

MASSACHUSETTS WATER RESOURCES COMMISSION
Hydrologic Conditions in Massachusetts
October 2016 Summary



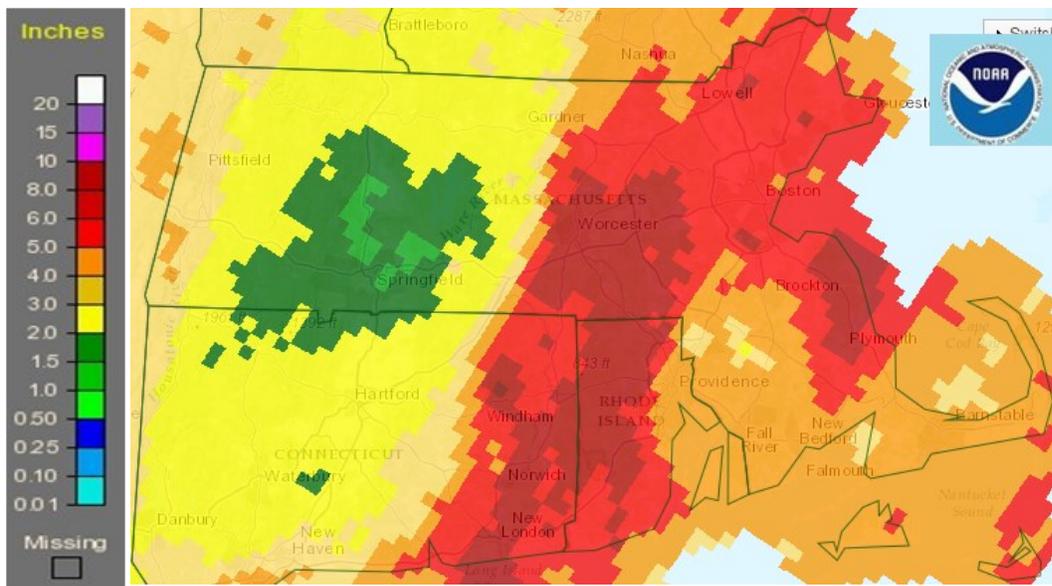
- October precipitation ranged from above normal in the East to below normal westward.
- October streamflows continued to be below normal and have been for 6 to 8 months.
- October groundwater levels were significantly below normal except on Cape Cod and the Islands. These conditions have persisted for 6 to 8 months. Although water levels have generally stopped declining, the percentiles comparing to previous Octobers are mostly the same or worse than in September since October is usually a wet month and groundwater is expected to begin recovering from the summer.
- October reservoir levels ranged from normal to two standard deviations below normal.
- Drought levels are triggered in all regions . 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 CONDITIONS

Region	Estimated Rainfall (inches)	Departure from Average October (inches)	MA Drought Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Western	3.2	-0.4	Normal	Normal
CT River Valley	2.9	-1.0	Advisory	Watch
Central	5.1	1.2	Advisory	Normal
Northeast	6.3	2.7	Advisory	Normal
Southeast	6.1	2.3	Normal	Normal
Cape Cod & Islands	6.2	2.3	Advisory	Normal

October 2016 Observed Precipitation

Map from the National Weather Service (NWS) Advanced Hydrologic Prediction Center (<http://water.weather.gov/precip/>)
 The map is generated based on radar data correlated to NWS rainfall gauge reports



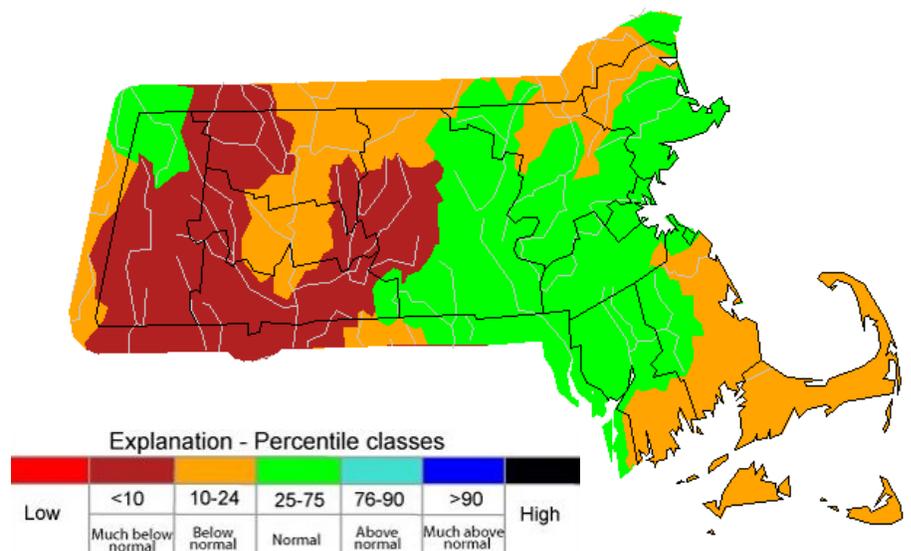
STREAMFLOW CONDITIONS

Region	Number of Gages	MA Drought Plan Index (# months majority below 25th percentile)	Number of gages below 10th percentile for Oct	Number of gages at Record Low for Oct
Western	7	6 of 7	3	0
CT River Valley	16	7 of 7	9	1
Central	16	8 of 8	6	1
Northeast	19	7 of 7	3	0
Southeast	5	7 of 7	2	0

Note: Streamflow conditions for individual streamflow-gaging stations may differ from general conditions. Streamflow index is not applied to Cape Cod and the Islands

Monthly Streamflow Compared to Historical Streamflow 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>

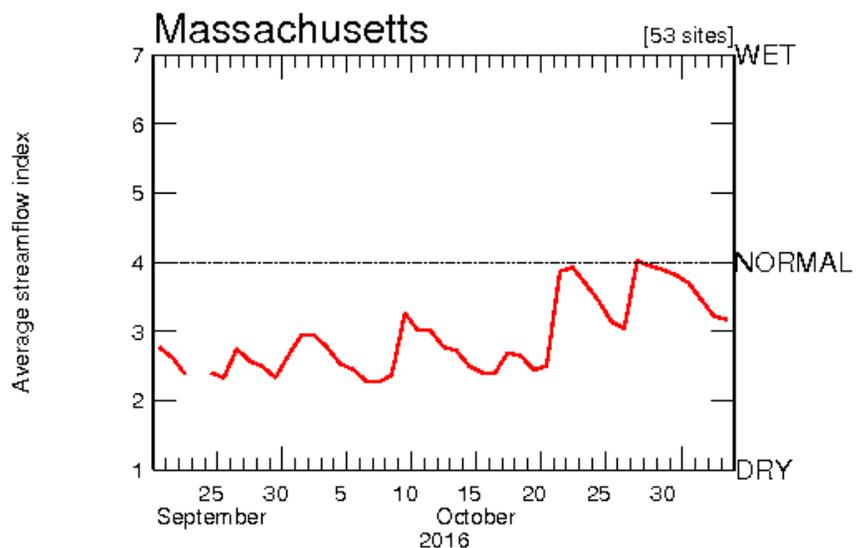


Daily Streamflow Compared to Historical Streamflow for the Day of the Year

This plot depicts data for the 45-day period ending November 4. 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



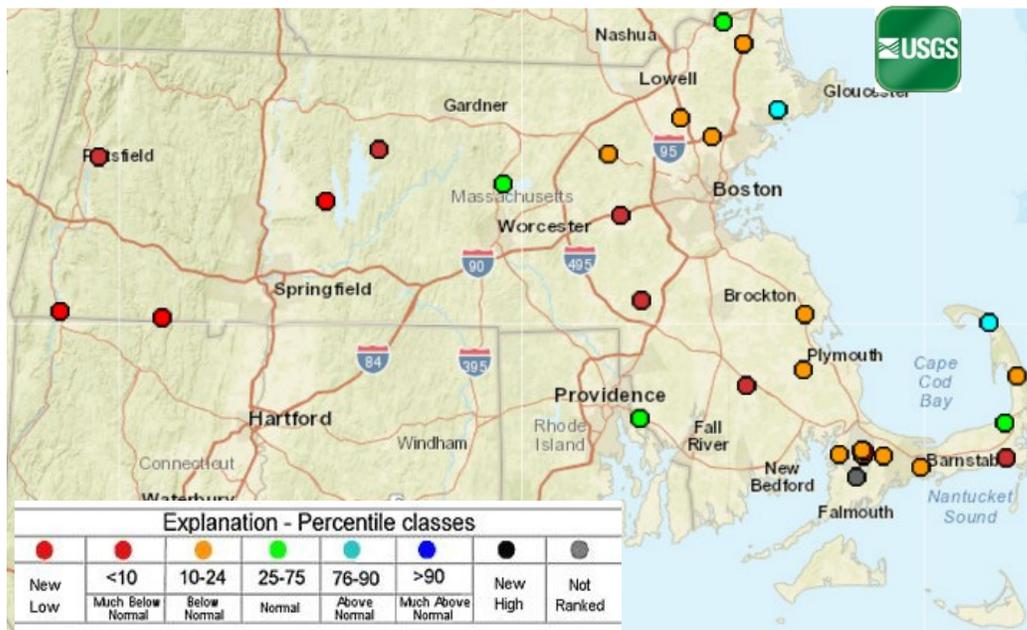
GROUNDWATER LEVELS

Region	Number of wells	MA Drought Plan Index (# consecutive months majority below 25 th percentile)	Number of wells below 10 th percentile for Oct	Number of wells at Record Low for Oct
Western	5	8	3	1
CT River Valley	11	7	1	9
Central	10	7	2	1
Northeast	17	7	3	2
Southeast	12	6	5	0
Cape and Islands	13	0	1	0

Note: Groundwater levels at individual wells may differ from general conditions for a region.

Groundwater Conditions at Real-Time Sites on November 4, 2016

from USGS <http://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=rtn&sc=25>



RESERVOIR LEVELS

Region	Reservoir Levels	MA Drought Plan Reservoir Index
Western	Normal	Watch
CT River Valley	Normal	Watch
Central	Below	Watch
Northeast	Below*	Warning
Southeast	Below	Watch
Cape Cod & Islands	Normal	Normal

*Two medium reservoirs are 2 standard deviations below normal

NWS/NOAA DROUGHT OUTLOOK AND FORECAST

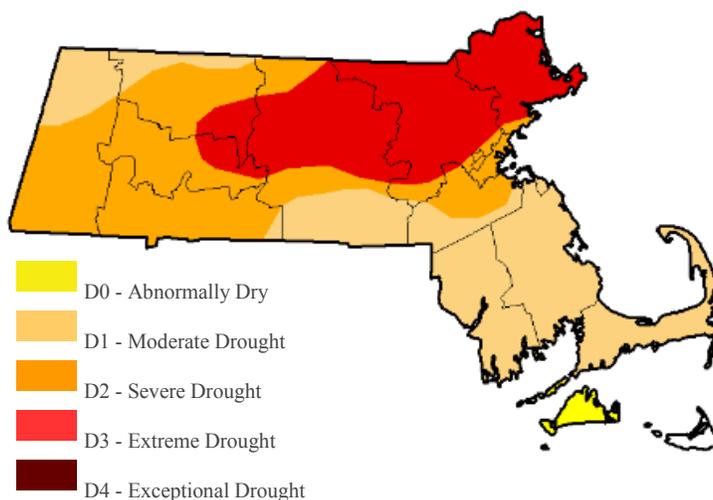
U.S. Drought Monitor: Massachusetts, November 1, 2016

Summary: As of November 1, 2016, the U.S. Drought Monitor shows that 98 percent of Massachusetts is a drought with 63 percent in a severe or extreme drought.

Produced by the National Drought Mitigation Center (NDMC). Intensity based on NDMC criteria.

For updated map see:

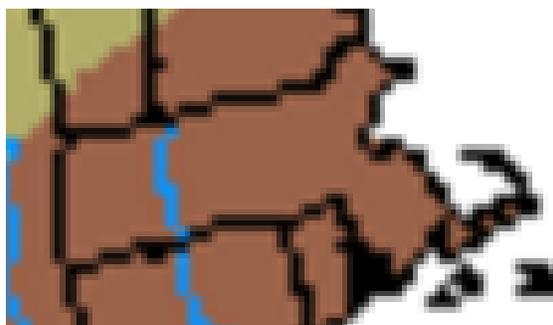
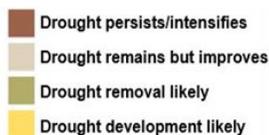
<http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?MA>



U.S. Seasonal Drought Outlook: Drought Tendency During October 20, 2016 - January 31, 2017

The Outlook projects drought persistence and/or intensification in Massachusetts.

http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php



NOAA National Weather Service Climate Prediction Center

The Climate Prediction Center 6-10 day Outlook for November 12 to 16 indicates a 40 percent chance of temperatures below normal and likely normal precipitation (i.e., equal chance of above normal, normal and below normal) for Massachusetts (<http://www.cpc.noaa.gov/products/predictions/610day/>).

The Center's three-month outlook (November through January) shows a 40 percent probability of above normal temperatures and likely normal precipitation (i.e., equal chances for above normal, normal and above normal) (http://www.cpc.noaa.gov/products/predictions/long_range/seasonal.php?lead=1). More information is available at (<http://www.cpc.noaa.gov/index.php>).

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

<http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/rainfall-program.html>

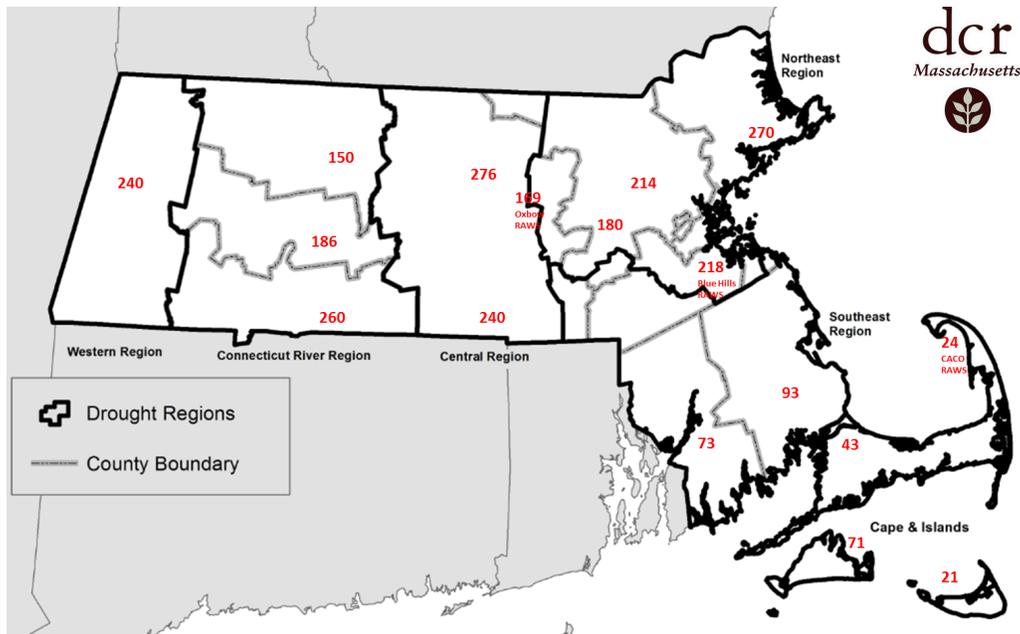
This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary in nature. Additional information, previous hydrological conditions reports, and drought management information can be found on our web site:

<http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/>

Appendix I: Additional Information

Keetch-Byram Drought Index by DCR Forest Fire Control Districts as of November 4, 2016

Region	MA Drought Plan Index
Western	Advisory
CT River Valley	Advisory
Central	Advisory
Northeast	Advisory
Southeast	Normal
Cape and Islands	Normal



Crop Moisture Index for the Week Ending October 29, 2016

The Crop Moisture Index shows the short-term need versus available water in a shallow soil profile.
 (http://www.cpc.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif)

Region	MA Drought Plan Index
Western	Normal
CT River Valley	Normal
Central	Normal
Northeast	Normal
Southeast	Normal
Cape and Islands	Normal



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.