MASSACHUSETTS WATER RESOURCES COMMISSION

March 2018 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

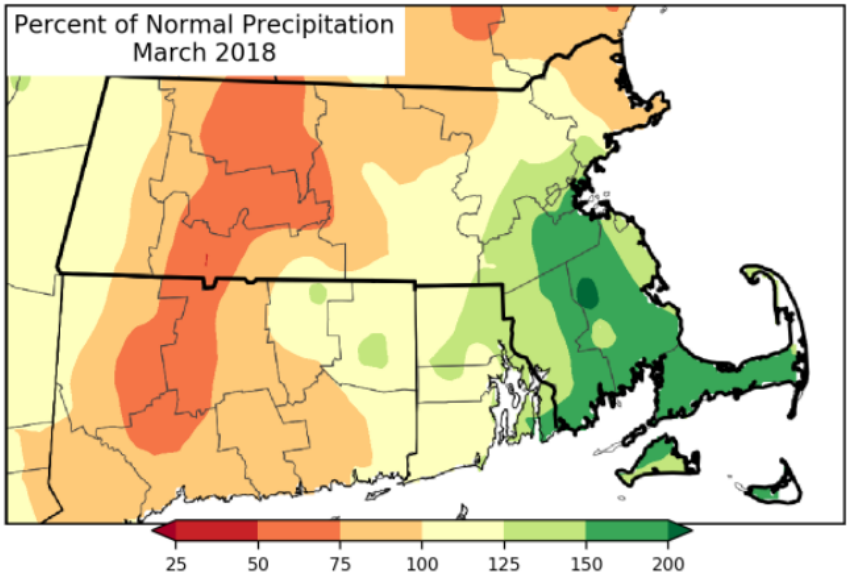
- Precipitation index is Normal for all regions. Coastal storms have resulted in above normal precipitation in the Northeast, Southeast and Cape and Islands.
- Average monthly streamflow index is Normal in all regions. The Northeast and Southeast experienced significantly above normal flows at some gages including one record high.
- The groundwater index is Normal for all regions. The Southeast and Cape and Islands experienced some significantly above normal levels including multiple record highs.
- The reservoir index is Normal for all regions.
- NOAA's forecast for April is a slight probability of below normal temperatures and above normal precipitation in Massachusetts.
- Appendix I provides values of indices not presented in the main report. Appendix II provides a description of the indices from the Drought Management Plan.

PRECIPITATION

Region	Estimated Rainfall (inches)	Departure from Average March (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	3.20	-0.19	Normal	Normal
CT River Valley	2.35	-1.38	Normal	Normal
Central	4.00	-0.15	Normal	Normal
Northeast	5.08	1.16	Normal	Normal
Southeast	6.96	2.74	Normal	Normal
Cape Cod & Islands	8.36	4.11	Normal	Normal

Note: Additional precipitation data are in Appendix I.

March 2018 Precipitation, Percent of Normal



Map from the Northeast Regional Climate Center's Monthly Maps.

http://www.nrcc.cornell.edu/regional/monthly/monthly.html

STREAMFLOW

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

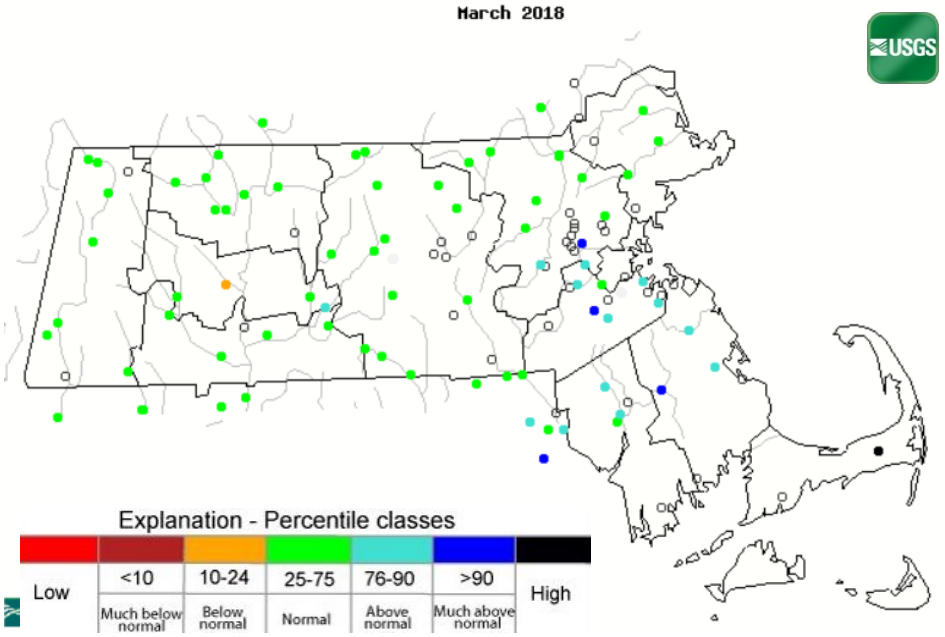
Region	Number of Gages				MA Drought Plan Index / # consecutive months majority below 25th percentile	>90th percentile flow
	Total Reporting for March	<25th to 10th percentile	<10th percentile to above record low	Record low		
Western	7	0	0	0	Normal/0	0
CT River Valley	14	1	0	0	Normal/0	0
Central	11	0	0	0	Normal/0	0
Northeast	18	0	0	0	Normal/0	2
Southeast	6	0	0	0	Normal/0	1

Key to Drought Levels
Normal
Advisory
Watch
Warning
Emergency

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.

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

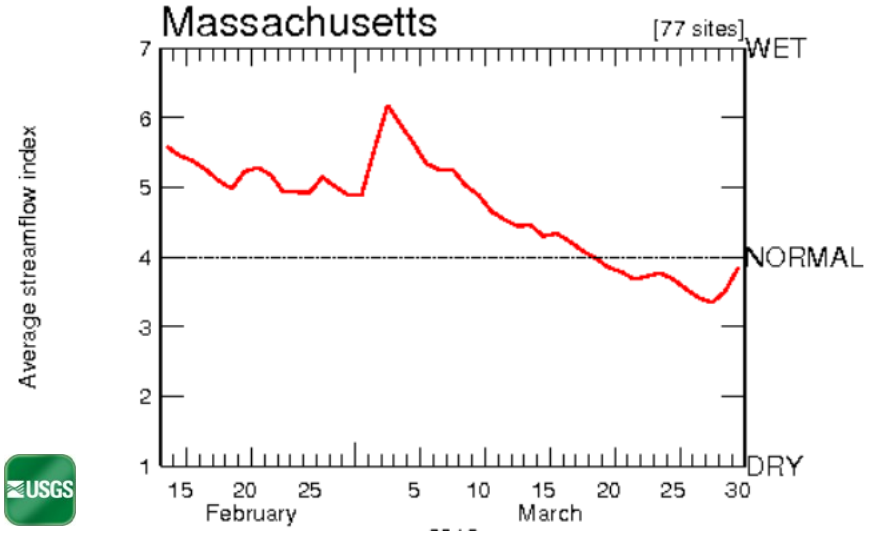


Average Daily Streamflow Compared to Historical for the Day of the Year

This plot depicts data for the 45-day period ending April 1.

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



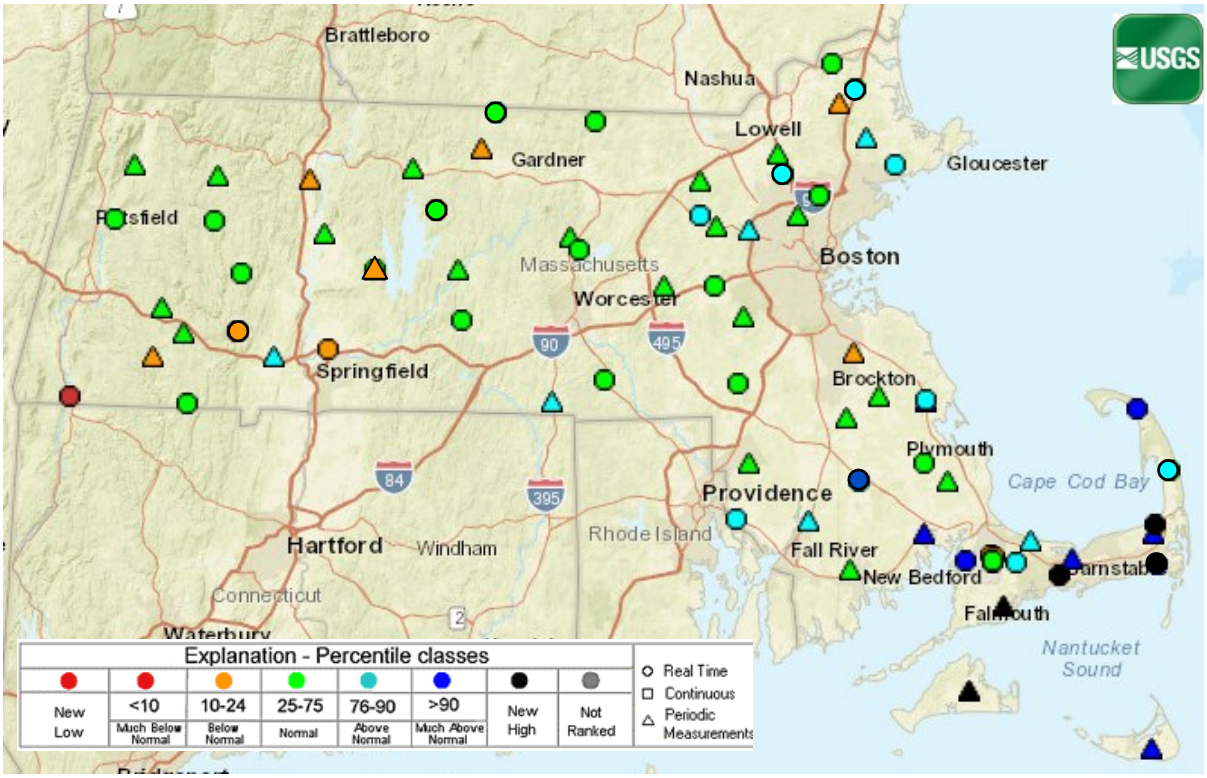
GROUNDWATER

Region	Number of wells					MA Drought Plan Index /# consecutive months majority below
	Total Reporting for March	<25th to 10th percentile	<10th percentile to above record low	Record low	> 90th percentile	
Western	5	**1**	**1**	0	0	Normal/0
CT River Valley	11	**3**	0	0	0	Normal/0
Central	10	**1**	0	0	0	Normal/0
Northeast	16	**1**	0	0	0	Normal/0
Southeast	12	0	0	0	**2**	Normal/0
Cape and Islands	11	0	0	0	**9**	Normal/0

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

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

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



RESERVOIRS

Region	Total Reporting for March	Reservoir Levels	MA Drought Management Plan Reservoir Index
Western	2	Normal & Below*	Normal
CT River Valley	2	Normal	Normal
Central	3	Normal	Normal
Northeast	6	Normal	Normal
Southeast	2	Normal	Normal
Cape Cod & Islands	1	Normal	Normal

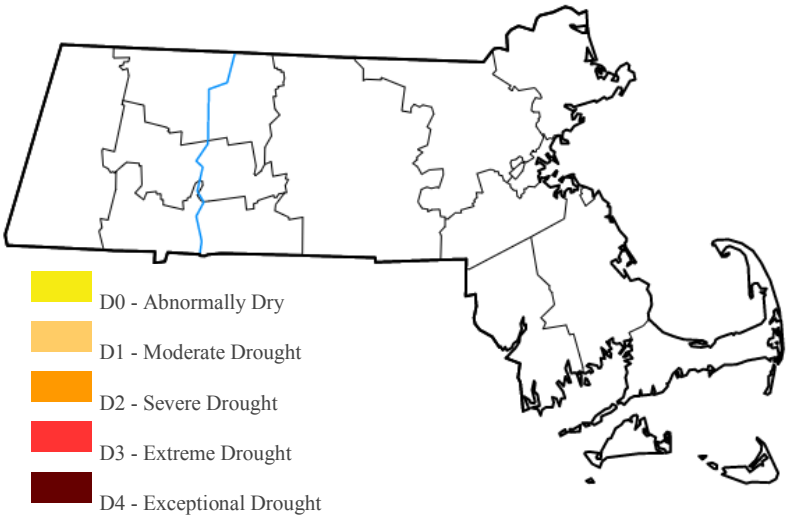
*Pittsfield (a medium sized reservoir) is at 93.5% full which is below average by one standard deviation plus 0.5% of its full volume.

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of March 27, 2018

Summary: The USDM map does not show any dry or drought conditions in the state.

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



NOAA Climate Prediction Center (CPC): Monthly and Seasonal Temperature and Precipitation Outlook

The outlook for April projects a slight probability of below normal temperatures and a slight probability of above normal precipitation in Massachusetts.

The outlook for April through June projects a 40-50 percent probability of above normal temperatures and a slight probability for above normal precipitation in Massachusetts.

NOAA CPC: Monthly and Seasonal Drought Outlook

Both the short and long term outlooks project normal conditions.

http://www.cpc.ncep.noaa.gov/products/Drought/

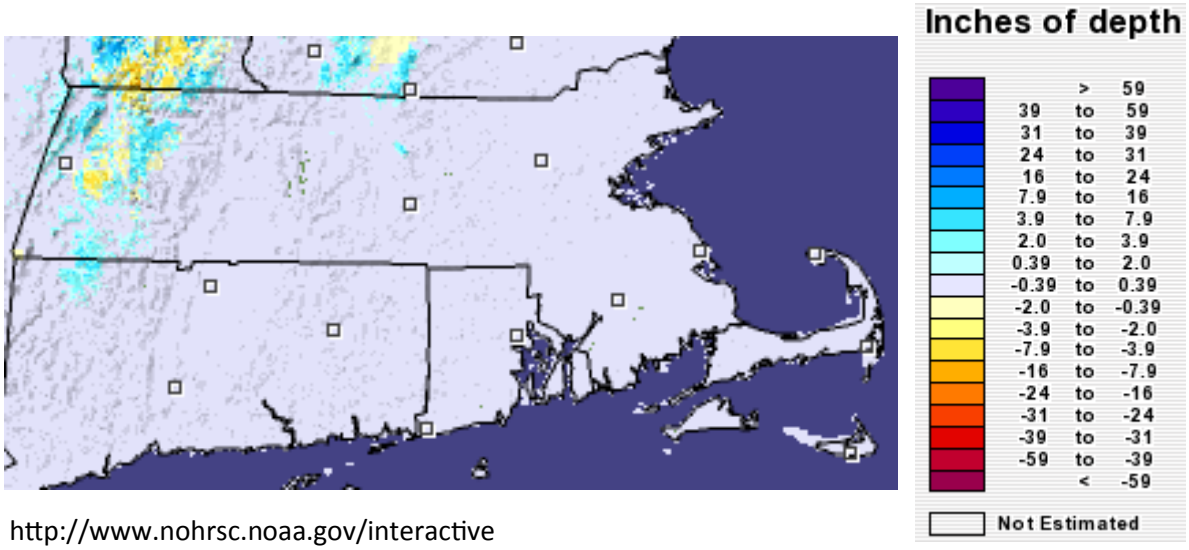
Valid for April 2018

Valid March 15 through June 30, 2018

Key Links: Massachusetts Drought Management: http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/drought-status.html
DCR Precipitation Monitoring Composite Reports and SPI
https://www.mass.gov/service-details/precipitation-composite-estimates-1
https://www.mass.gov/service-details/standardized-precipitation-index-spi-0
This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary in nature. Additional information, previous hydrological conditions reports, and drought management information can be found on our web site:
https://www.mass.gov/water-data-tracking

Appendix I: Additional Information

Modeled Snow Depth, Departure from Normal, as of April 2, 2018



http://www.nohrsc.noaa.gov/interactive

Keetch-Byram Drought Index

The fire index was not available. Based on limited Massachusetts data, national modeling by the United States Forest Service showed KBDI values of less than 300 for all regions of the state as of the first week of April. These values put all regions in Normal range for the index.
http://www.wfas.net/index.php/keetch-byram-index-moisture--drought-49

Crop Moisture Index for the Week Ending April 7, 2018

At the beginning of April, the index is Normal for all regions. 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.
http://www.cpc.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif

Appendix I: Additional Information, continued

Percent of Average Historical Precipitation for March

March-18			Percent	Excess/	Excess or Deficit Since Last								
	Normal	Actual	Normal	Deficit	10/1/2017	2 Months	% Norm	3 Months	% Norm	6 Months	% Norm	12 Months	% Norm
State	3.97	4.84	122	0.87	3.05	2.31	132	3.22	129	3.05	114	5.92	113
Western	3.39	3.20	94	-0.19	2.45	1.35	122	2.93	131	2.45	112	5.00	111
Connecticut River	3.73	2.35	63	-1.38	1.64	0.23	103	1.29	113	1.64	108	3.40	107
Central	4.15	4.00	96	-0.15	2.90	0.84	111	0.83	107	2.90	112	5.21	111
Northeast	3.92	5.08	130	1.16	1.07	1.74	124	2.34	122	1.07	105	3.64	108
Southeast	4.22	6.96	165	2.74	4.39	4.09	153	5.64	148	4.39	119	7.22	116
Cape Cod and Islands	4.25	8.36	197	4.11	9.29	7.90	202	9.03	178	9.29	139	18.76	141

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 March

REGION	3-Month SPI	6-Month SPI	12-Month SPI
Western Region	1.31	0.70	0.83
Connecticut River Region	0.51	0.44	0.51
Central Region	0.36	0.68	0.79
Northeast Region	0.83	0.30	0.58
Southeast Region	1.67	0.92	1.00
Cape & Islands	2.57	1.90	2.55

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).