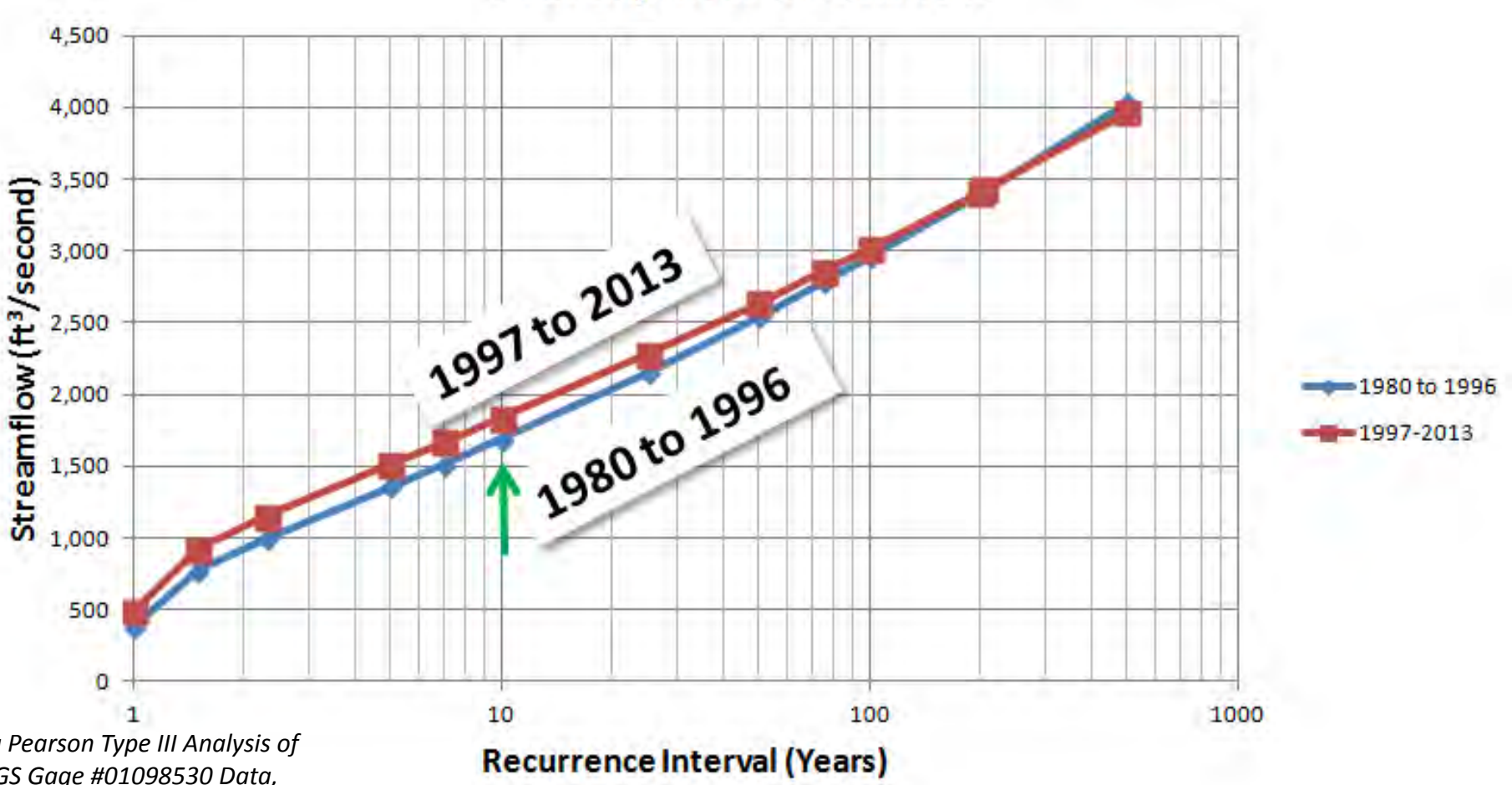
Log Pearson Type III Analysis of peak annual maxima series at USGS Gage #01097000 Data, skew = 0.298

FEMA 2014 Ratio Listed in Study (2010/1984)	Gage 2010/FEMA 1978 Q Ratio	Gage Ratio Actual (2010/1984)
1.22	1.22	1.00

Sudbury River, Saxonville, MA, USGS Gage, 1980 to 2013



Sudbury River at Saxonville (Framingham), MA, USGS Gage, Recurrence Interval Comparison

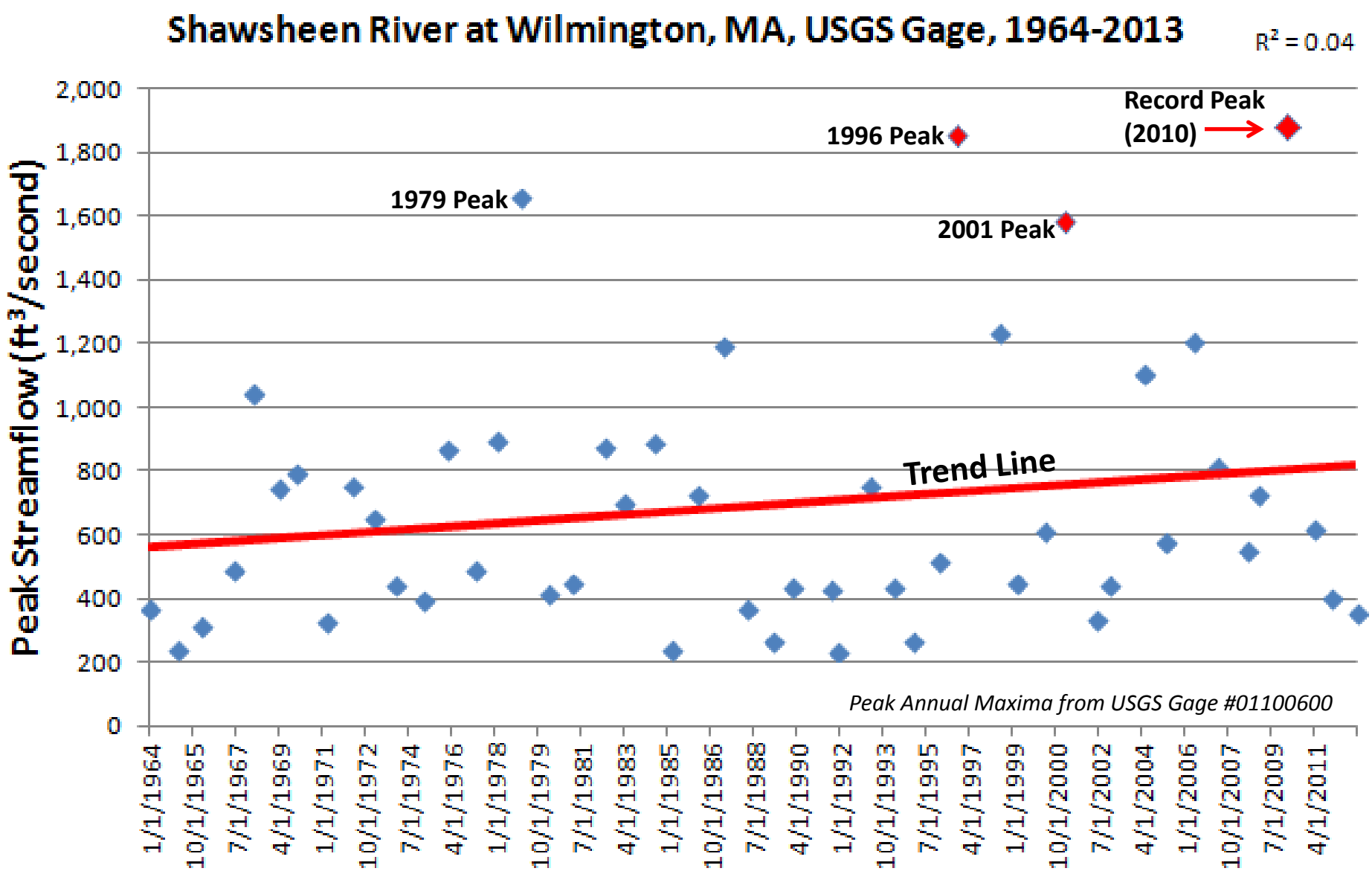


Log Pearson Type III Analysis of USGS Gage #01098530 Data, skew = 0.35

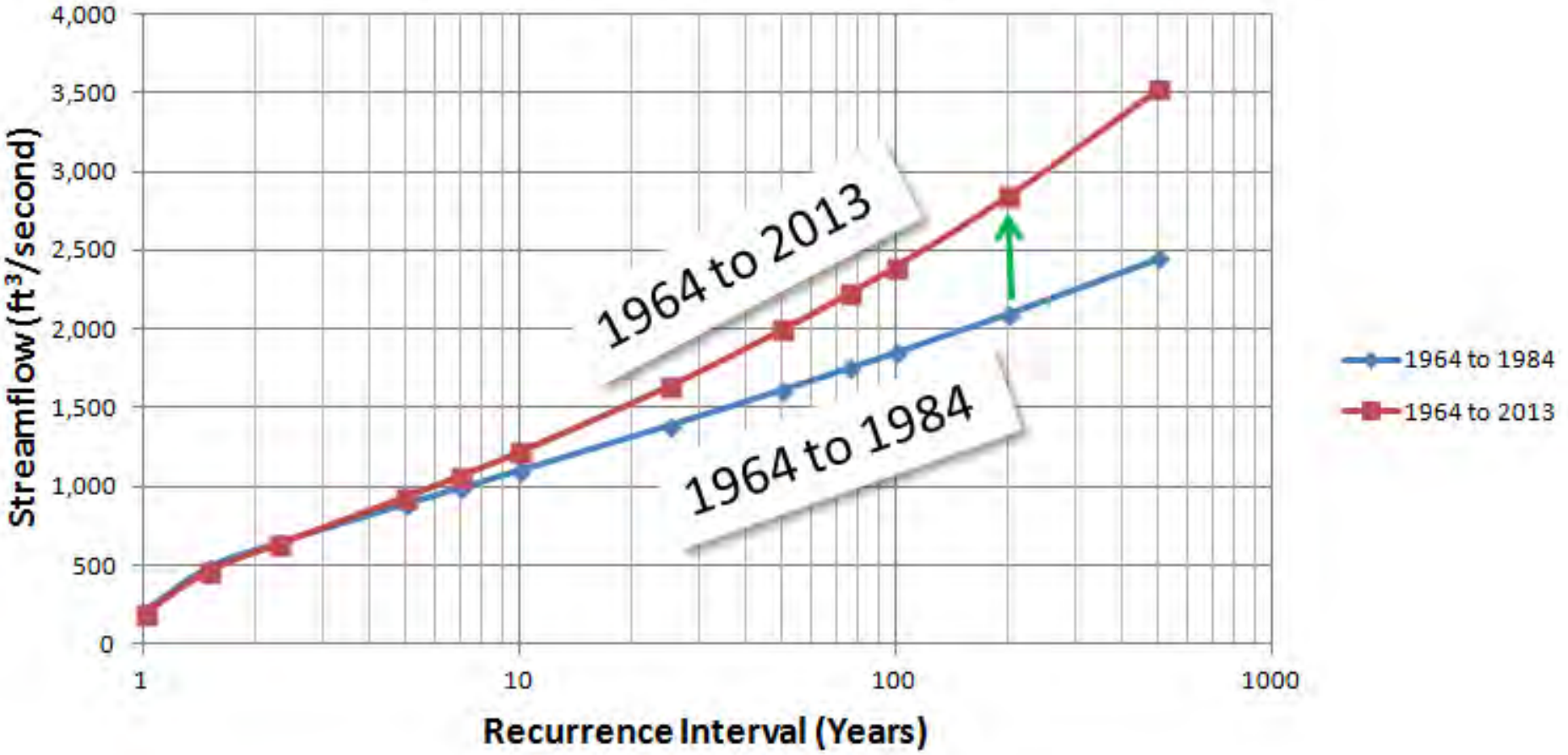
FEMA 2014 Ratio Listed in Study (2010/1972)	Gage 2010/FEMA 1992 Q Ratio	Gage Ratio Actual
0.77	0.66	Non-applicable

FEMA 1992 value was derived from a TR20 rainfall/runoff model.

Gage has only been operating since 1980.

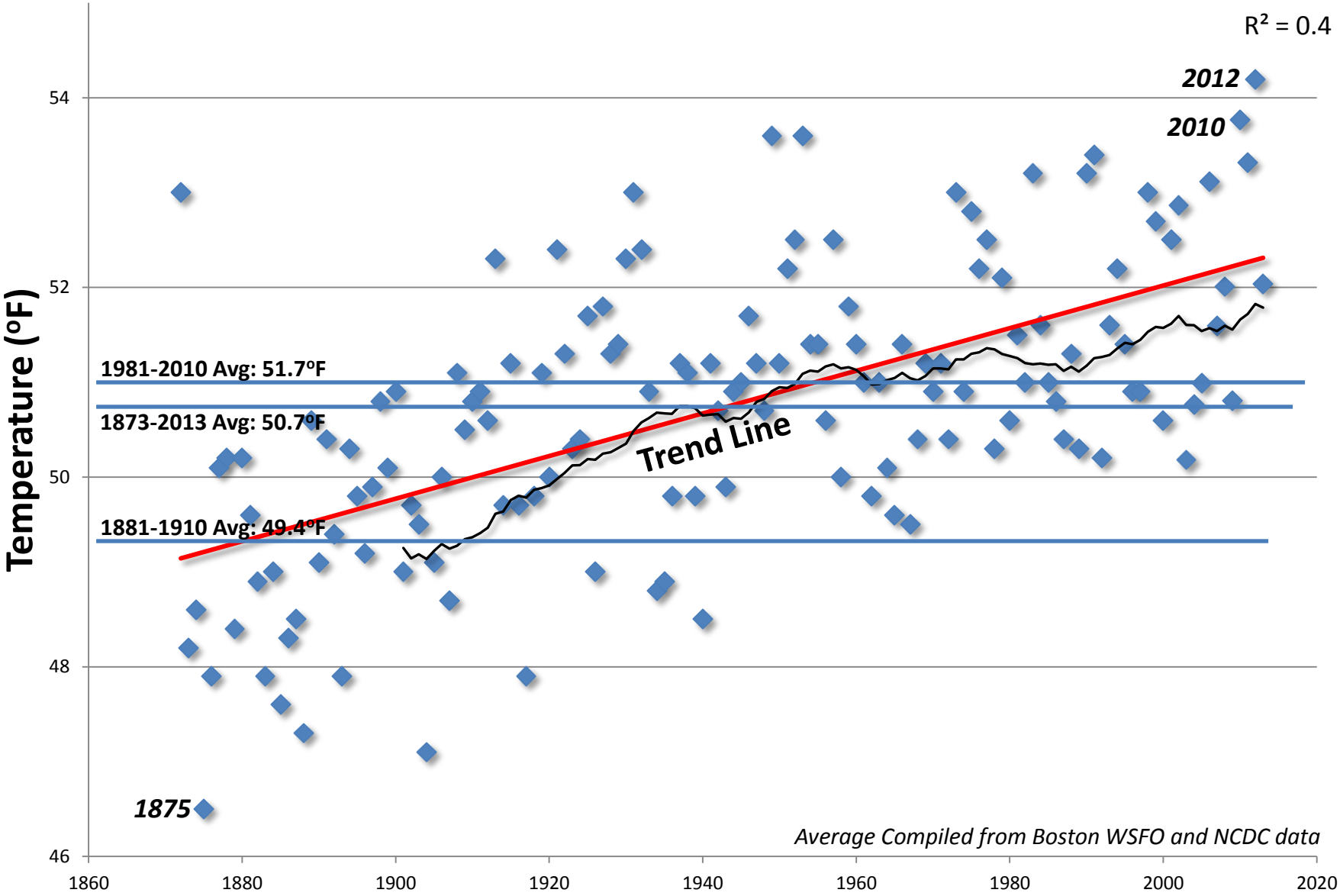

Shawsheen River at Wilmington, MA, USGS Gage, 1964-2013
R² = 0.04
Peak Streamflow (ft³/second)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Record Peak
(2010)
1996 Peak
1979 Peak
2001 Peak
Trend Line
Peak Annual Maxima from USGS Gage #01100600
1/1/1964
10/1/1965
7/1/1967
4/1/1969
1/1/1971
10/1/1972
7/1/1974
4/1/1976
1/1/1978
10/1/1979
7/1/1981
4/1/1983
1/1/1985
10/1/1986
7/1/1988
4/1/1990
1/1/1992
10/1/1993
7/1/1995
4/1/1997
1/1/1999
10/1/2000
7/1/2002
4/1/2004
1/1/2006
10/1/2007
7/1/2009
4/1/2011

Shawsheen River at Wilmington, MA USGS Gage, Recurrence Interval Comparison

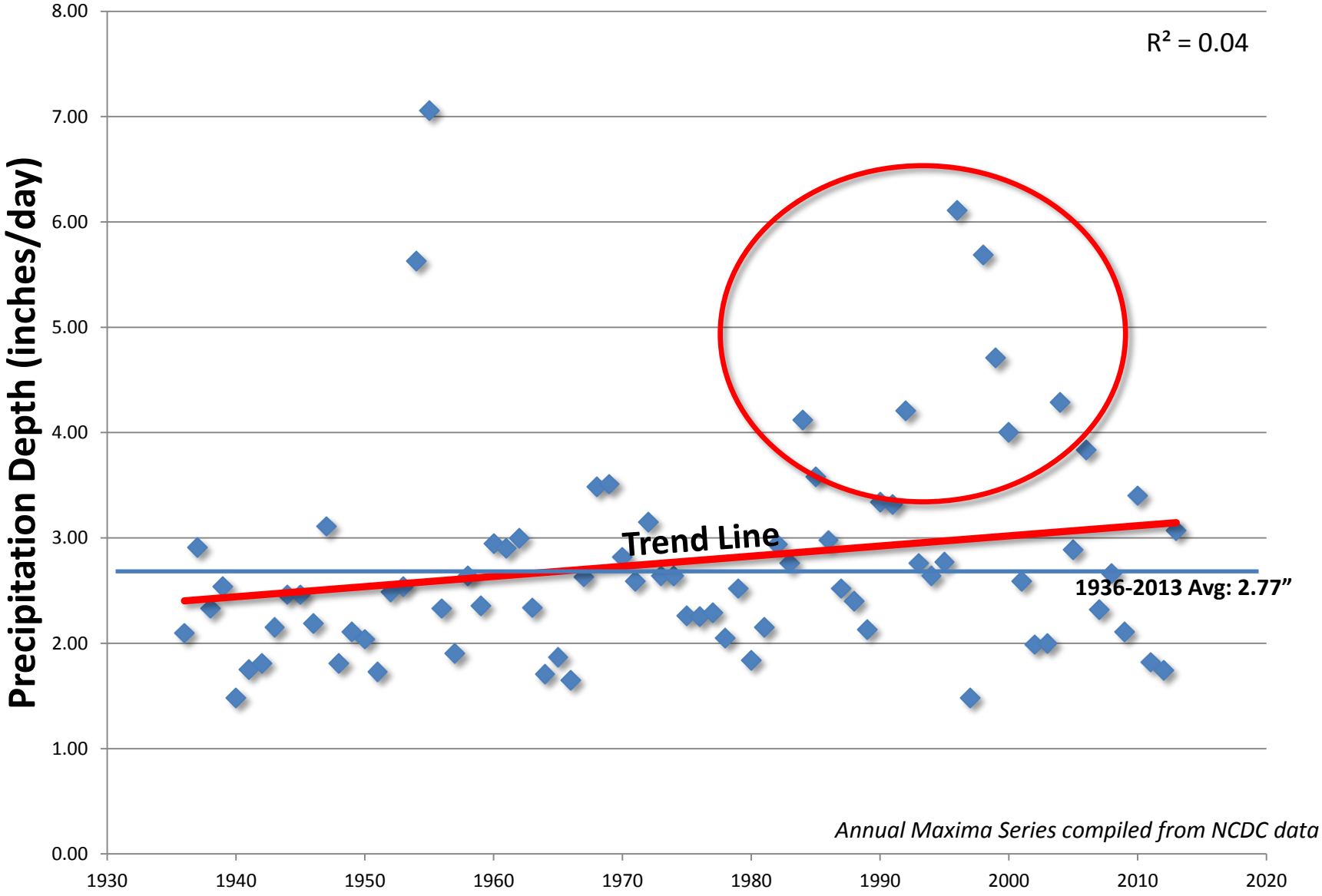


Log Pearson Type III Analysis of USGS Gage #01100600 Data

Boston, MA: Temperature Average Annual 1873 to 2013



Boston, MA: Precipitation, Annual Daily Maxima



USGS Regression Equations

- **The Wandle 1983 USGS regression equations used in the FEMA 2014 study have been shown to *no longer reflect current conditions.***

See:

- **Zariello and Carlson 2009, Characteristics of the April 2007 flood at 10 stream-gaging stations in Massachusetts, USGS Scientific Investigations Report 2009-5068**
- **Zariello, Ahearn, and Levin, 2012, Magnitude of flood flows for selected annual exceedance probabilities in Rhode Island through 2010, USGS Scientific Investigations Report 2012-5109 (investigated flooding probabilities in southeast Massachusetts, in addition to Rhode Island)**

FEMA 2014 to FEMA Prior Study Comparison Locations

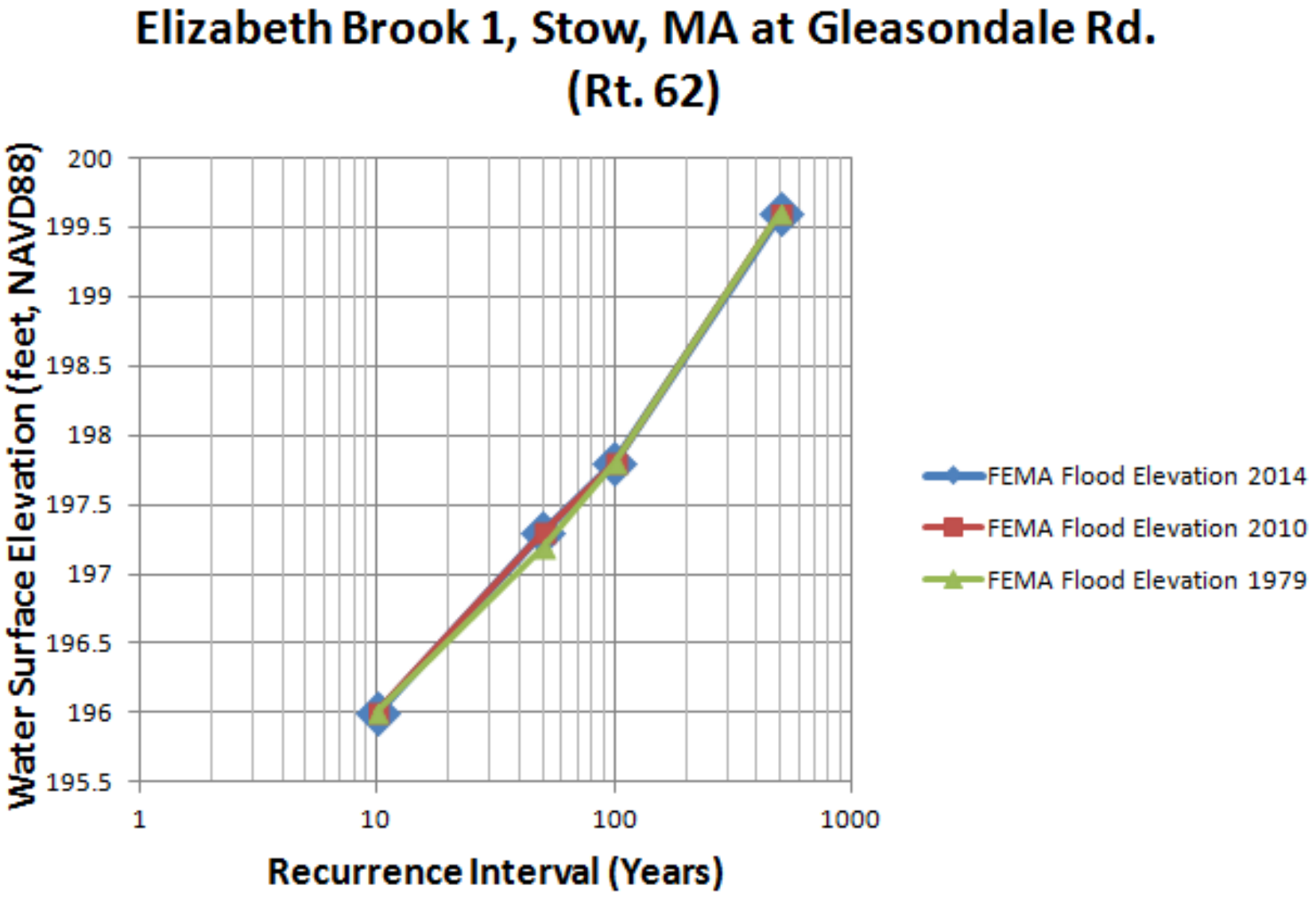
- Stow, Gleasondale Road (Rt. 62), Elizabeth Brook
- Lowell, Rogers St., Concord River
- Billerica, Boston Road (Rt. 129/3A), Concord River
- Bedford, Rt. 225 Bridge, Concord River
- Concord, Old North Bridge, Concord River
- Wayland, Boston Post Road, Sudbury River
- Maynard, Waltham St., Assabet River

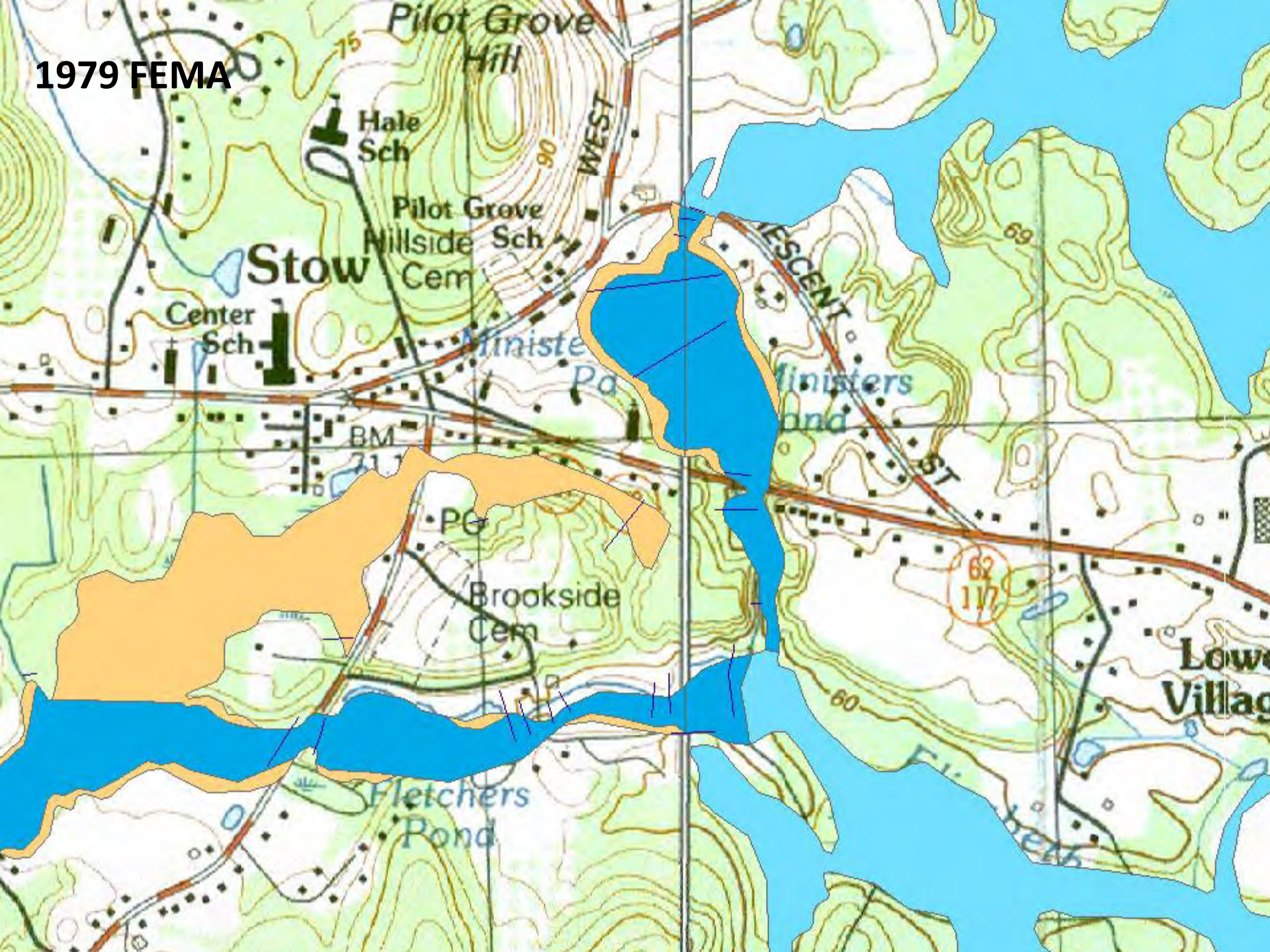

Elizabeth Brook, Stow, at Gleasondale Rd.

Elizabeth Brook, Stow
Hydrology - What Happened ?????

Location Gleasondale Road (Rt. 62)	Area	10-yr (ft^3/s)	50-yr (ft^3/s)	100-yr (ft^3/s)	500-yr (ft^3/s)
1979 FEMA	17.8 mi^2	446	760	918	1,324
2010 FEMA	17.8 mi^2	446	760	918	1,324
2014 FEMA	17.8 mi^2	446	760	918	1,324
Change FEMA 2014-1979	0%	0%	0%	0%	0%

Hydraulics - What Happened ?????




1979 FEMA
Pilot Grove Hill
Hale Sch
WEST
Pilot Grove
Hillside Sch
Cem
Stow
Center Sch
BM
PG
Brookside Cem
Fletchers Pond
Ministers Pond
ST
75
90
69
60
62
117

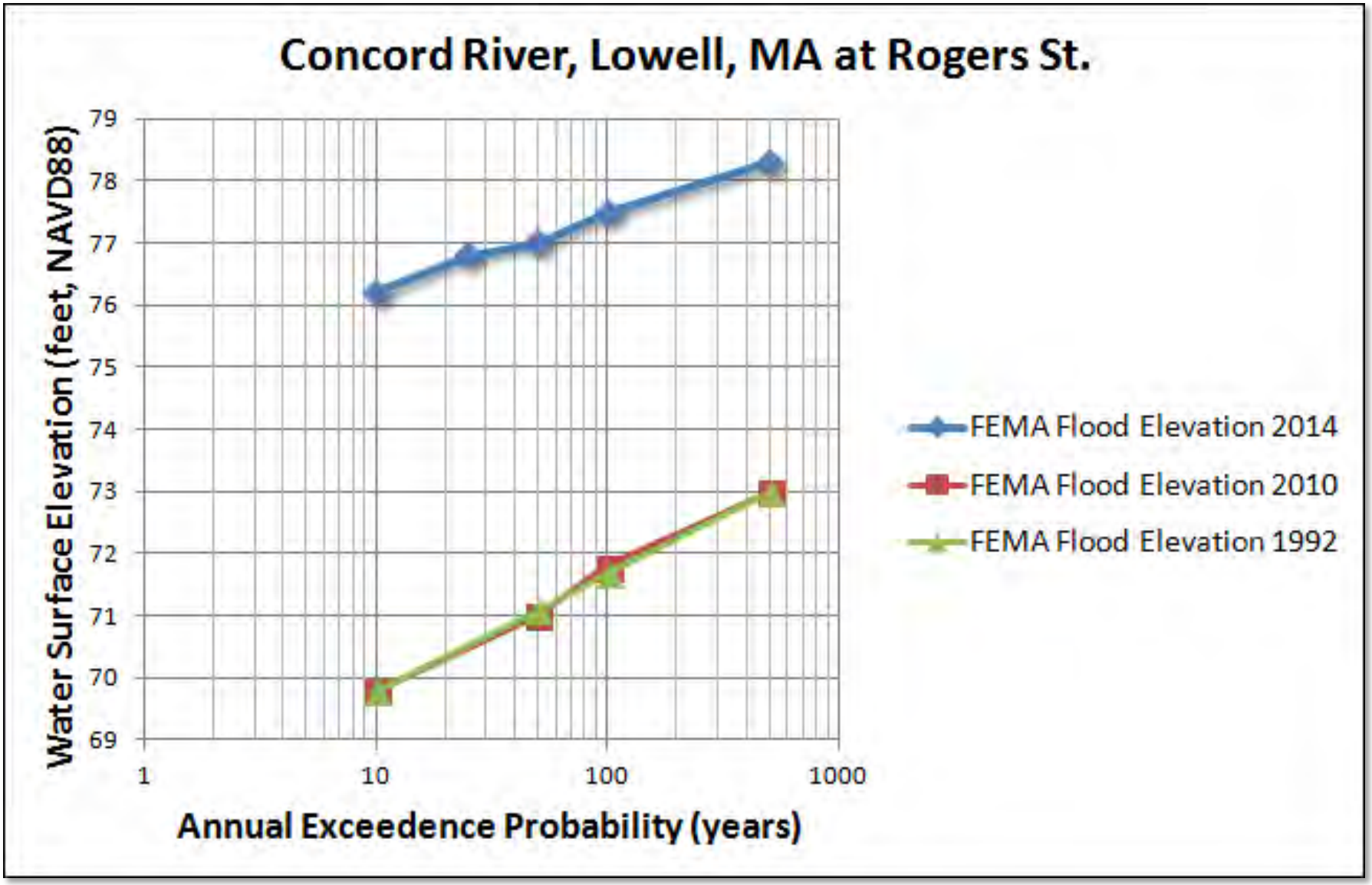

2014 FEMA
Pilot Grove Hill
Hale Sch
WEST
Pilot Grove Hillside Cem
Sch
Stow
Center Sch
CRESCENT
ST
Ministers Pd
Ministers Pond
BM
Pd
Brookside Cem
Fletchers Pond
Lowe
Villag
75
90
69
60
62
117


4 8:59:58 am
10 am
Rogers St at Lowell, MA, Concord River
Rogers St
Merrill St
121 ft
© 2014 Google

Rogers St., Concord River, Lowell
Hydrology - What Happened ?????

Location Concord River at Corporate Limit	Area	10-yr (ft^3/s)	50-yr (ft^3/s)	100-yr (ft^3/s)	500-yr (ft^3/s)
1992 FEMA	405 mi^2	3,700	5,300	6,000	7,800
2014 FEMA	Not Listed – Text Indicates No Change				
USGS Gage (1938-2013)	400 mi^2	4,126	5,607	6,244	7,753
Change FEMA 2014-1992		0%	0%	0%	0%

Hydraulics - What Happened ?????



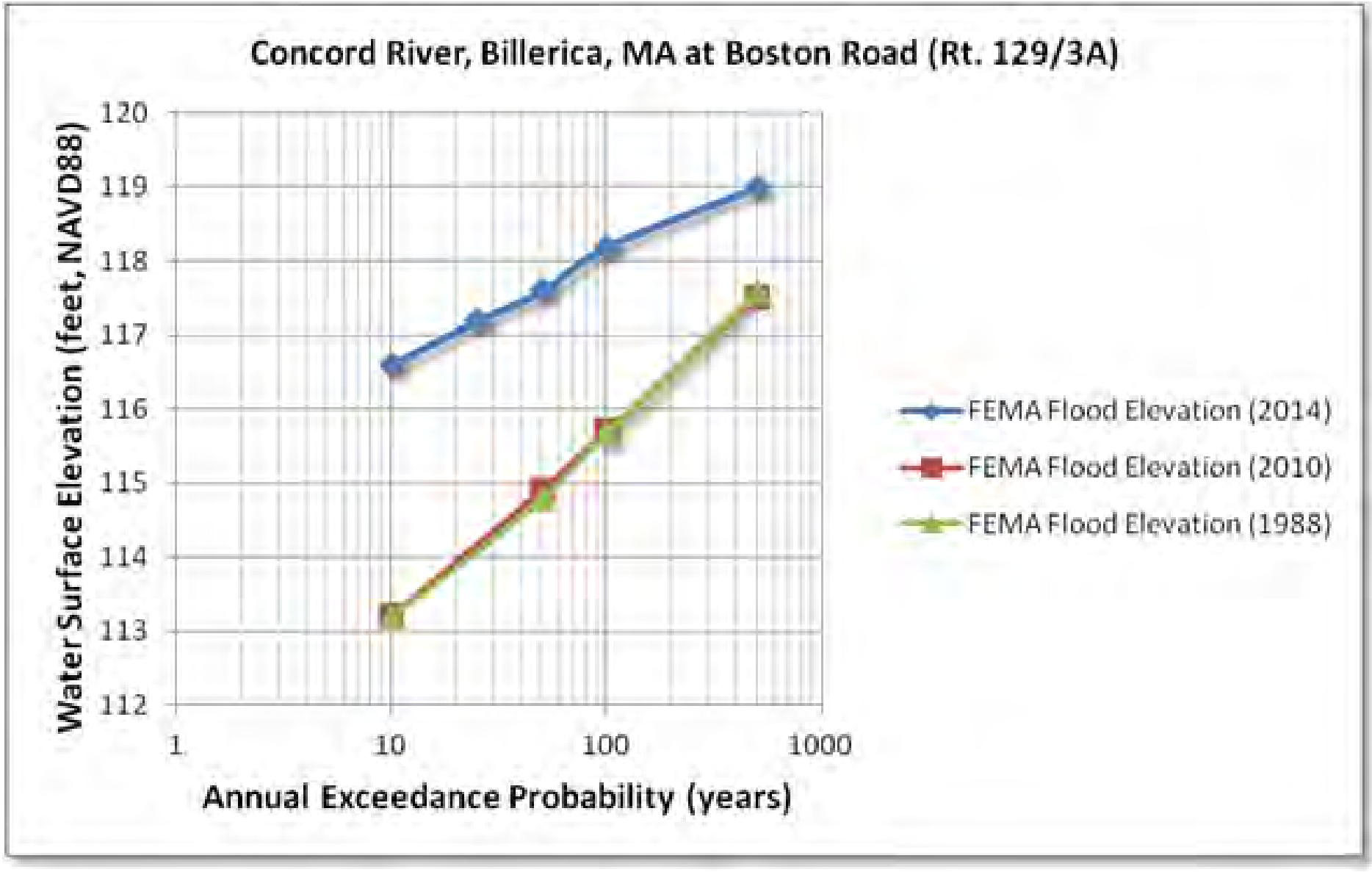

1992 FEMA Q3
SHERMAN
Moody
Sch
Gage
St
LAWRENCE


2014 FEMA
Moody
Sch
LAWRENCE

Concord River, Billerica
Hydrology - What Happened ?????

Location Talbot Mill Dam	Area	10-yr (ft^3/s)	50-yr (ft^3/s)	100-yr (ft^3/s)	500-yr (ft^3/s)
1985 FEMA	370 mi^2	2,940	4,660	5,675	8,395
2014 FEMA	370 mi^2	2,940	4,660	5,675	8,395
USGS Gage (1938-2013)	Adjusted to 370 mi^2 from gage area	3,817	5,186	5,776	7,172
Change FEMA 2014-1985	0%	0%	0%	0%	0%

Hydraulics - What Happened ?????




1985 FEMA Q3
3A
A LANE
RD
Filtration
Plant
BM 36.2
Rt. 3A, Billerica
Sandpit
ST
BRIDGE
BM 34.2
COVE
AVE

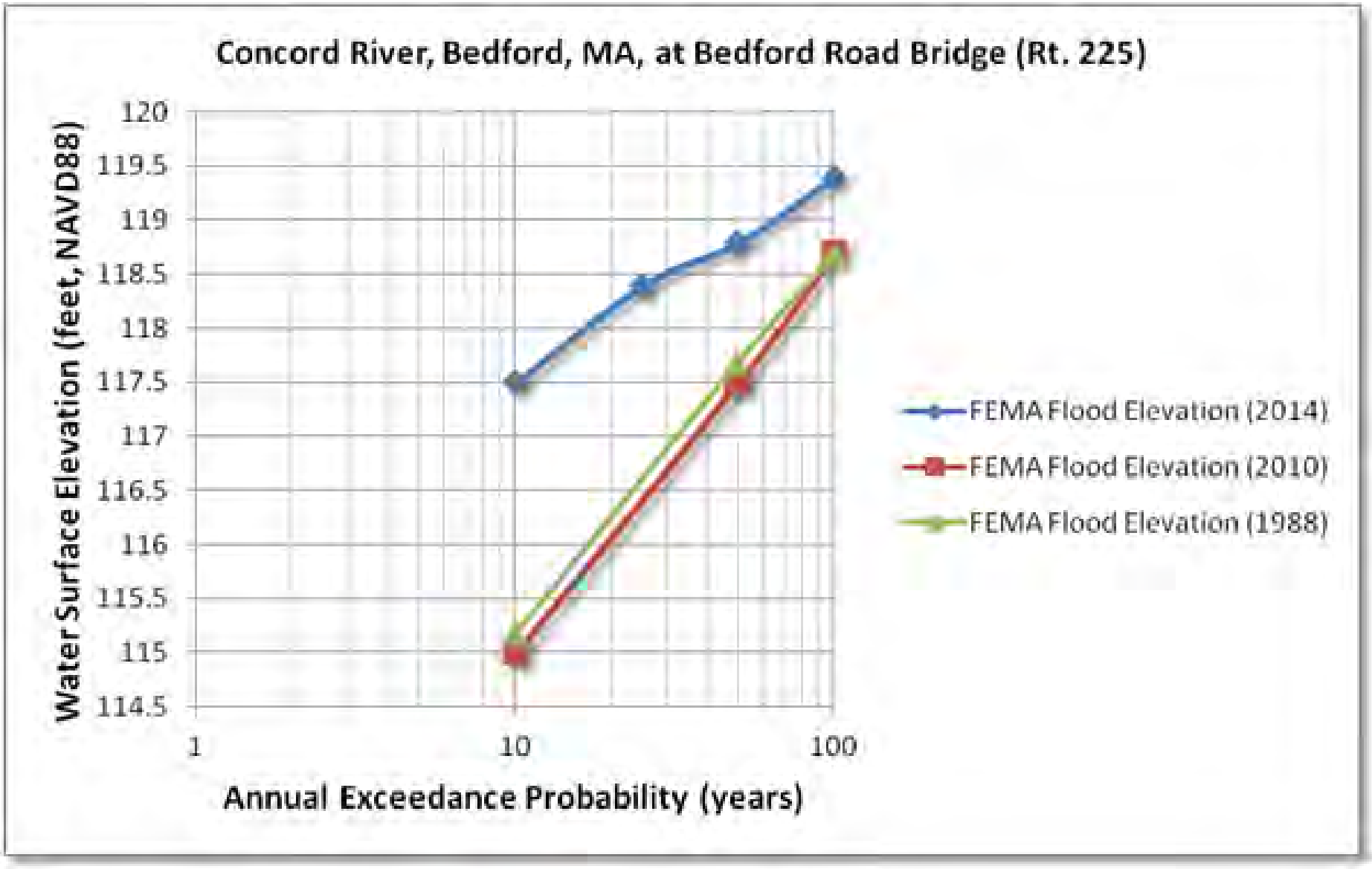

2014 FEMA
A LANE
RD
Filtration
Plant
BM 38
BM 36.2
Rt. 3A, Billerica
Sandpit
ST
BRIDGE
BM 34.2
COVE
AVE


Rt. 225 Bridge,
Bedford, MA
Concord River
(2014)

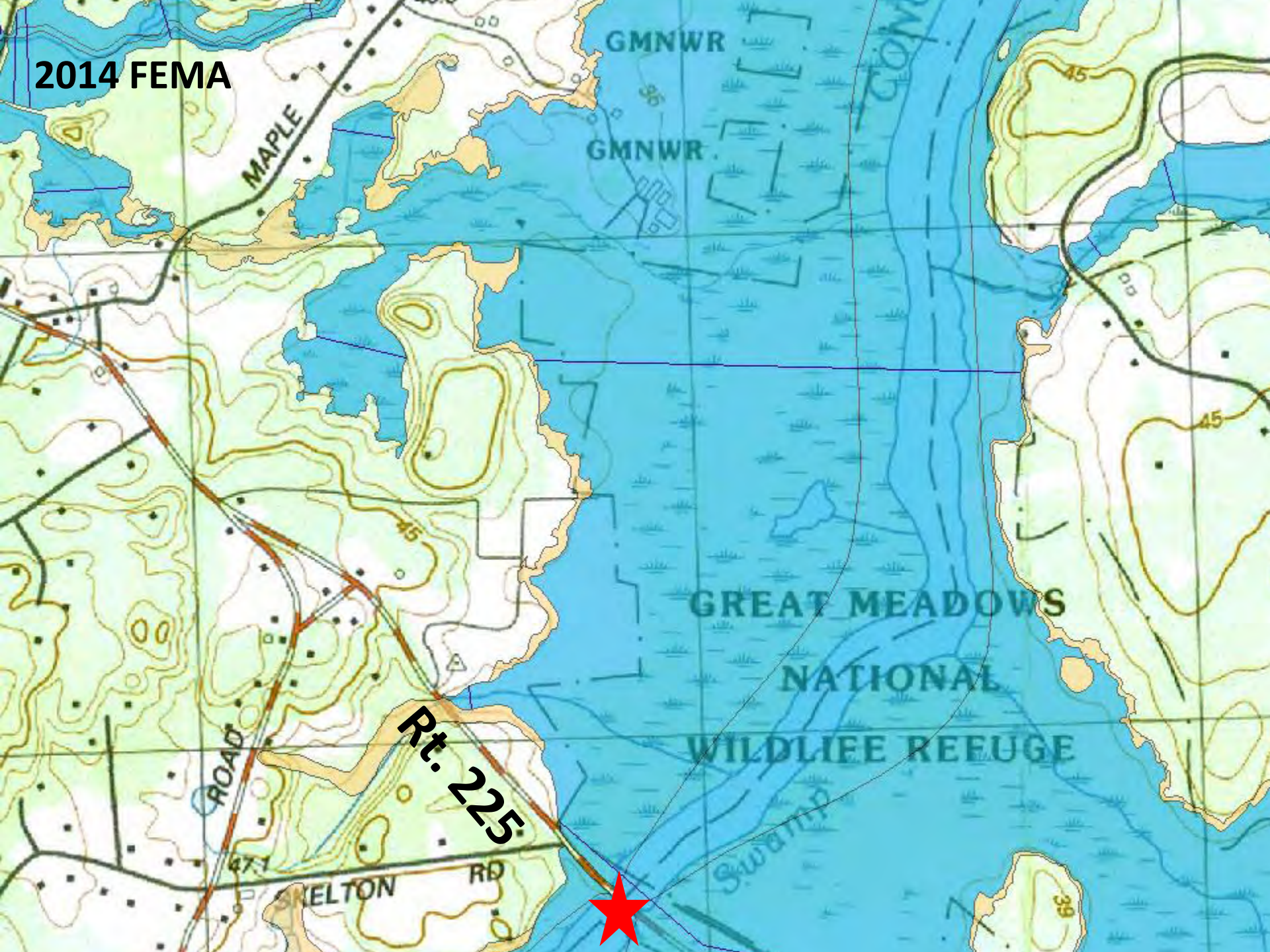
Route 225 Bridge, Concord River, Bedford
Hydrology - What Happened ?????

Location US Rt. 3 Bridge	Area	10-yr (ft^3/s)	50-yr (ft^3/s)	100-yr (ft^3/s)	500-yr (ft^3/s)
1988 FEMA	363 mi^2	2,885	4,577	5,575	8,245
2014 FEMA	363 mi^2	2,885	4,577	5,575	8,245
USGS Gage (1938-2013)	Adjusted to 363 mi^2 from gage area	3,744	5,088	5,666	7,036
Change FEMA 2014-1988	0%	0%	0%	0%	0%

Hydraulics - What Happened ?????




1988 FEMA Q3
GMNWR
GMNWR
MAPLE
45
45
45
GREAT MEADOWS
NATIONAL
WILDLIFE REFUGE
Swamp
Rt. 225
ROAD
47.1
SKELTON
RD
39

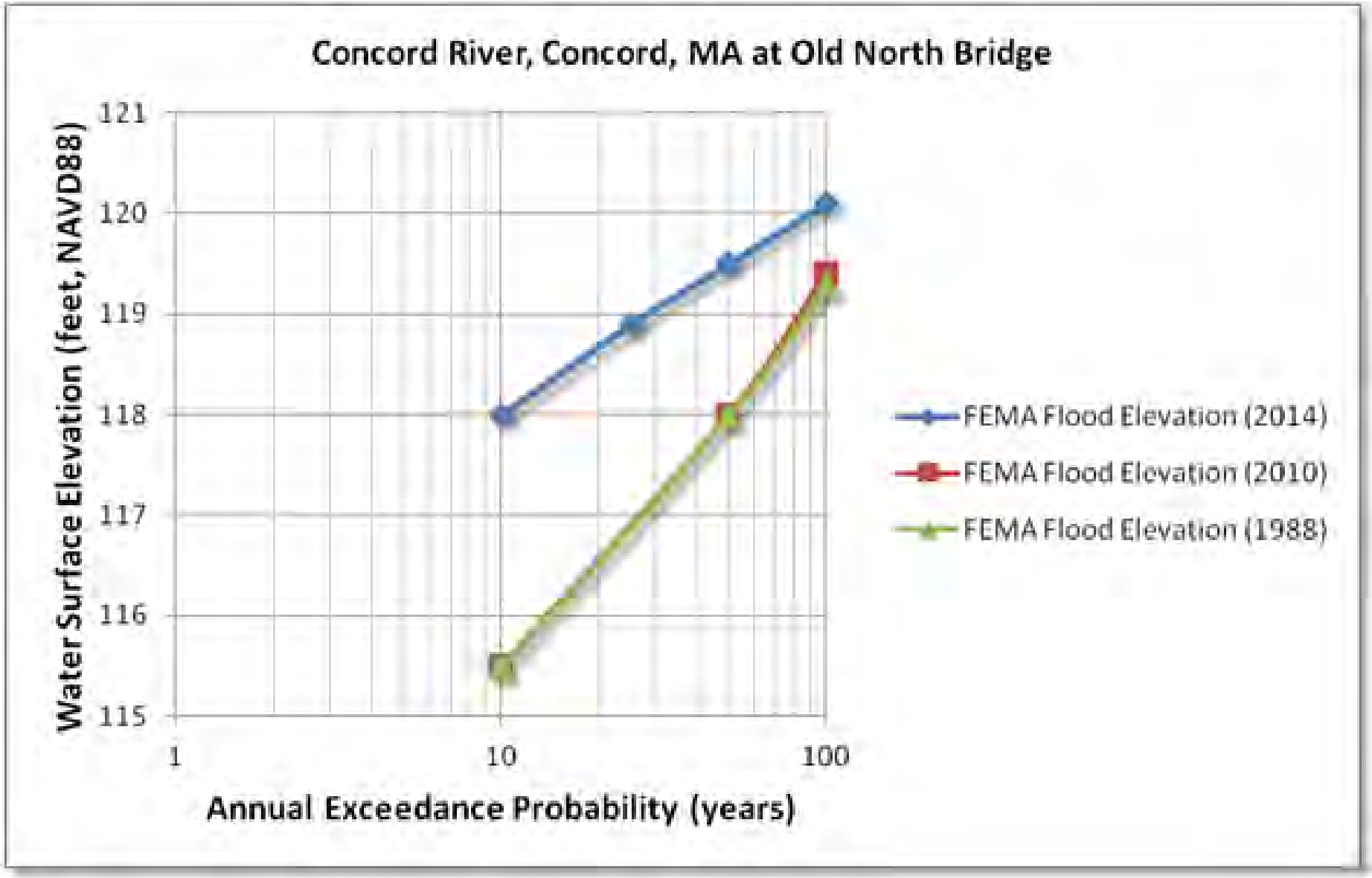

2014 FEMA
GMNWR
GMNWR
MAPLE
45
45
GREAT MEADOWS
NATIONAL
WILDLIFE REFUGE
Swamp
Rt. 225
ROAD
47.1
SKELTON
RD
39


Old North Bridge, Concord, MA
Concord River

Old North Bridge, Concord River, Concord Hydrology - What Happened ?????

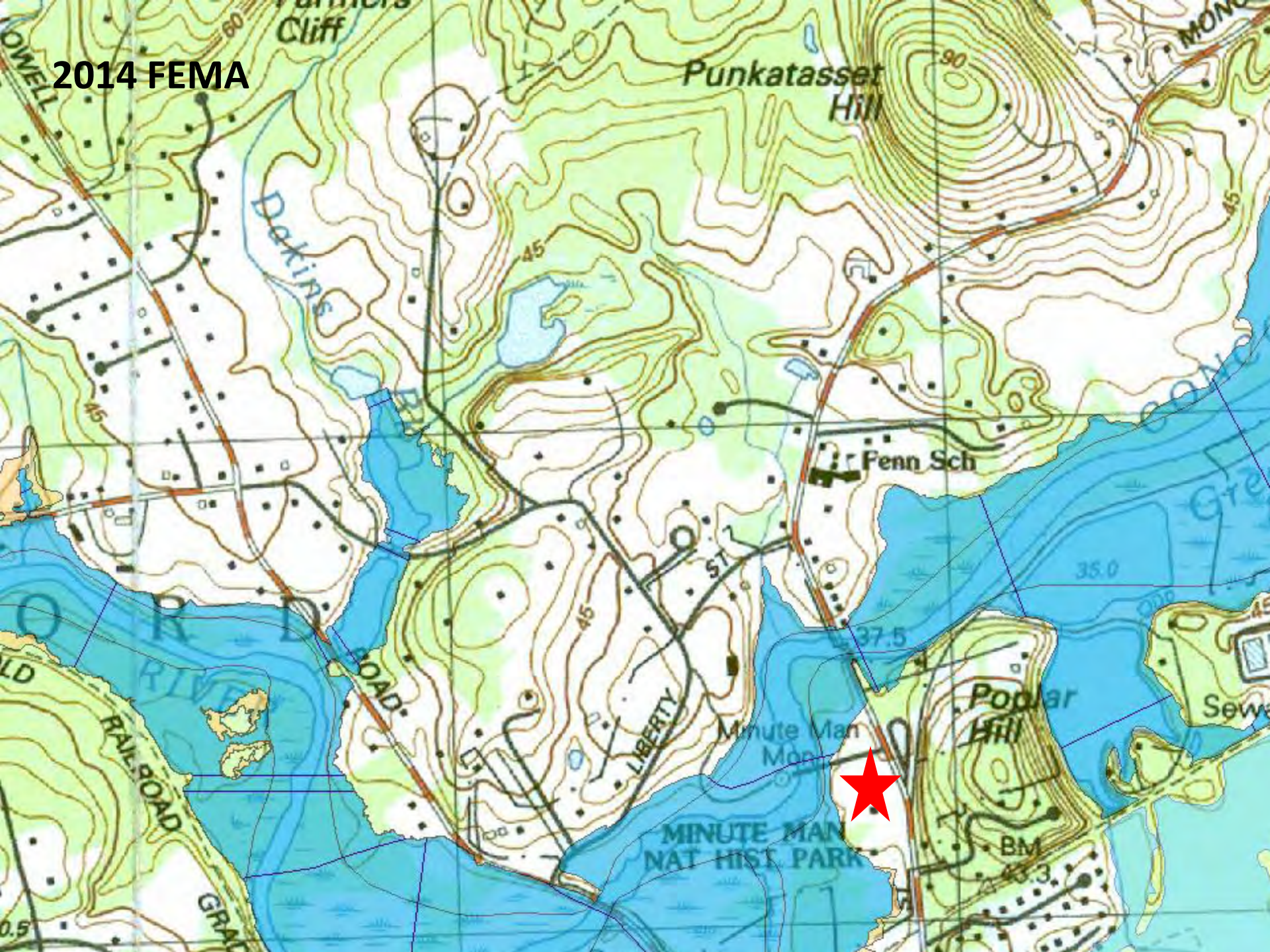
Location Concord River at Corporate Limit	Area	10-yr (ft^3/s)	50-yr (ft^3/s)	100-yr (ft^3/s)	500-yr (ft^3/s)
1988 FEMA	352 mi^2	2,930	4,680	5,700	8,430
2014 FEMA	352 mi^2	2,930	4,680	5,700	8,430
USGS Gage (1938-2013)	Adjusted to 352 mi^2 from gage area	3,631	4,934	5,495	6,823
Change FEMA 2014-1988	0%	0%	0%	0%	0%

Hydraulics - What Happened ?????



1988 FEMA Q3


Cliff
Punkatasset Hill
Dakins Brook
Fenn Sch
CONCORD RIVER
ROAD
LIBERTY
ST
Minute Man Mon
MINUTE MAN NAT HIST PARK
Poplar Hill
BM 43.3
Sew
RAILROAD
GRAD
35.0
37.5
45
90

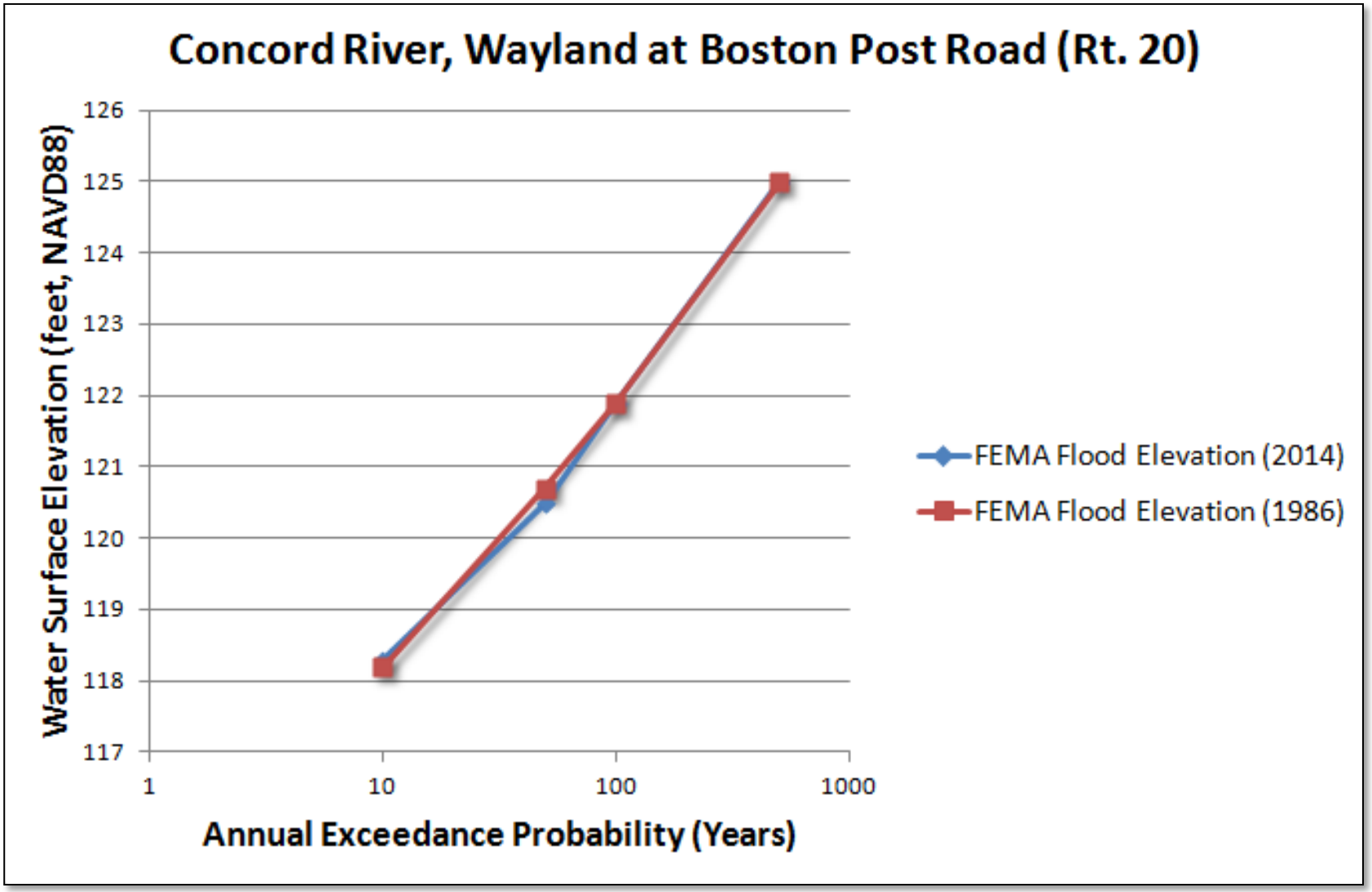

2014 FEMA
Punkatasset Hill
Cliff
Fenn Sch
Minute Man
MINUTE MAN
NAT HIST PARK
Poplar Hill
BM
LIBERTY
ST
ROAD
RAILROAD

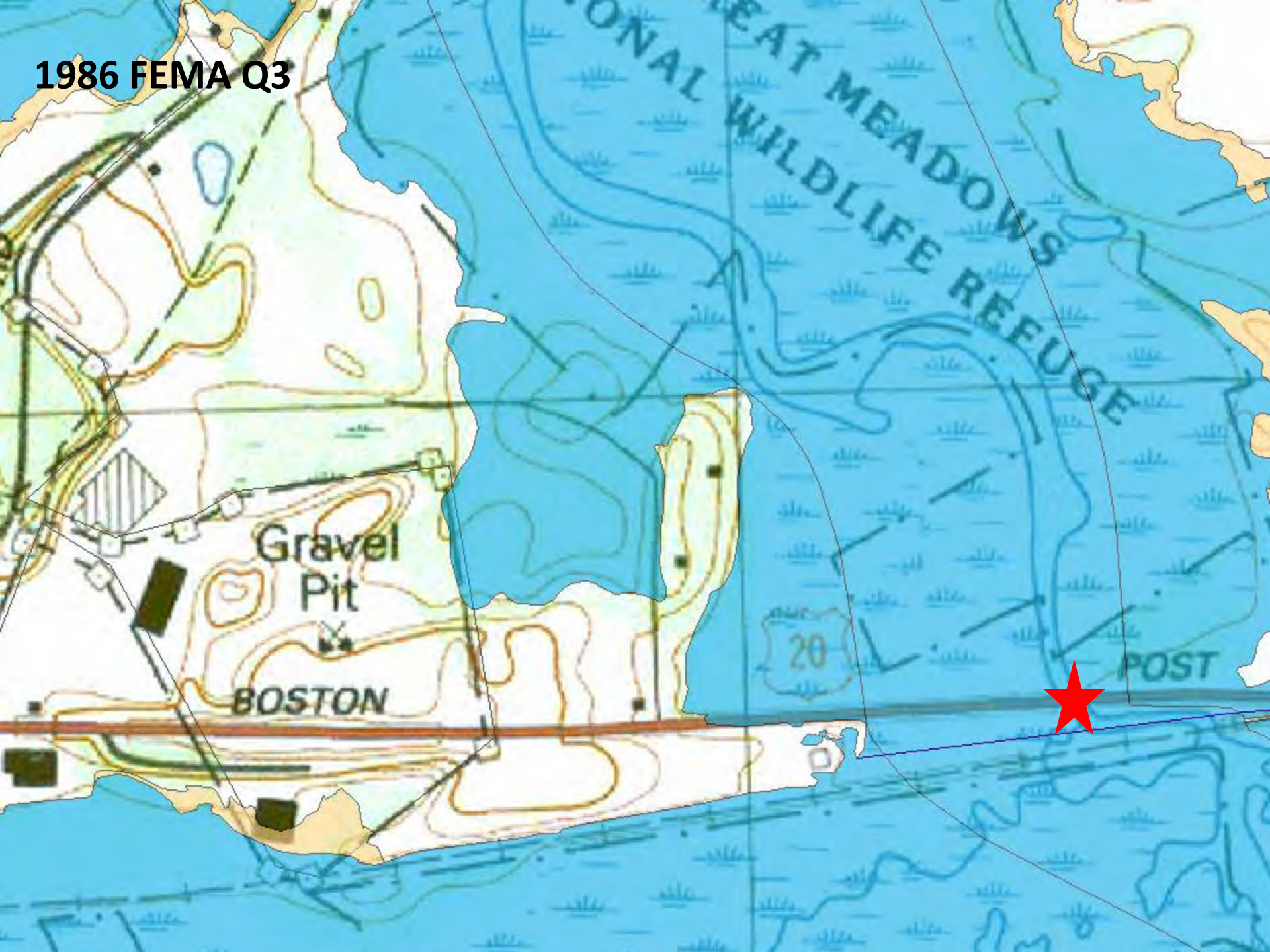
Rt. 20/27/126, Wayland MA Sudbury River (2010)

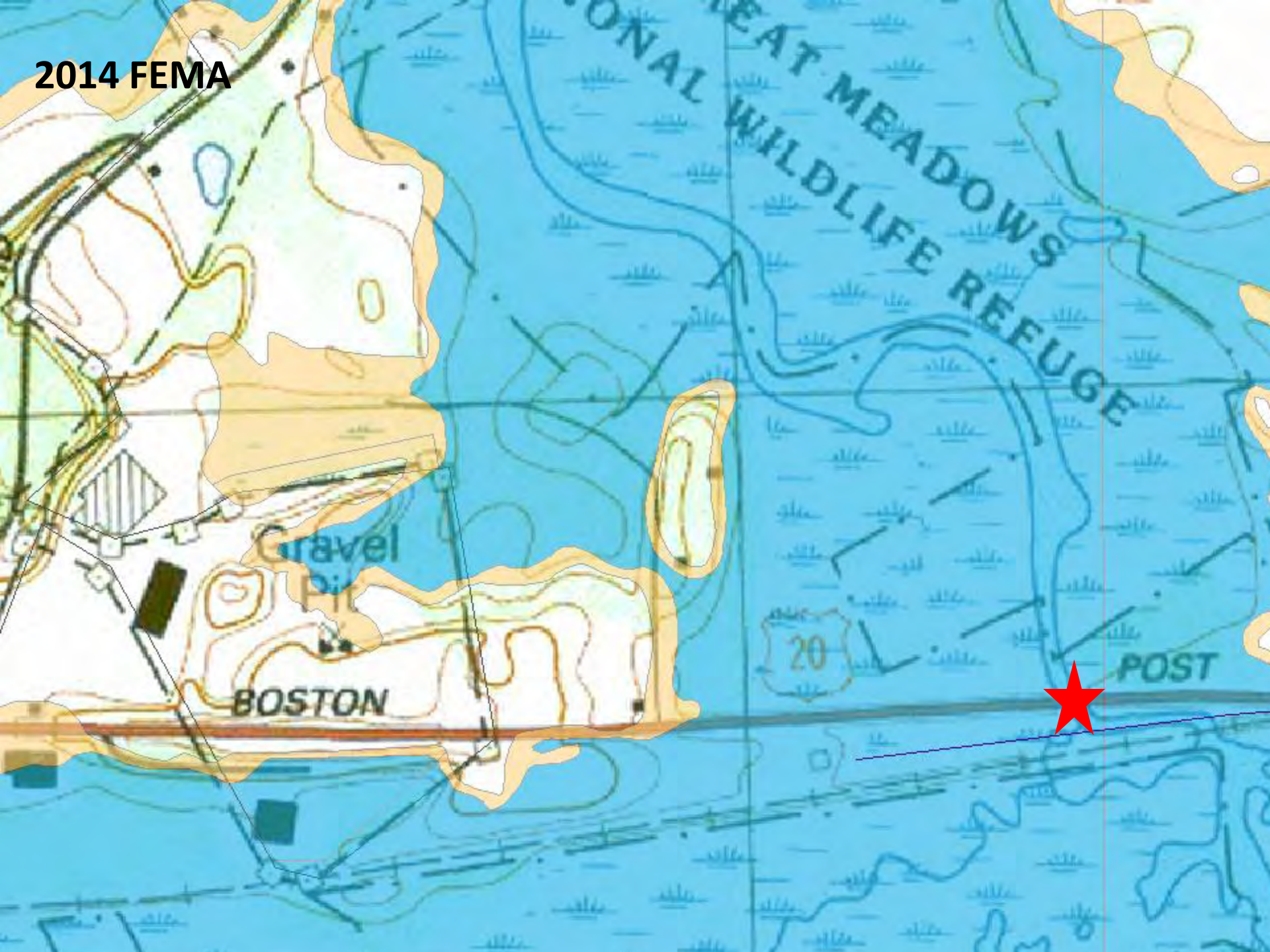
Sudbury River, Wayland
Hydrology - What Happened ?????

Location D.S. Old Sudbury Road	Area	10-yr (ft^3/s)	50-yr (ft^3/s)	100-yr (ft^3/s)	500-yr (ft^3/s)
1986 FEMA (developed using NRCS TR20)	140.95 mi^2	2,810	4,330	5,080	6,800
2014 FEMA	140.8 mi^2	2,180	3,350	3,940	5,570
USGS Gage (1980-2013)	Adjusted to 140 mi^2 from gage area of 106 mi^2	2,491	3,600	4,128	5,514
Change FEMA 2014-1986		-22%	-22%	-22%	-18%

Hydraulics - What Happened ?????



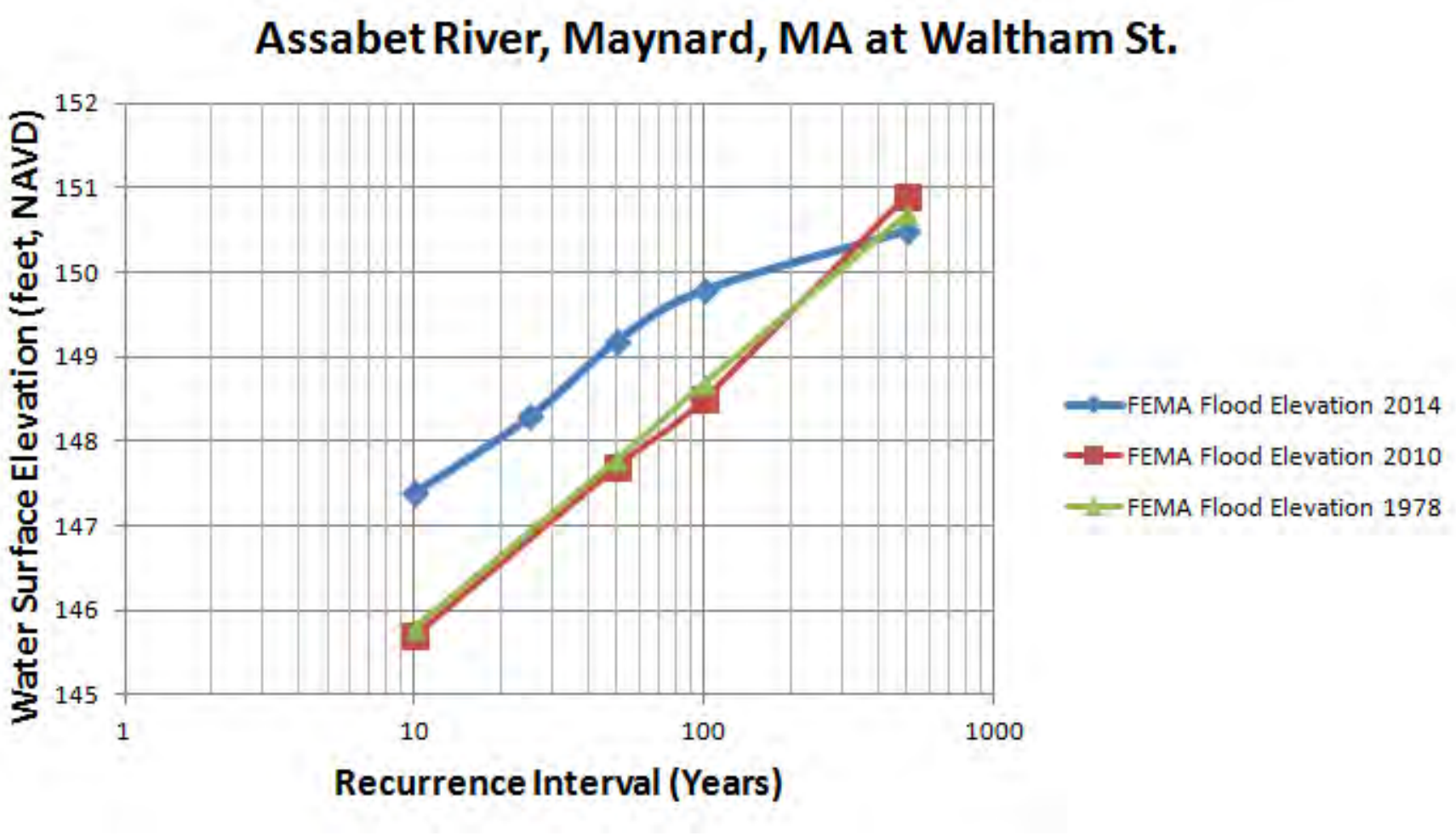

1986 FEMA Q3
ONAL WILDLIFE REFUGE
EAT MEADOWS
Gravel
Pit
BOSTON
20
POST

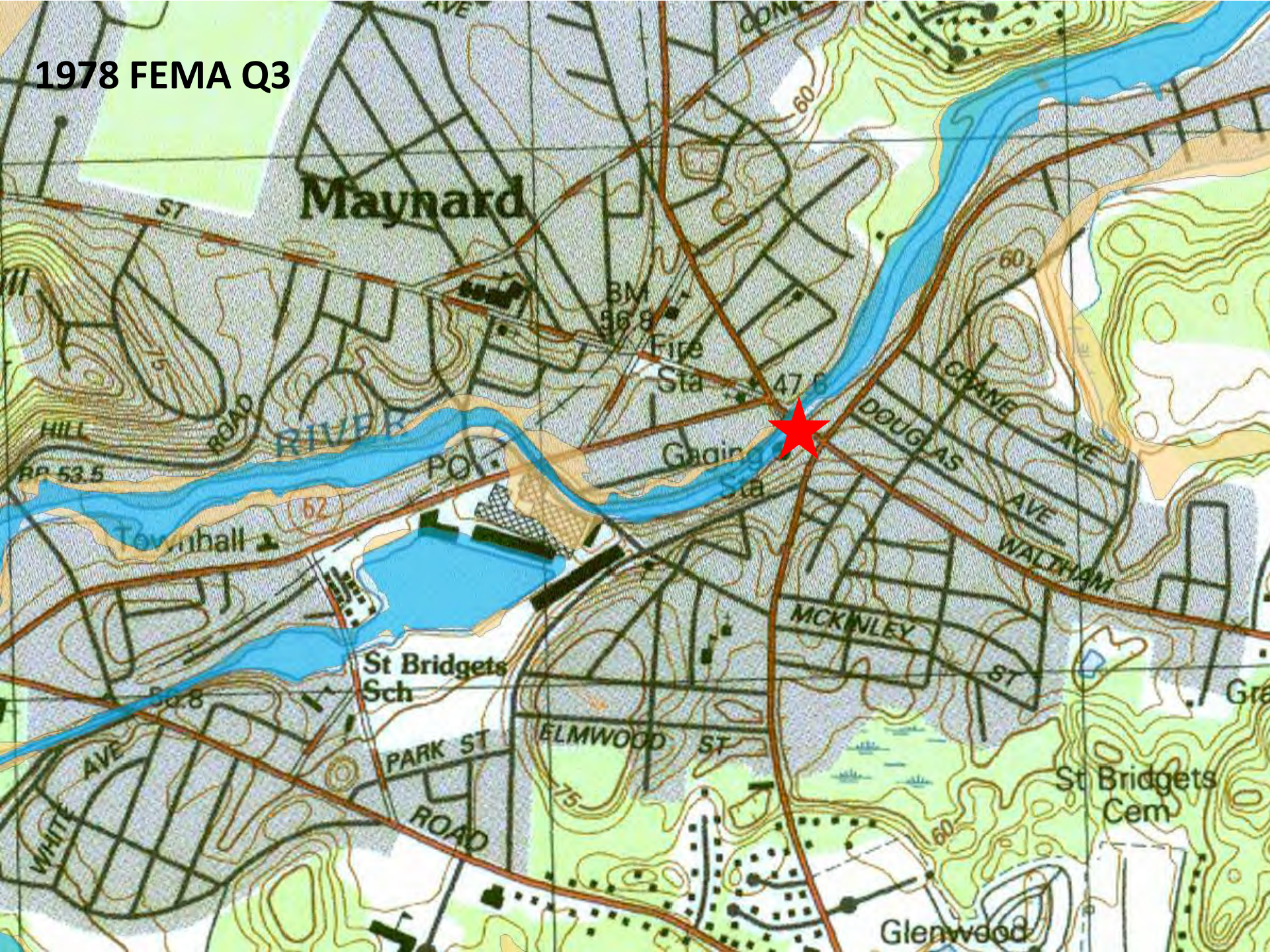

2014 FEMA
ONAL WILDLIFE REFUGE
EAT MEADOWS
Gravel
Pit
BOSTON
20
POST

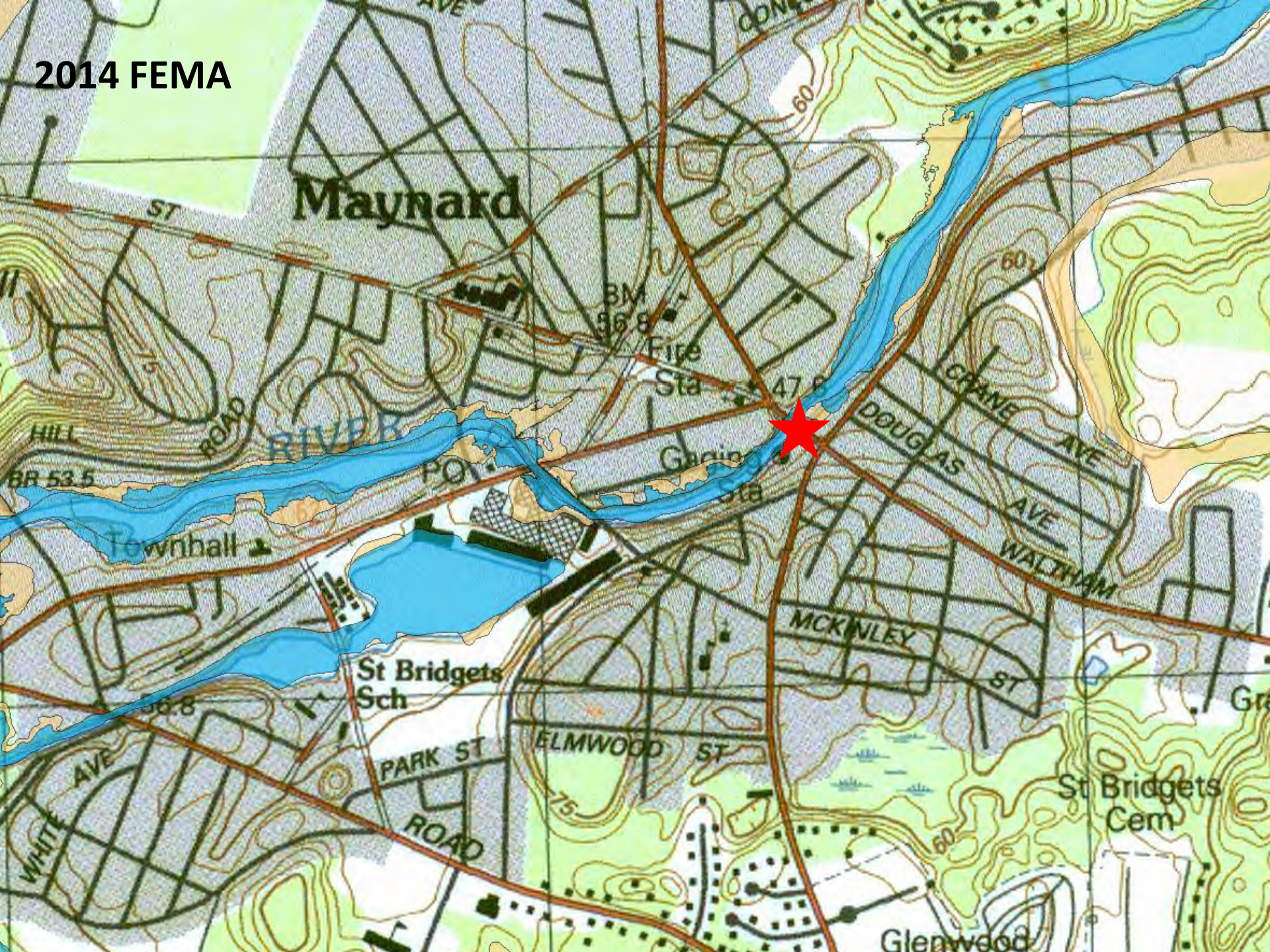
Assabet River, Maynard
Hydrology - What Happened ?????

Location near Acton town line	Area	10-yr (ft^3/s)	50-yr (ft^3/s)	100-yr (ft^3/s)	500-yr (ft^3/s)
1978 FEMA	117.3 mi^2	1,600	2,702	3,320	5,201
2014 FEMA	117.8 mi^2	2,280	3,450	4,010	5,460
USGS Gage (1942-2013)	Adjusted to 117.8 mi^2 from gage area of 116 mi^2	2,229	3,437	4,032	5,642
Change FEMA 2014-1978		+42%	+28%	+21%	+5%

Hydraulics - What Happened ?????




1978 FEMA Q3
Maynard
ST
BM
568
Fire
Sta
47.8
HILL
ROAD
RIVER
PO
Townhall
DOUGLAS
AVE
CRANE
AVE
WALTHAM
MCKINLEY
ST
St Bridgets
Sch
ELMWOOD
ST
PARK ST
ROAD
WHITE
AVE
St Bridgets
Cem
Glenwood
60
75


2014 FEMA
Maynard
ST
BM
Fire
Sta
CRANE
AVE
DOUGLAS
AVE
WALNUM
HILL
RIVER
PO
Townhall
MCKINLEY
ST
St Bridgets
Sch
PARK ST
ELMWOOD ST
AVE
WHITE
ROAD
St Bridgets
Cem
Glenwood
60
75

Consequences

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWN OF
WINCHESTER,
MASSACHUSETTS
MIDDLESEX COUNTY

PANEL 2 OF 4
(SEE MAP INDEX FOR PANELS NOT PRINTED)

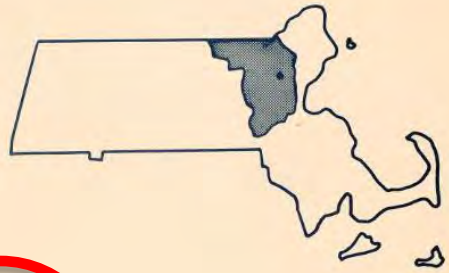
COMMUNITY-PANEL NUMBER
250228 0002 B

EFFECTIVE DATE:
JUNE 18, 1980

U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

FLOOD INSURANCE STUDY

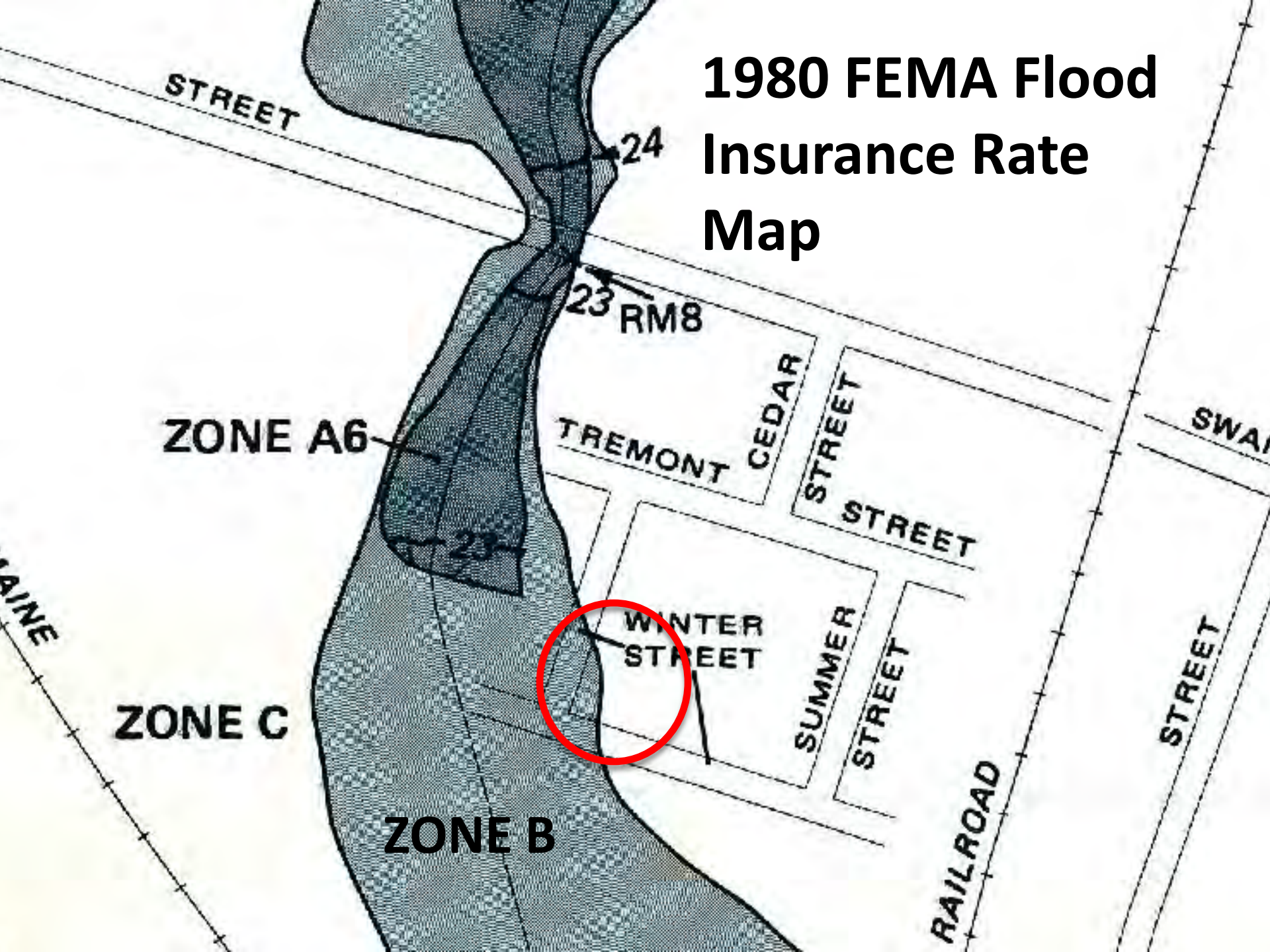
TOWN OF
WINCHESTER,
MASSACHUSETTS
MIDDLESEX COUNTY

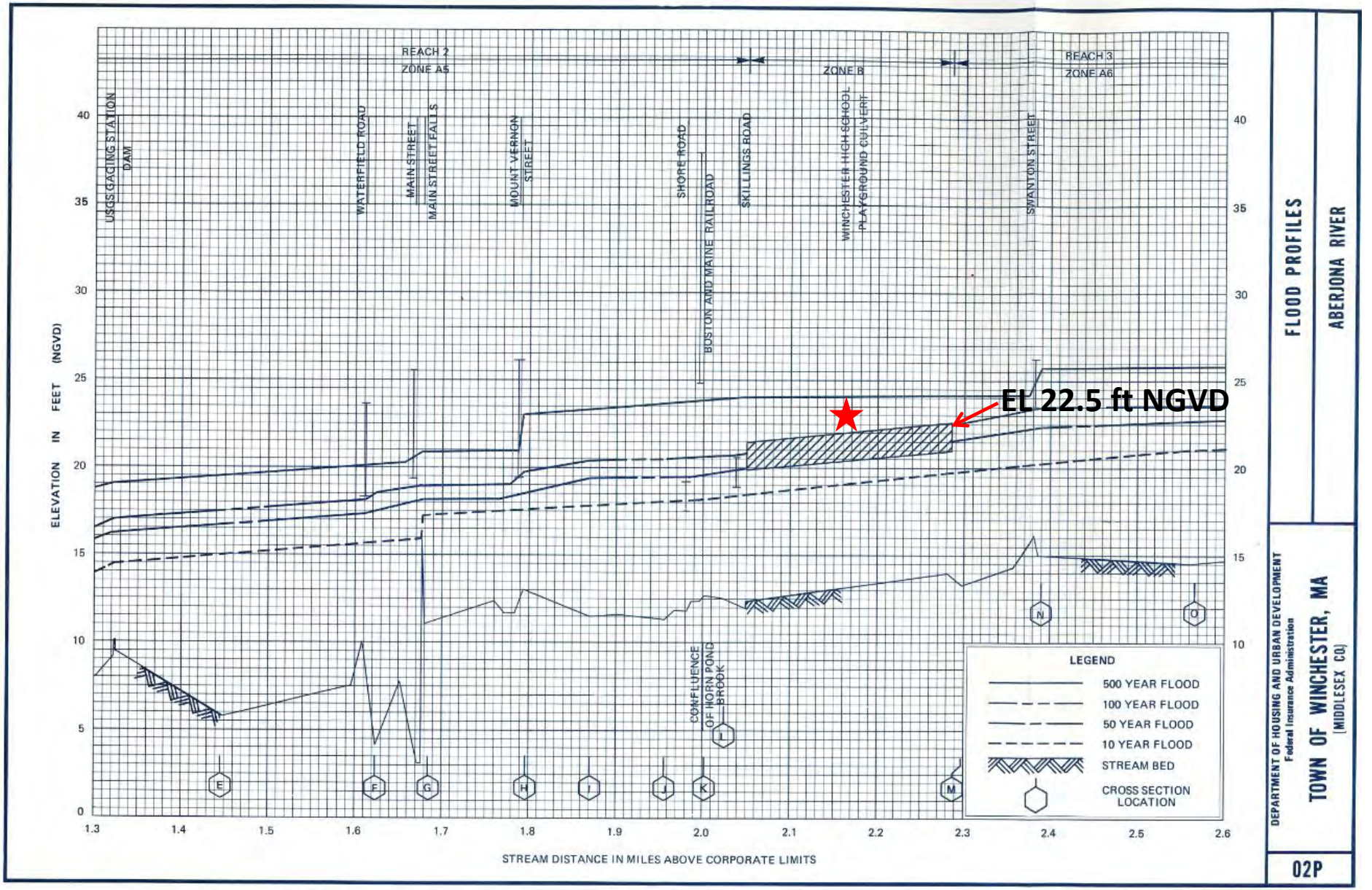


DECEMBER 1979

FEDERAL EMERGENCY MANAGEMENT AGENCY
FEDERAL INSURANCE ADMINISTRATION

COMMUNITY NUMBER - 250228


1980 FEMA Flood Insurance Rate Map
STREET
24
23
RM8
ZONE A6
TREMONT
CEDAR
STREET
STREET
SWA
WINTER
STREET
SUMMER
STREET
STREET
RAILROAD
ZONE C
ZONE B



1979 FEMA Flood Profile

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Aberjona River								
A	0.869	70	320	4.1	9.8	9.8	9.8	0.0
B	1.005	67	370	3.5	13.5	13.5	13.5	0.0
C	1.111	78	390	3.4	15.2	15.2	15.2	0.0
D	1.297	197	775	1.7	16.6	16.6	16.6	0.0
E	1.446	68	390	3.1	17.6	17.6	17.6	0.0
F	1.622	44	595	2.1	18.5	18.5	18.5	0.0
G	1.682	142	790	1.5	18.9	18.9	18.9	0.0
H	1.796	38	215	5.6	19.7	19.7	19.8	0.1
I	1.871	116	790	1.5	20.4	20.4	20.5	0.1
J	1.955	80	630	1.9	20.4	20.4	20.5	0.1
K	2.002	104	750	1.6	20.7	20.7	20.8	0.1
L	2.024	56	400	3.1	20.7	20.7	20.8	0.1
M	2.296	100	420	1.7	22.5	22.5	22.5	0.0
N	2.387	58	385	1.9	23.5	23.5	23.7	0.2
O	2.568	50	425	1.7	23.6	23.6	24.0	0.4
P	2.744	50	330	2.2	25.3	25.3	26.1	0.8
Q	2.856	50	380	1.9	25.5	25.5	26.3	0.8
R	3.040	50	295	2.4	26.5	26.5	26.9	0.4
S	3.092	100	825	0.9	26.6	26.6	27.0	0.4

[1] Miles above corporate limits

1979 FEMA Floodway Data Table

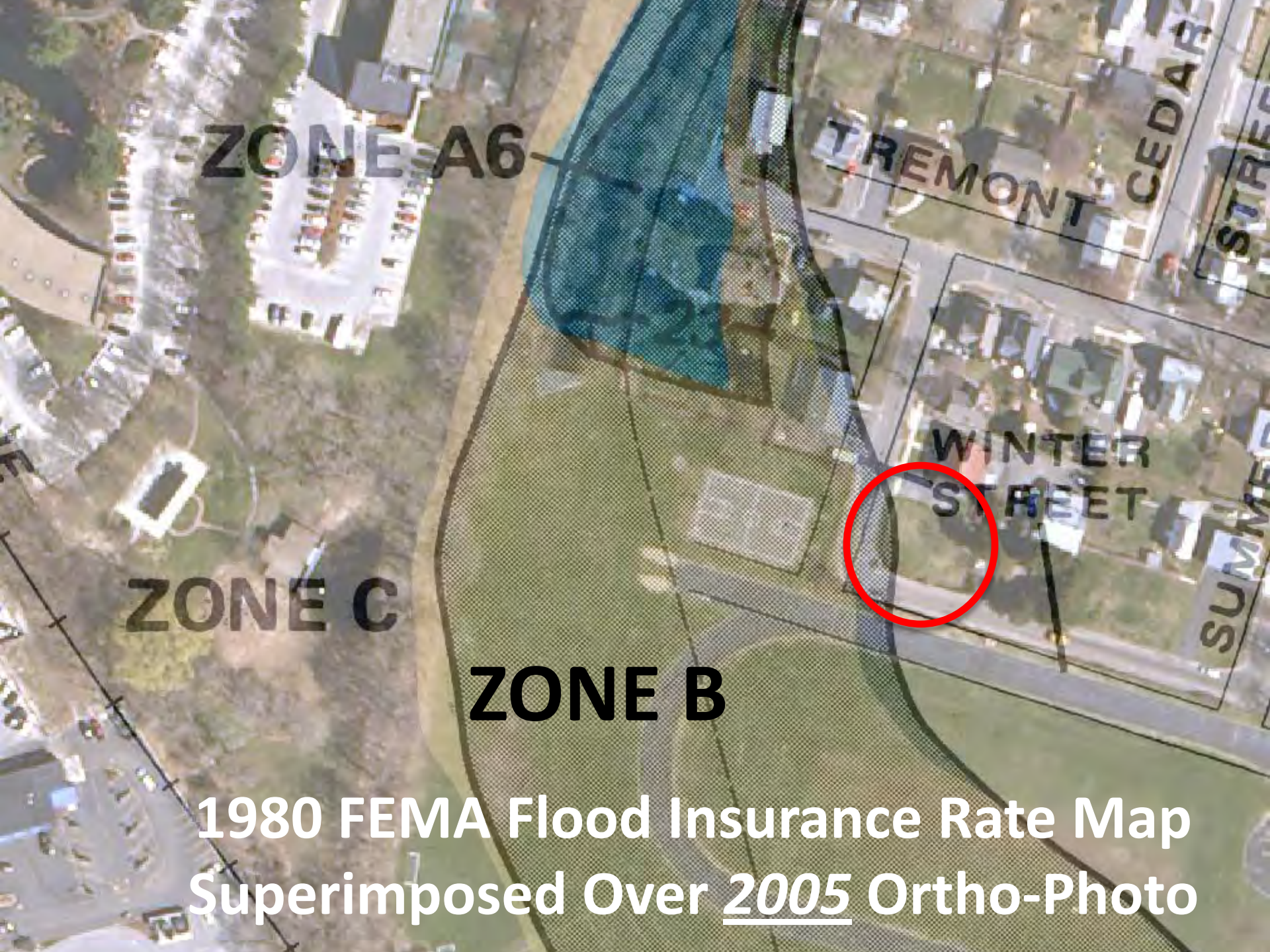
TABLE 2

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

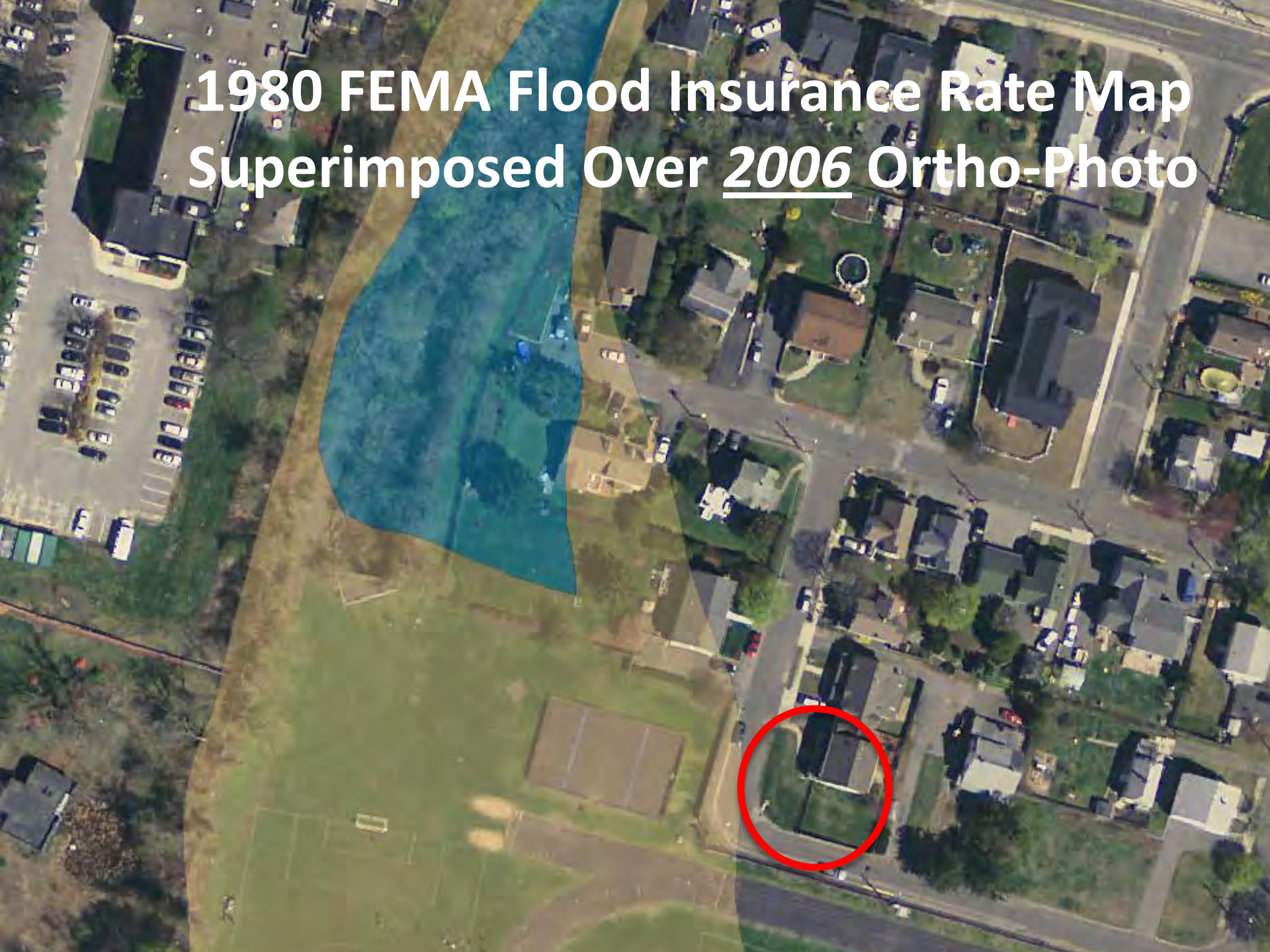
TOWN OF WINCHESTER, MA
(MIDDLESEX CO.)

FLOODWAY DATA

ABERJONA RIVER



1980 FEMA Flood Insurance Rate Map
Superimposed Over *2005* Ortho-Photo


1980 FEMA Flood Insurance Rate Map
Superimposed Over *2006* Ortho-Photo


Same building, March 2010 flood
(approximately only a 40-year flood)

Aberjona River, Winchester
Hydrology - What Happened ?????

Location	1979 FEMA Study 100-yr Flood Q	2010 FEMA Study 100-yr Flood Q	% Increase
USGS Aberjona River Gage at Winchester, MA	1,200 ft^3/sec	1,830 ft^3/sec	53%

2010 FEMA Update, Flood Map Insurance Rate Map

The building was built in 2006. It was not located in FEMA flood zone at that time according to 1980 FEMA study that was then available . No compensatory flood storage was provided. The preliminary FEMA study was issued in 2007. The building flooded in March 2010. The FEMA study was issued in June 2010.

Conclusion

- River flooding is increasing in some rivers in New England based on analysis of peak annual maxima series recorded at USGS gages.
- Outdated Wandle 1983 regression equations were used in the FEMA 2014 study for Concord River watershed to develop the hydrology.
- FEMA 2014 study results under represents actual hydrology for the Concord River based on comparison with USGS gage records.
- FEMA 2014 study for Concord River watershed and flood insurance rate maps did not incorporate future climate change.
- Recent LiDar topography and bridge/culvert surveys incorporated into FEMA hydraulic portion of the study played role in determining extent of flooding in Concord River watershed.

Conclusion

- **Use FEMA flood profile contained in the Flood Insurance Study required by 310 CMR 10.57 for Wetlands regulatory purposes as flood maps may not properly locate flood elevation.**
- **When FEMA flood profile is available, Conservation Commissions must use the most recently available flood profile, unless the presumption is overcome.**
- **If the preliminary flood study is more recently dated than the effective flood study, use the FEMA flood profile in the preliminary study, unless the presumption is overcome.**
- **Familiarize yourself with most recent FEMA study/maps for your town so you can determine where changes were made.**
- **Where no FEMA flood profile is available, Conservation Commissions must use procedures described at 310 CMR 10.57 to determine the BLSF boundary.**