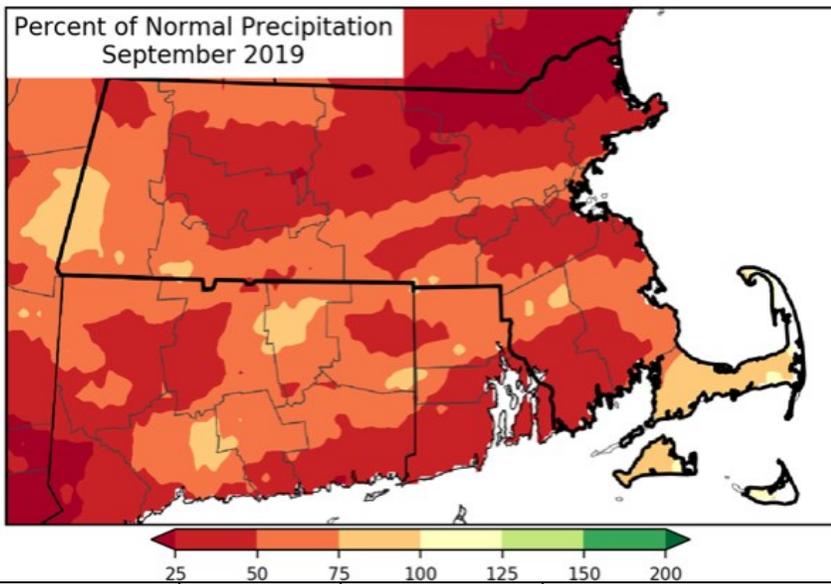


September 2019 Hydrologic Conditions in Massachusetts

SUMMARY OF CONDITIONS

- Temperatures were average to slightly above average for September.
- September was a very dry month across the state. The 1-month SPI values tripped at various severity levels for all regions except for the Cape Cod and Islands regions.
- Streamflows and groundwater levels ranged widely across the state. The Connecticut River Valley Region experienced Level 1 drought conditions for both indices.
- Reservoir and Crop Moisture Indices are at an index severity level of 0 for all regions.
- At the end of the month, Keetch-Byram Drought Index was at elevated severity levels for all regions except the Islands.
- For October, NOAA projects a 33-40% chance of above normal precipitation, a 33-40% chance for above normal temperatures in the West, and equal chances for above normal, normal, or below normal temperatures for the rest of the state.
- Appendix I details additional KBDI & precipitation data, including maps for Water Year 2019.

PRECIPITATION



Precipitation across the state was below average. The 1-month SPI drought index tripped for all regions except the Cape Cod and Islands regions.

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

Region	Estimated Precipitation	Departure from Average Sept.	MA Drought Plan Standardized Precipitation Index (SPI) 1-month
Western	3.05	-1.05	-0.74
CT River Valley	2.17	-1.79	-1.05
Central	1.61	-2.21	-1.15
Northeast	1.40	-2.09	-1.75
Southeast	1.92	-1.84	-1.22
Cape Cod	3.47	-0.35	0.22
Islands			-0.20

Key to Drought Plan SPI Severity Levels	
0	>-0.52
1	≤ -0.52 and > -0.84
2	≤ -0.84 and > -1.28
3	≤ -1.28 and > -2.05
4	≤ -2.05

STREAMFLOW

The statewide averages of daily streamflows were generally the same as average historical values at the beginning of September and then decreased. Across the state, median streamflows at individual gages varied from less than the 10th percentile to greater than the 90th percentile. The CT River Valley region experienced below normal and normal streamflows, and the median was below the 30th percentile (Level 1 drought).

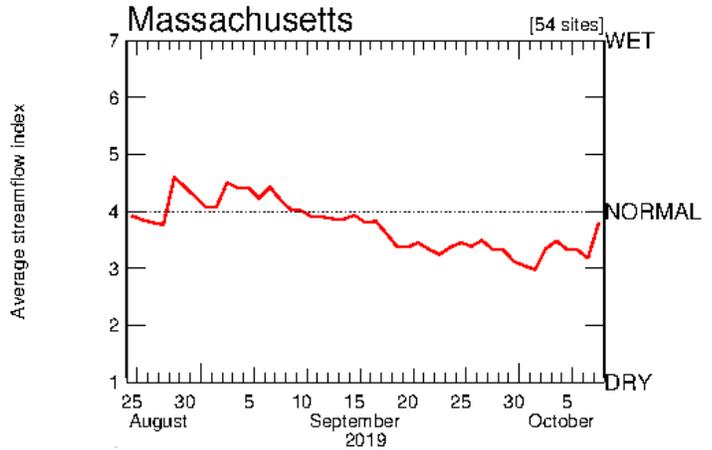
Average Daily Streamflow Compared to Historical for the Day of the Year

- 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

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

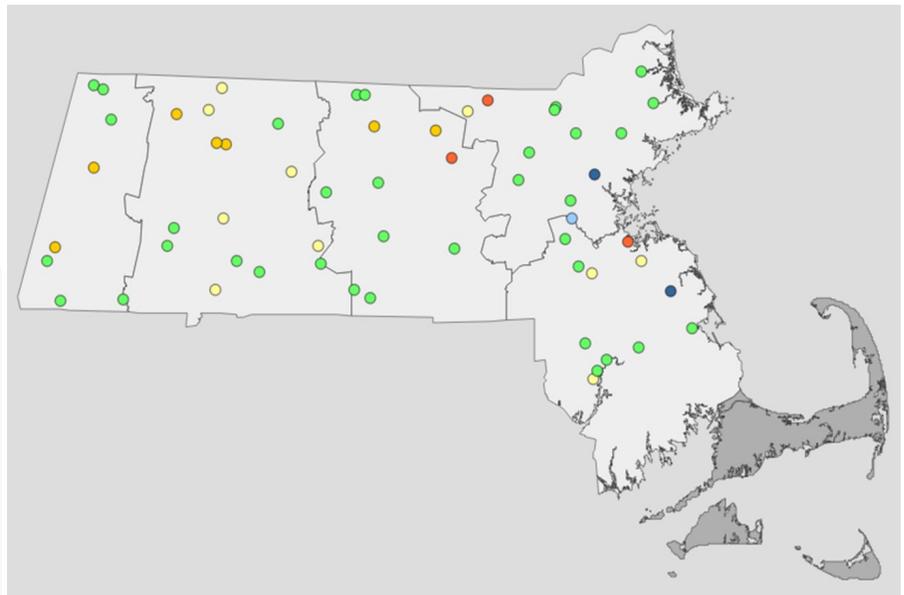
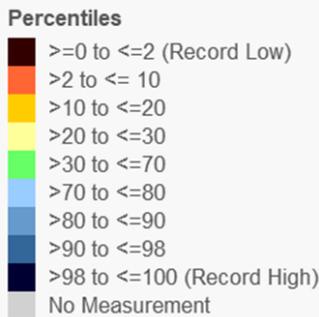


Last 45 Days



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

September Percentiles of Median Monthly Streamflows



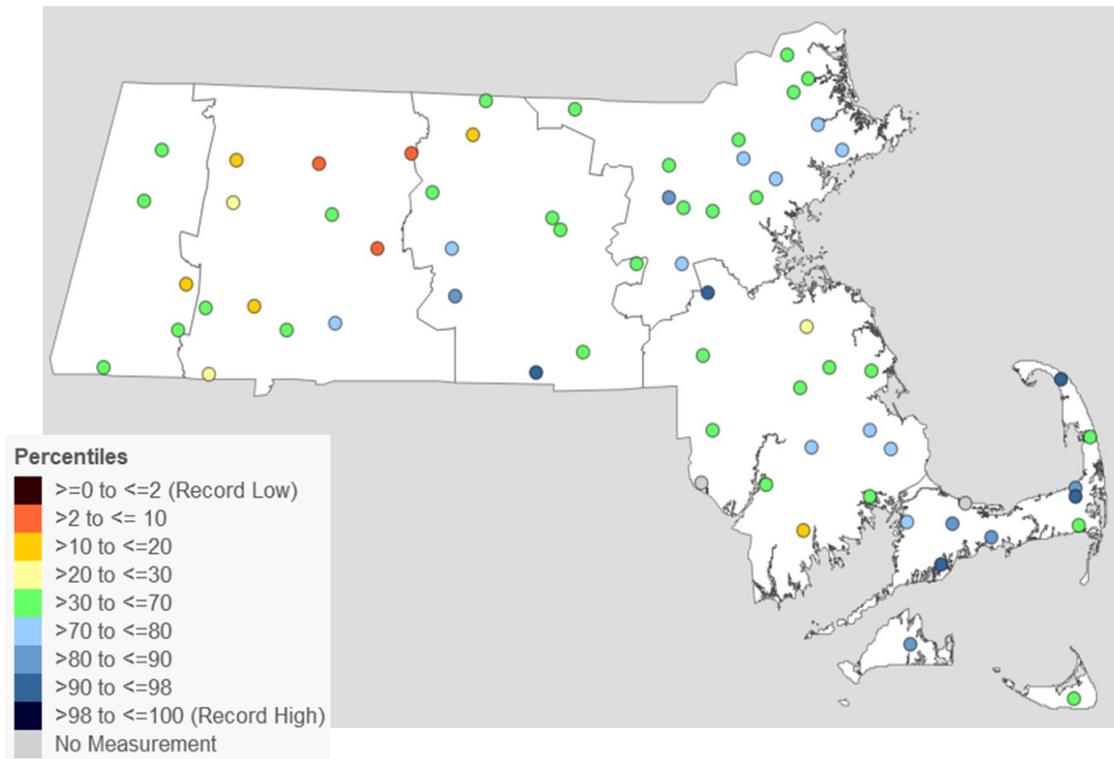
Region	Number of Gages			>90th percentile flow	MA Drought Plan Index Severity
	Total Reporting for September	Median Percentile of Gages	Record low		
Western	8	34	0	0	0
CT River Valley	15	26	0	0	1
Central	11	37	0	0	0
Northeast	13	45	0	1	0
Southeast	12	39	0	1	0

Notes: 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 CT River Valley region experienced below normal and normal groundwater levels, with a median percentile (<30th) that triggered Level 1 drought, while the rest of the state experienced mostly normal to well above normal levels.

Groundwater - Percentiles at the End of September



Region	Number of wells				MA Drought Plan Index Severity Level
	Total Reporting for	Median Percentile	Record low	> 90th percen-	
Western	5	41	0	0	0
CT River Valley	11	24	0	0	1
Central	10	58	0	1	0
Northeast	15	67	0	0	0
Southeast	13	58	0	1	0
Cape Cod	9	87	0	3	0
Islands	2	76	0	0	0

Notes: Not all data are available in time for reporting.

LAKES and IMPOUNDMENTS

At the end of September, more than half of reporting lakes and impoundments were at average to above average levels. Springfield's level, however, was below the 30th percentile (index severity level 1).

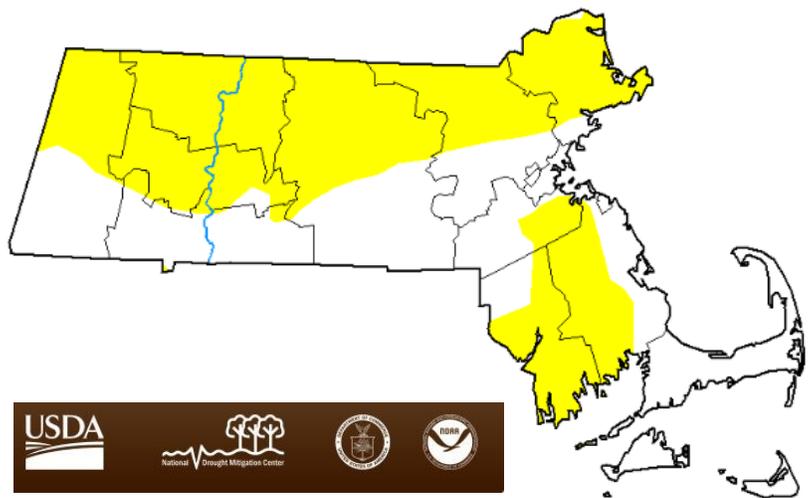
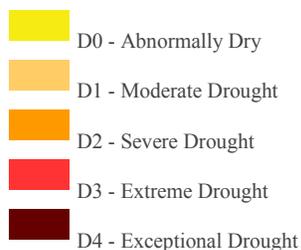
Region	Total Reporting for Sept	Lake/Impoundment Median Percentile of Levels	MA Drought Management Plan Lakes and Impoundments Index
Western	2	48	0
CT River Valley	2	32	0
Central	3	45	0
Northeast	8	61	0
Southeast	2	53	0
Cape Cod	1	76	0
Islands	N/A	N/A	N/A

DROUGHT CONDITIONS AND FORECASTS BY NOAA AND PARTNERS

U.S. Drought Monitor: Drought Conditions as of October 1, 2019

Summary: The USDM map shows much of MA as Abnormally Dry.

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

October: The outlook projects 33% -40% chance for above normal temperature for the western part of the state and equal chances for above normal, normal, or below normal for temperatures for the rest of the state; 33-40% chance for above average precipitation.

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

NOAA Climate Prediction Center: Monthly and Seasonal Drought Outlook

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

Appendix I: Additional Information

Keetch-Byram Drought Index (KBDI)

Six regions have reached an elevated level for the Drought Index. The DCR Fire Chief reports, however, that brief showers have kept fire danger low.

Region	KBDI value for end of September	Drought Index Severity
Western	443	2
CT River Valley	463, 459, 323	2
Central	332, 485	2
Northeast	465, 463, 497	2
Southeast	301, 303, 328	1
Cape Cod	203, 150	1
Islands	135, 27	0

Crop Moisture Index (CMI)

The CMI map for the week ending September 28, 2019 shows slightly dry to favorably moist conditions across the state, resulting in the Drought Index Severity Level being 0 for all regions.

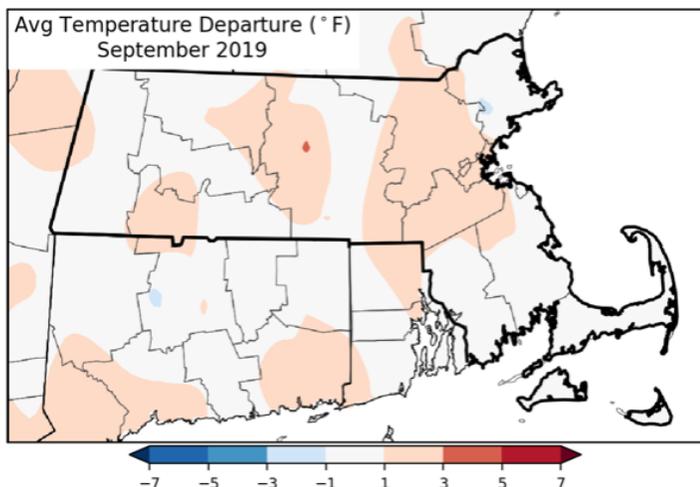
The CMI shows the short-term need versus available water in a shallow soil profile and responds quickly to changing conditions. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level. This indicator is most relevant during growing season. https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional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

Season-to-date Snowfall Departure and Snow Cover

Information provided seasonally.

Temperature

Monthly average temperatures ranged from average to slightly above average across the state for this time of the year. <http://www.nrcc.cornell.edu/regional/monthly/monthly.html>



Boston daily temperatures ranged from 50° F to 92° F. Deviation from historical daily average temperatures were -6 to +19° F, 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

September-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	3.80	2.07	54	-1.73	9.51	-2.07	73	-1.24	89	2.25	110	9.51	121
Western	4.10	3.05	74	-1.05	7.17	-1.33	84	-2.30	82	1.12	105	7.17	116
Connecticut River	3.96	2.17	55	-1.79	6.54	-2.09	74	-2.85	77	-0.60	97	6.54	114
Central	3.82	1.61	42	-2.21	8.79	-2.17	73	-0.76	94	3.24	114	8.79	119
Northeast	3.49	1.40	40	-2.09	9.67	-2.00	72	-0.20	98	3.42	116	9.67	122
Southeast	3.76	1.92	51	-1.84	12.67	-2.60	66	-0.85	92	3.12	114	12.67	128
Cape Cod and Islands	3.82	3.47	91	-0.35	12.96	-1.55	80	-0.65	94	3.19	115	12.96	128

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 September 2019

September 2019	Number	1-mos	2-mos	3-mos	6-mos	9-mos	12-mos	24-mos	36-mos
Drought Region		SPI1	SPI2	SPI3	SPI6	SPI9	SPI12	SPI24	SPI36
Cape Cod	5	0.22	-0.18	-0.12	0.68	0.56	1.08	0.95	1.07
Central	13	-1.15	-0.49	-0.1	0.5	0.31	0.87	1.47	1.21
Connecticut Riv-	10	-1.05	-0.55	-0.54	0.04	-0.01	0.62	1.31	0.76
Islands	4	-0.2	-0.42	-0.62	0.41	0.6	1.31	0.89	1.23
Northeast	13	-1.75	-0.56	-0.1	0.36	0.19	0.67	0.62	0.52
Southeast	19	-1.22	-0.88	-0.05	0.61	0.63	1.32	1.46	1.18
Western	6	-0.74	-0.87	-1.17	-0.49	-0.6	-0.15	0.38	0.28

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>

Key to Drought Plan Severity Levels	SPI Se-
0	>-0.52
1	≤ -0.52 and > -0.84
2	≤ -0.84 and > -1.28
3	≤ -1.28 and > -2.05
4	≤ -2.05

Appendix I: Additional Information, continued

A look back at the past Water Year 2019.

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

