

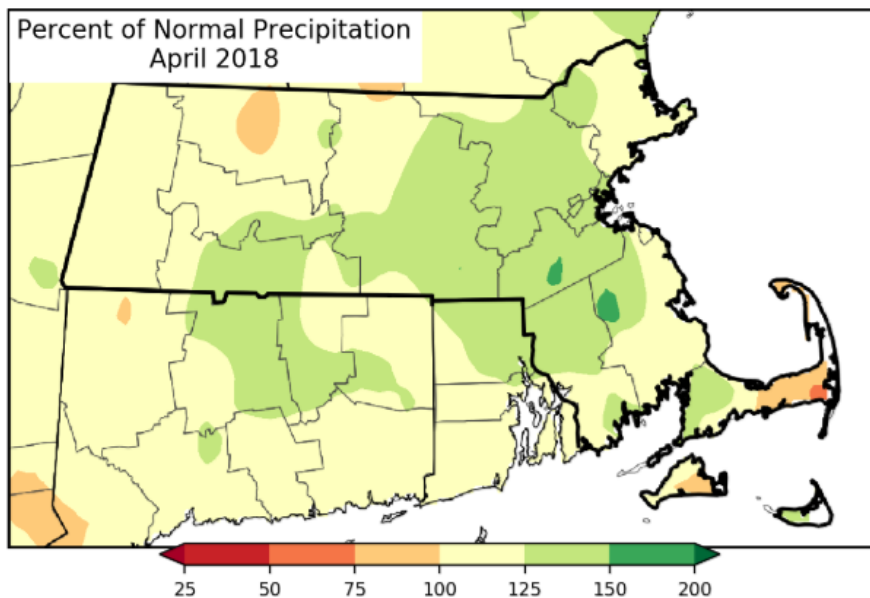
April 2018 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

- Precipitation index is Normal for all regions.
- Average monthly streamflow index is Normal for all regions.
- The groundwater index is Normal for all regions.
- The reservoir index is Normal for all regions.
- NOAA’s forecast for May is over 50 percent probability for above normal temperatures and equal chances for below normal, normal or above normal precipitation.
- 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

All regions were above average for April precipitation except parts of Cape and Islands and norther Connecticut River Valley. One precipitation event occurred April 16-17 that caused minor flooding. Some rain or snow fell on more than half of the days of the month. (Additional precipitation data are in Appendix I.)



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

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

Region	Estimated Rainfall (inches)	Departure from Average April (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	4.16	0.64	Normal	Normal
CT River Valley	4.74	1.17	Normal	Normal
Central	5.19	1.37	Normal	Normal
Northeast	5.31	1.69	Normal	Normal
Southeast	5.61	1.69	Normal	Normal
Cape Cod & Islands	4.59	0.54	Normal	Normal

Key to Drought Levels
Normal
Advisory
Watch
Warning
Emergency

STREAMFLOW

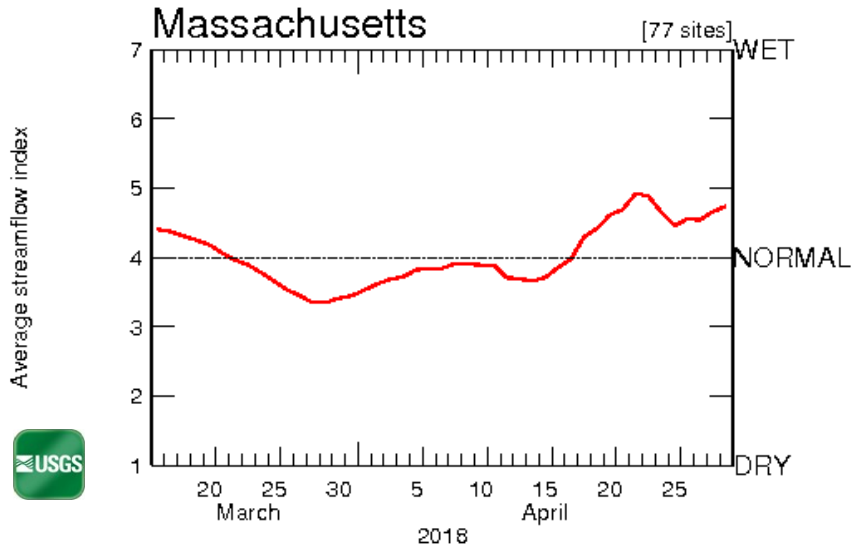
Average monthly streamflow was normal across the State except for one gage below normal in the Connecticut River Valley region. On a daily and weekly basis, gages were below and well below normal for the first half of the month. The second half of April saw more significant rain events and gages were above or well above normal.

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

This plot depicts data for the 45-day period ending April 30.

KEY:

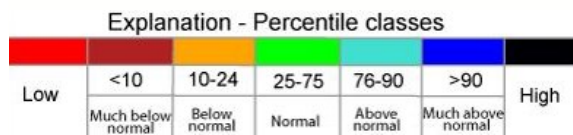
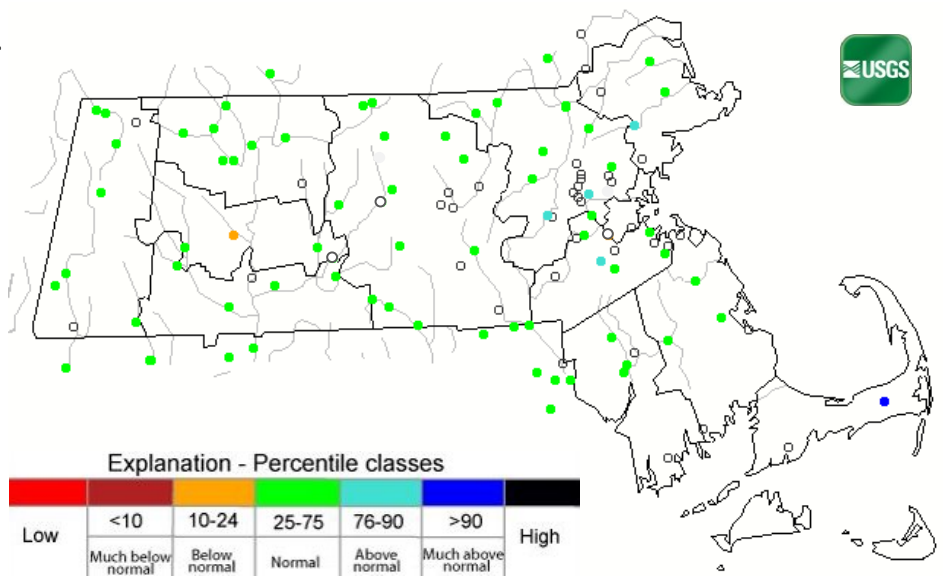
- 1 = New record low for day
- 2 = < 10th percentile
- 3 = 10th – 24th percentile
- 4 = 25th – 74th percentile
- 5 = 75th – 89th percentile
- 6 = > 90th percentile



Average April 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>



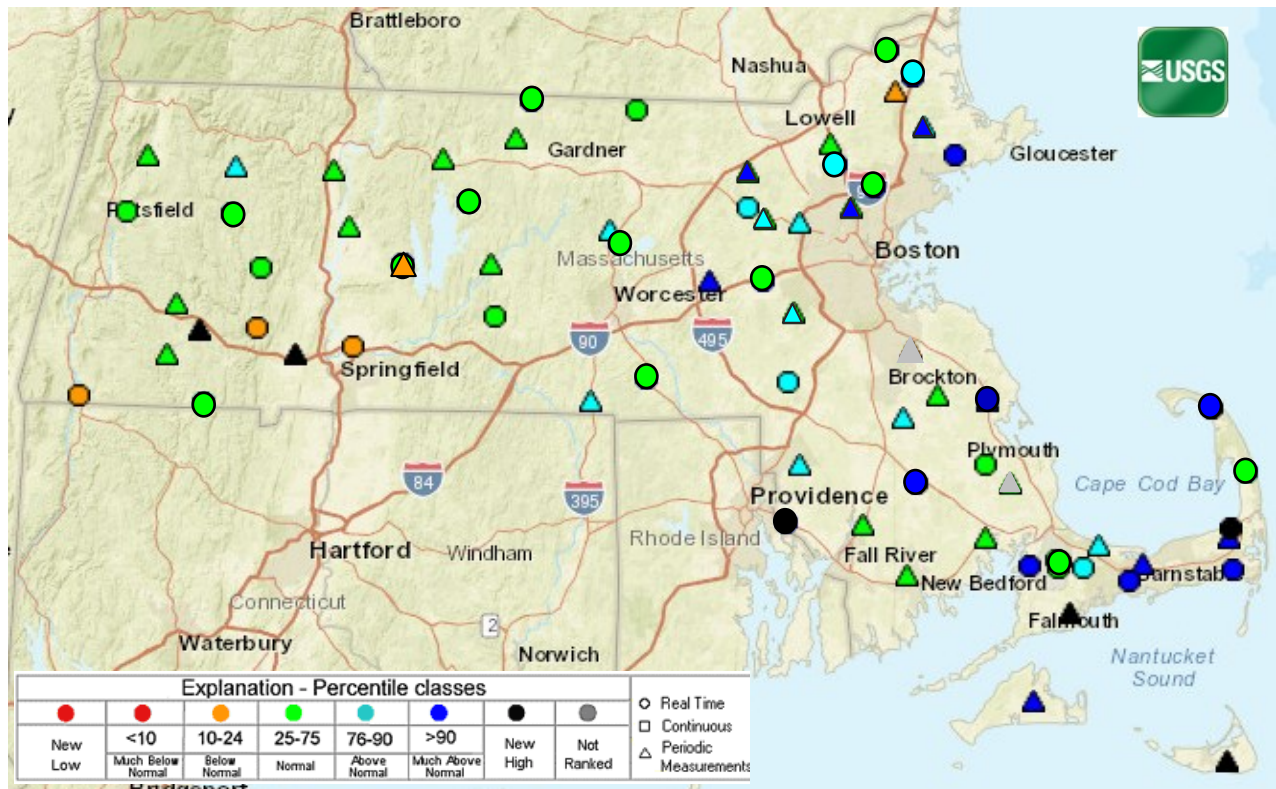
Region	Number of Gages					MA Drought Plan Index/# of consecutive months majority below 25th percentile
	Total Reporting for April	<25th to 10th percentile	<10th percentile to above record low	Record low	>90th percentile flow	
Western	7	0	0	0	0	Normal/0
CT River Valley	14	1	0	0	0	Normal/0
Central	11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

The State had a wide range of groundwater levels at the end of April from below normal up to record high. In the eastern part of the State, including the Northeast, Southeast, and Cape and Islands regions, most wells were significantly elevated. The rest of the State—Central, Connecticut River Valley, and Western regions—saw mostly normal or slightly below normal conditions. Both areas saw exceptions with one below normal well in the East and two record highs in the West.

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



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

RESERVOIRS

At the end of April, all reporting reservoirs were within one standard deviation of average April volumes.

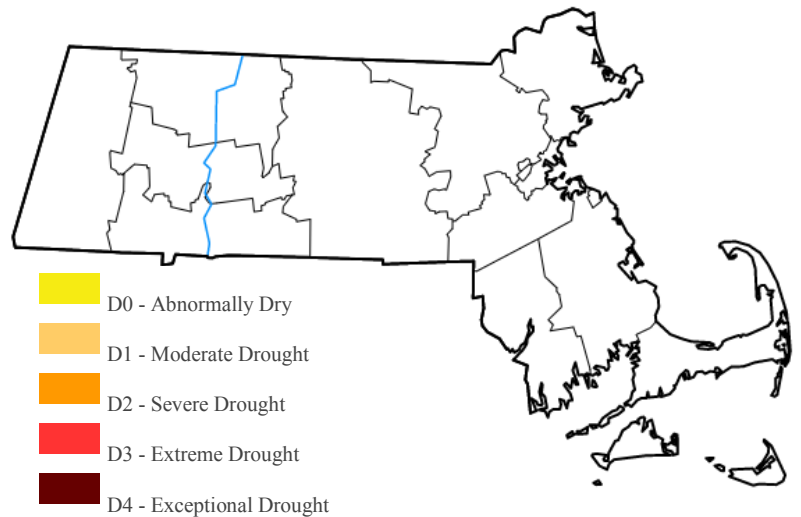
Region	Total Reporting for April	Reservoir Levels	MA Drought Management Plan Reservoir Index
Western	2	Normal	Normal
CT River Valley	2	Normal	Normal
Central	3	Normal	Normal
Northeast	8	Normal	Normal
Southeast	2	Normal	Normal
Cape Cod & Islands	1	Normal	Normal

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of May 1, 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 May projects over 50 percent probability for above normal temperatures and equal chances for below normal, normal or above normal precipitation in Massachusetts.

The outlook for May through July projects over 50 percent probability for above normal temperatures and a slight probability for above normal precipitation in Massachusetts.

<http://www.cpc.ncep.noaa.gov/products/predictions>

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS, cont.

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/>



- Drought persists
- Drought remains but improves
- Drought removal likely
- Drought development likely

Valid for May 2018



Valid April 19 through July 31, 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

Snow Depth as of May 9, 2018 is zero. <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 May. 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 May, 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 April 2018

April-18	Normal	Actual	Percent Normal	Excess/Deficit	-----Excess or Deficit Since Last-----								
					10/1/2017	2 Months	% Norm	3 Months	% Norm	6 Months	% Norm	12 Months	% Norm
State	3.74	5.05	135	1.31	4.36	2.18	128	3.62	133	1.11	105	5.64	113
Western	3.52	4.16	118	0.64	3.09	0.45	107	1.99	120	0.31	102	4.80	111
Connecticut River	3.57	4.74	133	1.17	2.81	-0.21	97	1.40	113	-1.54	93	3.16	107
Central	3.82	5.19	136	1.37	4.27	1.22	115	2.21	119	-1.15	95	5.94	113
Northeast	3.62	5.31	147	1.69	2.76	2.85	138	3.43	132	0.42	102	3.49	108
Southeast	3.92	5.61	143	1.69	6.08	4.43	154	5.78	149	4.42	119	6.46	114
Cape Cod and Islands	4.05	4.59	113	0.54	9.83	4.65	156	8.44	171	6.31	126	16.94	137

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 April 2018

REGION	3-Month SPI	6-Month SPI	12-Month SPI
Western Region	0.79	0.15	0.77
Connecticut River Region	0.49	-0.38	0.47
Central Region	0.78	-0.23	0.87
Northeast Region	1.12	0.16	0.54
Southeast Region	1.60	0.94	0.88
Cape & Islands	2.17	1.30	2.26

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 <u>or</u> 6-month > -1.0 <u>or</u> 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 <u>or</u> 6-month = -1.0 to -1.5 <u>or</u> 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 <u>or</u> 6-month = -1.5 to -3.0 <u>or</u> 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% <u>or</u> 6 month cum. < 70% <u>or</u> 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 <u>or</u> 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%, <u>or</u> 6 month cum. < 65% and 12 month cum. < 65%, <u>or</u> 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>).