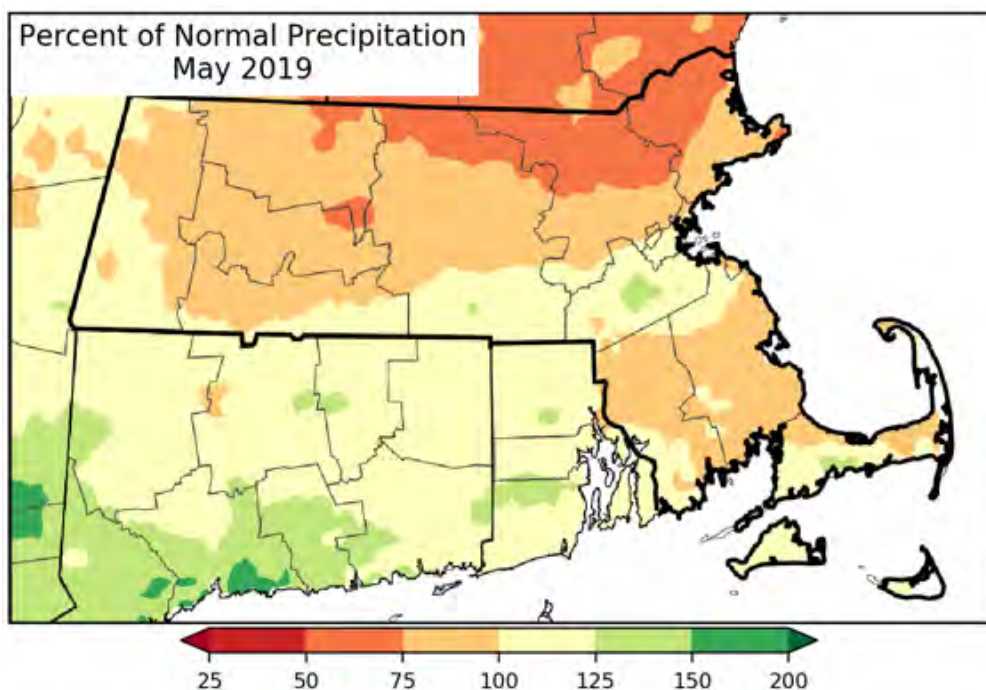


May 2019 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

- Monthly average temperatures were 3 degrees below to 1 degree Fahrenheit above historical average.
- Precipitation ranged from near average to below average but both Precipitation Indices are Normal for all regions.
- Streamflows and groundwater levels started above average, steadily declined throughout the month and in general ended near average. Streamflow and Groundwater Indices are Normal.
- Reservoir, Crop Moisture, and Keetch-Byram Drought Indices are Normal for all regions.
- For June, NOAA projects equal chances for above average, average, or below average temperatures, and 33-40% chance of below average precipitation.
- 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 below average to average across the state for May.

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

Region	Estimated Precipitation (inches)	Departure from Average May (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	4.91	0.95	Normal	Normal
CT River Valley	3.15	-0.82	Normal	Normal
Central	3.57	-0.09	Normal	Normal
Northeast	3.20	-0.22	Normal	Normal
Southeast	3.85	0.47	Normal	Normal
Cape Cod & Islands	3.58	0.02	Normal	Normal

Key to Drought Plan Levels
Normal
Advisory
Watch
Warning
Emergency

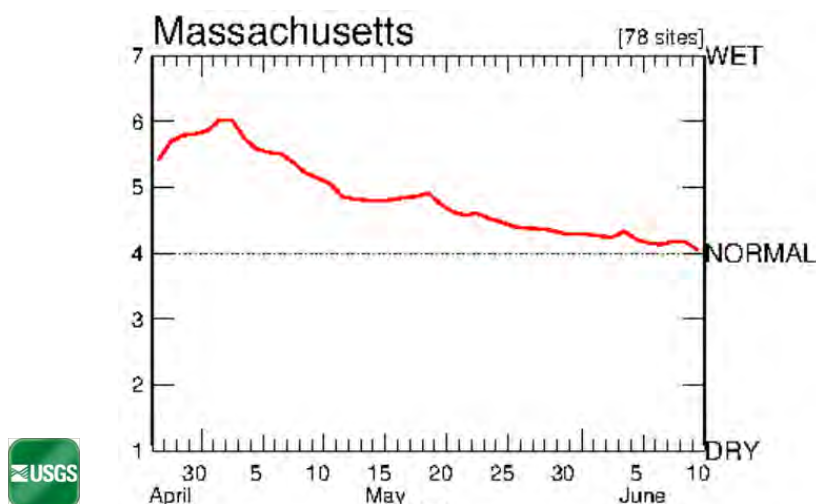
STREAMFLOW

Daily streamflows started above average, declined throughout the month and ended at average historical values. Monthly average streamflows ranged from average to above average with 11 gages still registering at greater than their respective 90th percentile value for the month.

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

KEY:

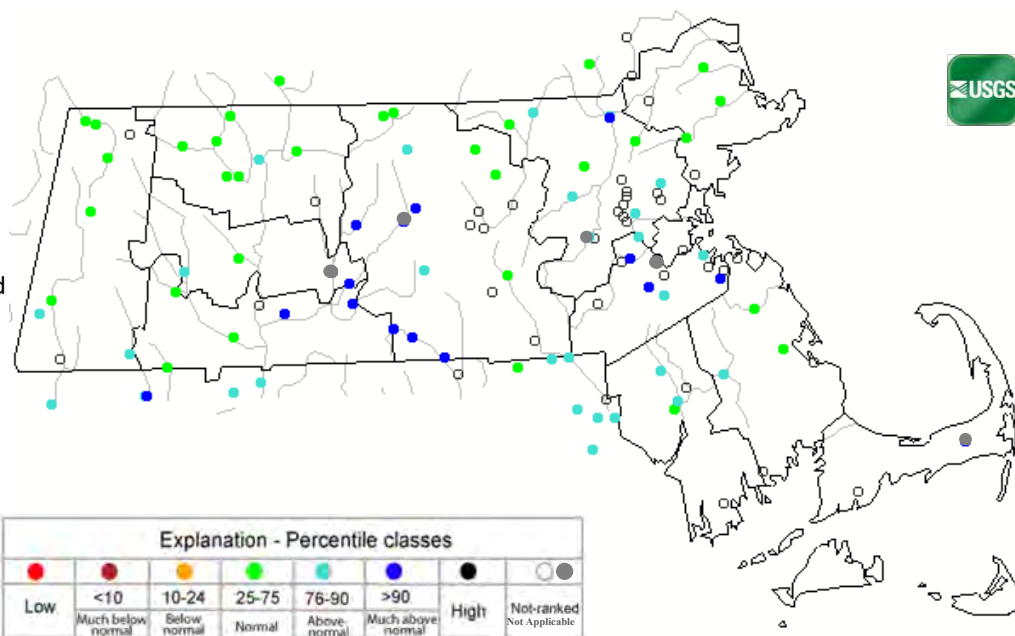
- 1 = New record low for day
- 2 = < 10th percentile
- 3 = 10th – 24th percentile
- 4 = 25th – 74th percentile
- 5 = 75th – 89th percentile
- 6 = > 90th percentile
- 7 = New record high for day



Average May 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 May	<25th to 10th percentile	<10th percentile to above record low	Record low		
Western	7	0	0	0	0	Normal/0
CT River Valley	14	0	0	0	3	Normal/0
Central	11	0	0	0	4	Normal/0
Northeast	17	0	0	0	4	Normal/0
Southeast	6	0	0	0	0	Normal/0

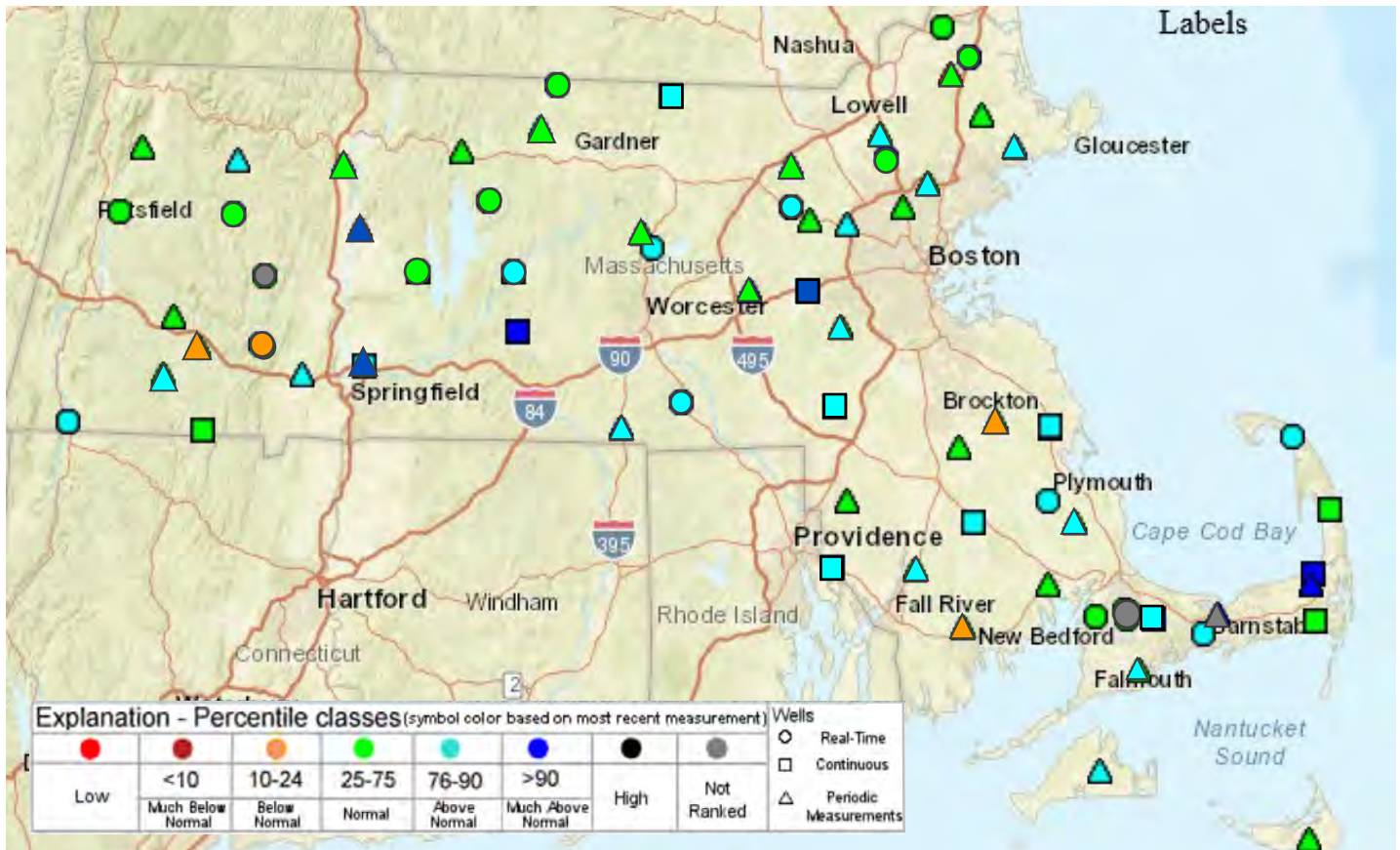
Notes: Gage counts are non-cumulative except for "total reporting". Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to Cape Cod and the Islands.

GROUNDWATER

Groundwater levels declined throughout the month but levels continue to vary across the state from below normal to above normal. 6 of 65 reporting wells are greater than their respective 90th percentile value and 4 wells are below their respective 25th percentile value.

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

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



Region	Number of wells					MA Drought Plan Index /# consecutive months majority below 25 th percentile
	Total Reporting for May	<25th to 10th percentile	<10th percentile to above record low	Record low	> 90th percentile	
Western	5	0	0	0	0	Normal/0
CT River Valley	11	2	0	0	2	Normal/0
Central	10	0	0	0	1	Normal/0
Northeast	16	0	0	0	1	Normal/0
Southeast	12	2	0	0	0	Normal/0
Cape and Islands	11	0	0	0	2	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 May, many reporting reservoirs were full. The Quabbin lower spillway continues to spill.

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

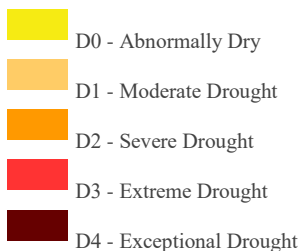
*The Town of Milford reported but the value was excluded because the reservoir was artificially low to permit work on the dam. Therefore, only two reservoirs were used in determining the index for the Southeast.

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of May 28, 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>



NOAA Climate Prediction Center: Temperature and Precipitation Outlook

June: The outlook projects equal chances for above normal, normal, or below normal temperatures, and 33-40% chance of below normal precipitation.

June through August: The outlook projects 50-60% chance of above normal temperatures and equal chances for below normal, normal, or above normal precipitation.

<https://www.cpc.ncep.noaa.gov/>

NOAA Climate Prediction Center: Monthly and Seasonal Drought Outlook

The monthly outlook for June and seasonal outlook valid through August do not project drought conditions.

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

Appendix I: Additional Information

Keetch-Byram Drought Index (KBDI)

KBDI values are lower than expected this time of year with most districts under 100, resulting in the index being Normal for all regions.

Crop Moisture Index (CMI)

The CMI map for the week ending June 1, 2019 shows slightly dry to favorably moist conditions across the state, resulting in the index being Normal for all regions.

The CMI shows the short-term need versus available water in a shallow soil profile and responds quickly to changing conditions. 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

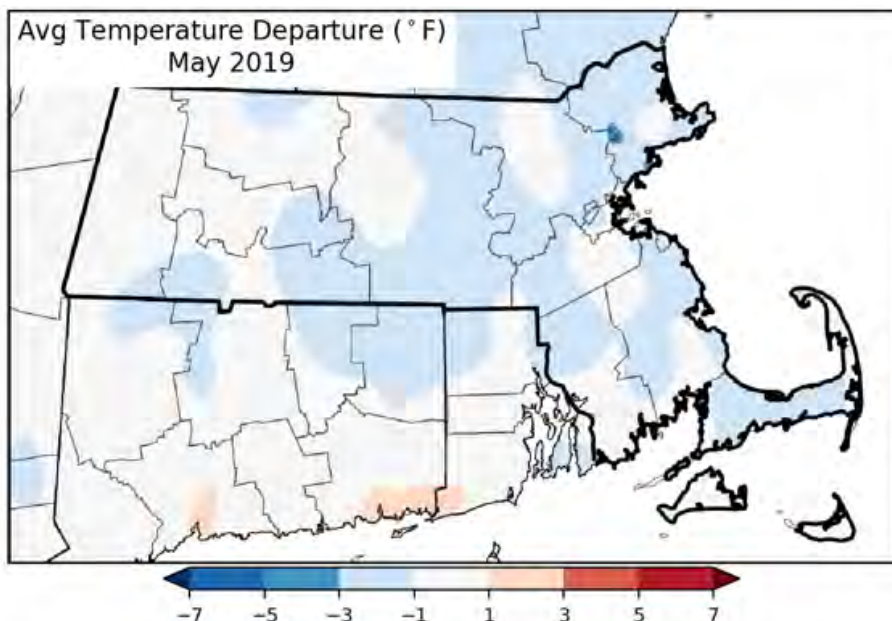
Season-to-date Snowfall Departure and Snow Cover

Information provided seasonally.

Temperature

Monthly average temperatures were 3 degrees below to 1 degree Fahrenheit above average for this time of the year. <http://www.nrcc.cornell.edu/regional/monthly/monthly.html>

Boston daily temperatures ranged from 43 to 89 degrees Fahrenheit. Deviation from historical daily average temperatures were -11.8 to +17.9 degrees Fahrenheit, respectively. <https://w2.weather.gov/climate/index.php?wfo=box>



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

May-19	Nor- mal	Actu- al	Per- cent Nor- mal	Excess/ Deficit	-----Excess or Deficit Since Last-----								
					10/1/2018	2 Months	% Norm	3 Months	% Norm	6 Months	% Norm	12 Months	% Norm
State	3.64	3.60	99	-0.04	10.17	2.90	139	1.54	114	3.28	115	18.00	140
Western	3.96	4.91	124	0.95	9.31	3.26	144	1.44	113	3.82	119	20.90	147
Connecticut River	3.97	3.15	79	-0.82	9.76	2.62	135	0.61	105	3.97	118	23.75	152
Central	3.66	3.57	98	-0.09	9.18	3.63	148	2.05	118	3.40	115	20.32	144
Northeast	3.42	3.20	94	-0.22	8.75	2.50	135	1.38	113	1.74	108	14.61	134
Southeast	3.38	3.85	114	0.47	13.24	3.69	150	2.50	122	4.11	118	17.12	138
Cape Cod and Is- lands	3.56	3.58	101	0.02	11.20	1.43	119	1.50	113	3.14	113	8.16	118

Standardized Precipitation Index for May 2019

REGION	3-Month SPI	6-Month SPI	12-Month SPI
Western Region	0.55	1.02	2.72
Connecticut River Region	0.24	0.95	2.91
Central Region	0.70	0.86	2.60
Northeast Region	0.51	0.46	1.95
Southeast Region	0.78	0.92	2.11
Cape & Islands	0.54	0.76	1.19

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 <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/docs/wrc/droughtplan.pdf>).