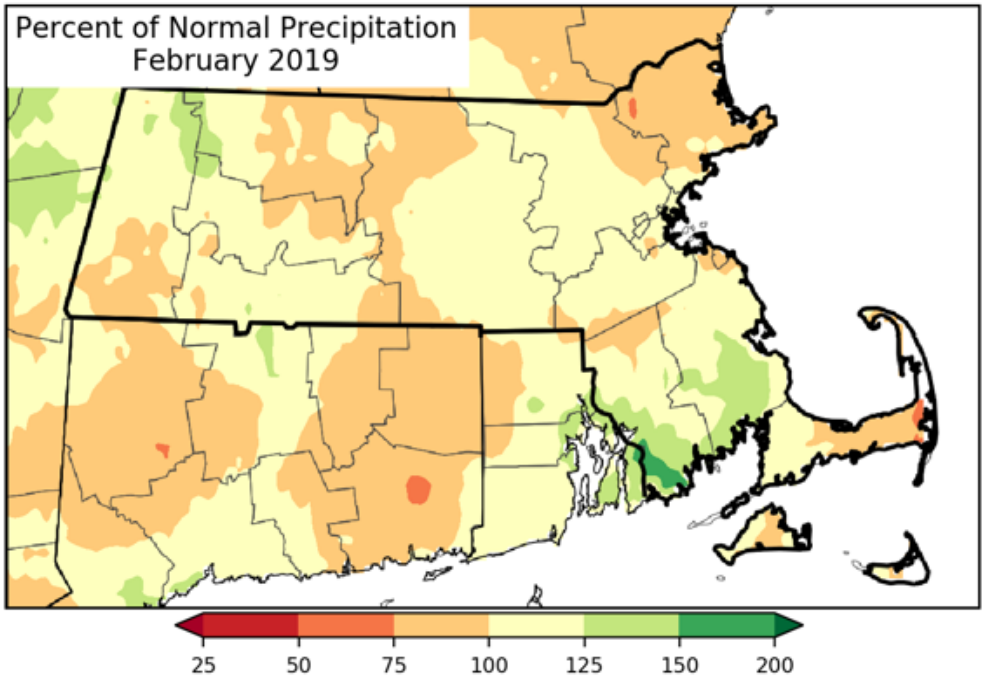
MASSACHUSETTS WATER RESOURCES COMMISSION

February 2019 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

- Monthly average temperatures were near normal to 3 degrees Fahrenheit higher than average but daily temperatures in Boston deviated from average by minus 15 to plus 22 degrees Fahrenheit.
- Precipitation, Streamflow, Groundwater, and Reservoir Indices are Normal for all regions. Some monthly average values remain high but a steady decline was observed over the course of the month ending at near average values across the state.
- Crop Moisture Index indicates wet conditions. Data for the Fire Index are not collected during the winter.
- NOAA's forecast for March projects 33-40% chance of below normal temperatures and 33-40% chance of above normal precipitation across the state.
- Appendix I presents indices not shown in the main report and additional details about precipitation. Appendix II presents the drought level thresholds for all indices.

PRECIPITATION



Precipitation was near average for February.

Map from the Northeast Regional Climate Center. http://www.nrcc.cornell.edu/regional/monthly/monthly.html

Region	Estimated Precipitation (inches)	Departure from Average Feb. (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	3.22	0.40	Normal	Normal
CT River Valley	3.50	0.32	Normal	Normal
Central	3.05	-0.45	Normal	Normal
Northeast	3.55	0.24	Normal	Normal
Southeast	3.56	0.02	Normal	Normal
Cape Cod & Islands	3.70	0.19	Normal	Normal

Key to Drought Plan Levels
Normal
Advisory
Watch
Warning
Emergency

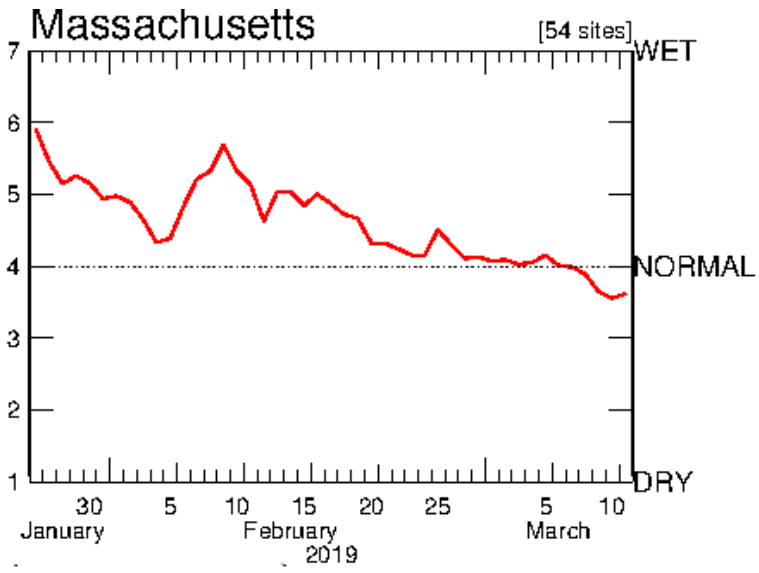
STREAMFLOW

Average monthly streamflow was above or near average flows relative to historical data. However, high flows steadily declined over the course of the month ending at near average flows.

Average Daily Streamflow Compared to Historical for the Day of the Year

This plot depicts data for the 45-day period ending March 10.
http://waterwatch.usgs.gov/index.php?id=real&sid=w__plot&r=ma

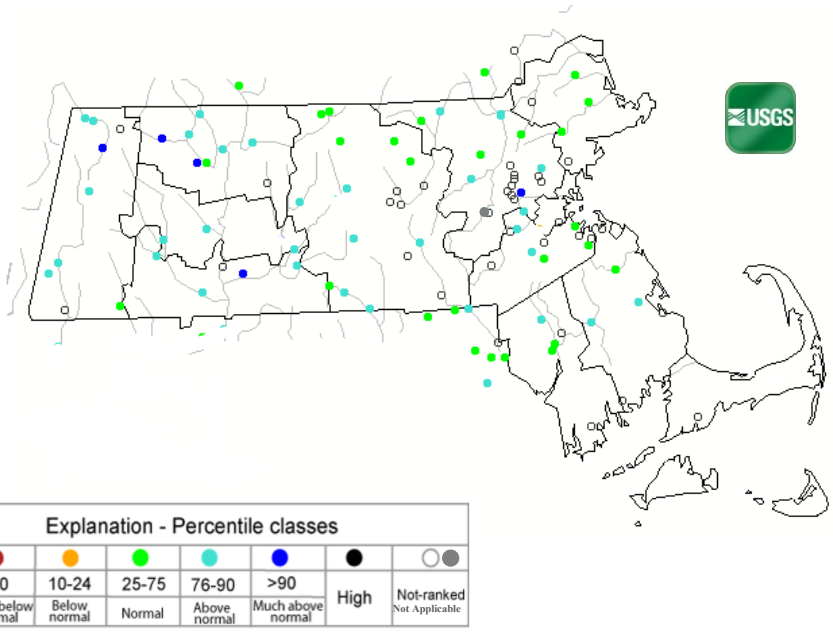
KEY:
1 = New record low for day
2 = < 10th percentile
3 = 10th – 24th percentile
4 = 25th – 74th percentile
5 = 75th – 89th percentile
6 = > 90th percentile
7 = New record high for day



Average February Streamflow Compared to Historical for the Month of the Year

Streamflow is monitored by the Commonwealth of Massachusetts and United States Geological Survey (USGS) cooperative stream gaging program.

http://waterwatch.usgs.gov/index.php?r=ma&id=mv01d



Region	Number of Gages				>90th percentile flow	MA Drought Plan Index/# of consecutive months majority below 25th percentile
	Total Reporting for February	<25th to 10th percentile	<10th percentile to above record low	Record low		
Western	7	0	0	0	**1**	Normal/0
CT River Valley	14	0	0	0	**3**	Normal/0
Central	11	0	0	0	**0**	Normal/0
Northeast	18	0	0	0	**1**	Normal/0
Southeast	6	0	0	0	**0**	Normal/0

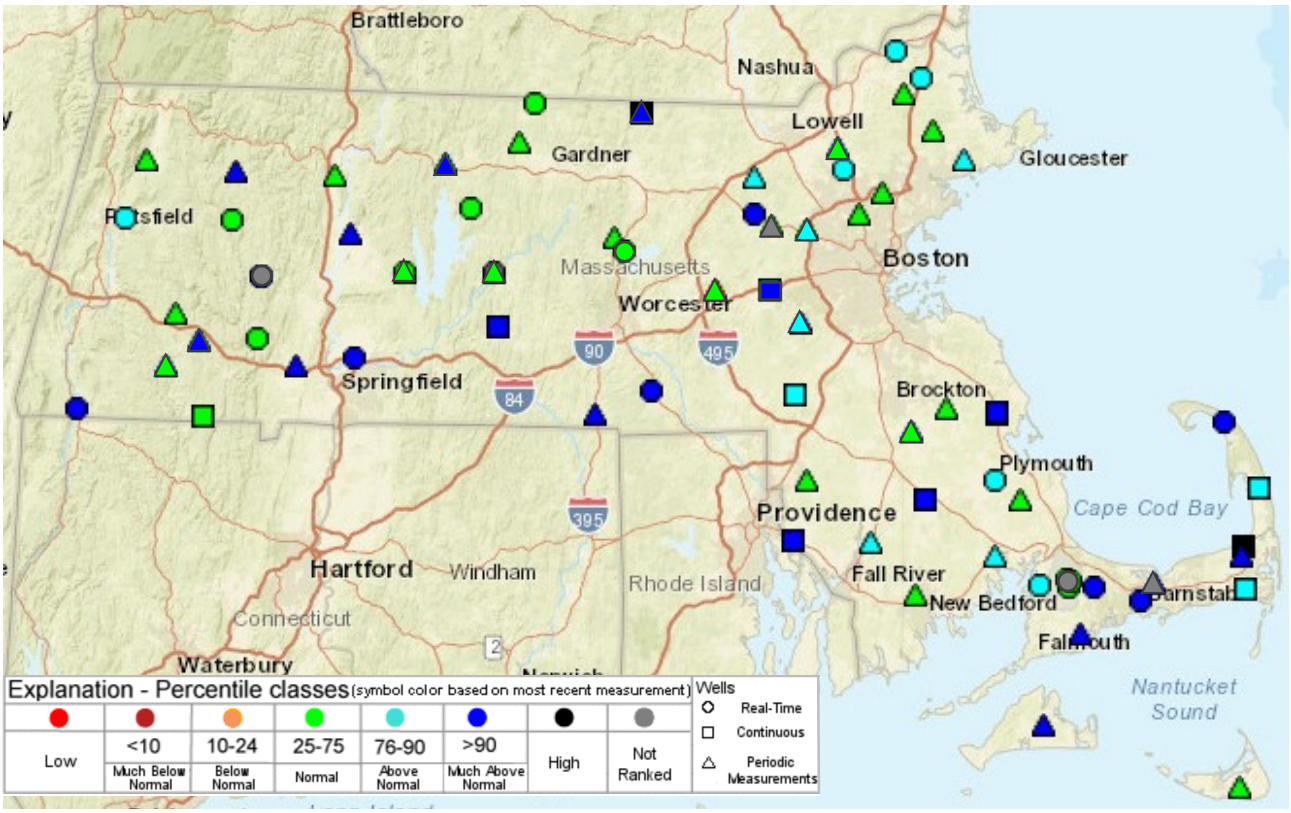
Notes: Gage counts are non-cumulative except for "total reporting". Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.

GROUNDWATER

Groundwater levels continue to vary across the state from normal to record high. 24 of 64 reporting wells are greater than their respective 90th percentile values. Some wells with real-time reporting showed a steady decline throughout the month but still remained above the 25th percentile threshold that is considered "normal".

Groundwater Conditions in the Climate Response Network at the End of February

https://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=crn&sc=25



Region	Number of wells					MA Drought Plan Index /# consecutive months majority below 25th percentile
	Total Reporting for February	<25th to 10th percentile	<10th percentile to above record low	Record low	> 90th percentile	
Western	5	0	0	0	**1**	Normal/0
CT River Valley	11	0	0	0	**6**	Normal/0
Central	10	0	0	0	**4**	Normal/0
Northeast	15	0	0	0	**2**	Normal/0
Southeast	12	0	0	0	**3**	Normal/0
Cape and Islands	11	0	0	0	**8**	Normal/0

Notes: Well counts are non-cumulative except for "total reporting". Not all data are available in time for reporting.

RESERVOIRS

At the end of February, most reporting reservoirs were significantly above normal, with some reservoirs spilling.

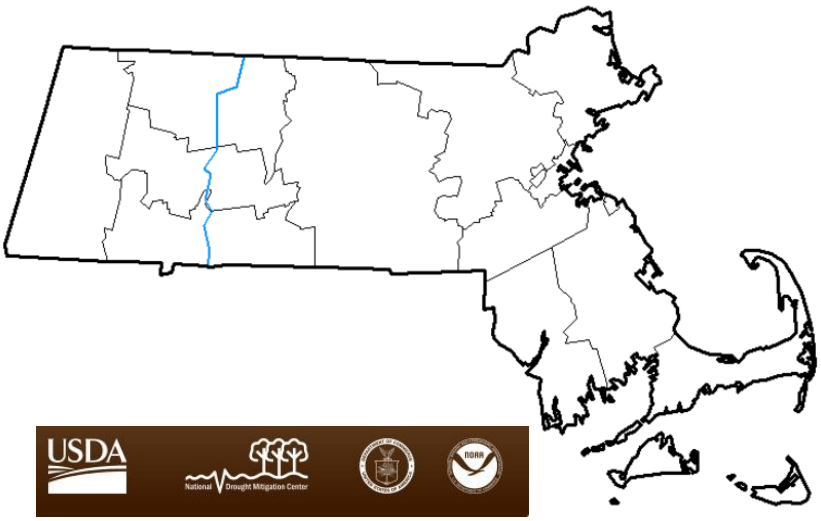
Region	Total Reporting for February	Reservoir Levels	MA Drought Management Plan Reservoir Index
Western	2	Normal	Normal
CT River Valley	2	Normal	Normal
Central	3	Normal	Normal
Northeast	5	Normal	Normal
Southeast	3	Normal	Normal
Cape Cod & Islands	1	Normal	Normal

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of February 26, 2019

Summary: The USDM map shows all regions as normal.

USDM maps are produced by the National Drought Mitigation Center (NDMC). For methods and weekly updates see: http://droughtmonitor.unl.edu



D0 - Abnormally Dry
D1 - Moderate Drought
D2 - Severe Drought
D3 - Extreme Drought
D4 - Exceptional Drought

NOAA Climate Prediction Center: Temperature and Precipitation Outlook

March: The outlook projects 33-40% chance of below normal temperatures and 33-40% chance of above normal precipitation across the state.

March through May: The outlook projects 55-70% chance of above normal temperatures and equal chances for below normal, normal, or above precipitation.
https://www.cpc.ncep.noaa.gov/

NOAA Climate Predication Center: Monthly and Seasonal Drought Outlook

The monthly outlook for March and seasonal outlook valid through May do not project drought conditions.
http://www.cpc.ncep.noaa.gov/products/Drought/

Appendix I: Additional Information

Keetch-Byram Drought Index

Data for the Fire Index are not collected during the winter.

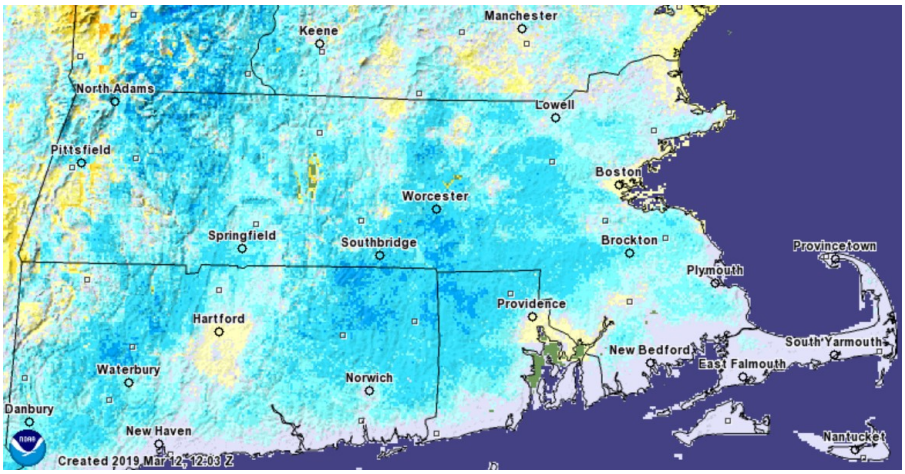
Crop Moisture Index

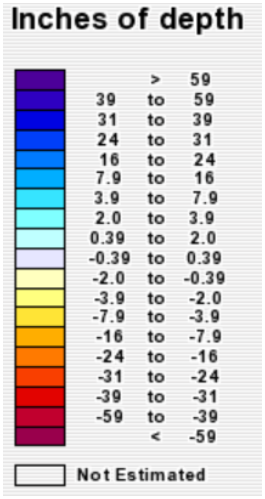
The CMI map for the week ending March 2, 2019 shows abnormally moist conditions.

The Crop Moisture Index shows the short-term need versus available water in a shallow soil profile. This index responds quickly to changing conditions and is subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level. This indicator is most relevant during growing season. https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif

Modeled Snow Depth Departure from Normal (Daily) for March 12, 2019

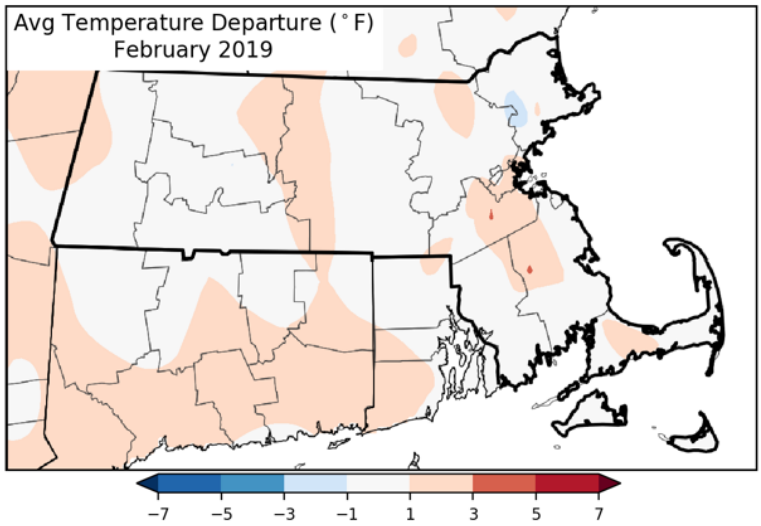
https://www.nohrsc.noaa.gov/interactive/html/map.html





From the February NWS E-5 Report, "During the month there was a gradual increase in snowpack across the higher terrain of interior southern New England. However elsewhere in the area, the periods of mild temperatures hindered substantial snowpack development."

Average Temperature Departure



Monthly average temperatures were near historical February average for most of the state. Parts of the Central, Southeast, and Cape regions had areas of up to 3 degrees Fahrenheit higher than average.

Boston daily temperatures ranged from 10 to 65 degrees Fahrenheit. Deviation from historical daily average temperatures were –15 to +22 degrees Fahrenheit, respectively.
http://www.nrcc.cornell.edu/regional/monthly/monthly.html

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Additional information, previous reports, and drought management information can be found at https://www.mass.gov/water-data-tracking.

Appendix I: Additional Information, continued

Percent of Average Historical Precipitation

February-19	Normal	Actual	Percent Normal	Excess/ Deficit	Excess or Deficit Since Last 10/1/2018	2 Months	% Norm	3 Months	% Norm	6 Months	% Norm	12 Months	% Norm
State	3.34	3.42	102	0.08	8.86	1.81	126	1.97	118	13.01	158	17.37	139
Western	2.82	3.22	114	0.40	7.79	2.22	137	2.30	125	12.47	160	18.97	143
Connecticut River	3.18	3.50	110	0.32	9.87	2.93	144	4.08	140	14.84	168	21.78	148
Central	3.50	3.05	87	-0.45	7.17	0.88	112	1.39	112	11.52	150	17.71	138
Northeast	3.31	3.55	107	0.24	7.38	0.82	112	0.37	103	11.01	151	15.19	135
Southeast	3.54	3.56	101	0.02	11.04	2.14	129	1.91	117	16.40	171	17.70	139
Cape Cod and Islands	3.51	3.70	105	0.19	10.09	2.40	132	2.03	118	10.25	144	10.23	122

Note: Precipitation values are total rainfall and melted snow in inches.
Values are estimated pending receipt of additional data and final calculations.

Standardized Precipitation Index for February 2019

REGION	3-Month SPI	6-Month SPI	12-Month SPI
Western Region	0.99	2.70	2.69
Connecticut River Region	1.22	2.77	2.73
Central Region	0.51	2.17	2.31
Northeast Region	0.18	2.19	2.11
Southeast Region	0.71	2.76	2.23
Cape & Islands	0.77	1.83	1.50

DCR Precipitation Monitoring Composite Reports and SPI are available at:
https://www.mass.gov/service-details/precipitation-composite-estimates-1

https://www.mass.gov/service-details/standardized-precipitation-index-spi-0

Appendix II: Description of Drought Indices

(from Table 3 of Massachusetts Drought Management Plan).

Drought Level	Standardized Precipitation Index	Crop Moisture Index*	Keetch-Byram Drought Index*	Precipitation	Groundwater	Streamflow	Reservoir***
Normal	3-month > -1.5 **or** 6-month > -1.0 **or** 12-month > -1.0	0.0 to -1.0 slightly dry	< 200	1 month below normal	2 consecutive months below normal**	1 month below normal**	Reservoir levels at or near normal for the time of year
Advisory	3-month = -1.5 to -2.0 **or** 6-month = -1.0 to -1.5 **or** 12-month = -1.0 to –1.5	-1.0 to -1.9 abnormally dry	200-400	2 month cumulative below 65% of normal	3 consecutive months below normal**	At least 2 out of 3 consecutive months below normal**	Small index Reservoirs below normal
Watch	3-month < -2.0 **or** 6-month = -1.5 to -3.0 **or** 12-month = -1.5 to -2.0	-2.0 to –2.9 excessively dry	400-600	1 of the following criteria met: 3 month cum. < 65% **or** 6 month cum. < 70% **or** 12 month cum. < 70%	4-5 consecutive months below normal**	At least 4 out of 5 consecutive months below normal**	Medium index Reservoirs below normal
Warning	6-month < -3.0 **or** 12-month = -2.0 to -2.5	< -2.9 severely dry	600-800	1 of the following criteria met: 3 month cum. < 65% and 6 month cum. <65%, **or** 6 month cum. <65% and 12 month cum. <65%, **or** 3 month cum. <65% and 12 month cum. <65%	6-7 consecutive months below normal**	At least 6 out of 7 consecutive months below normal**	Large index reservoirs below normal
Emergency	12-month < -2.5	<-2.9 severely dry	600-800	Same criteria as Warning and previous month was Warning or Emergency	>8 months below normal**	>7 months below normal**	Continuation of previous month's conditions

* The Crop Moisture Index is subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level.

** Below normal for groundwater and streamflow are defined as being within the lowest 25th percentile of the period of record.

*** Water suppliers should be consulted to determine if below normal reservoir conditions are due to operational issues.

Source: Massachusetts Drought Management Plan. May 2013 (http://www.mass.gov/eea/docs/eea/wrc/droughtplan.pdf).