MASSACHUSETTS WATER RESOURCES COMMISSION

AUGUST
2022

HYDROLOGIC CONDITIONS IN MASSACHUSETTS

The Commonwealth of Massachusetts
Charles D. Baker, Governor
Bethany A. Card, Secretary, Executive Office of Energy and Environmental Affairs

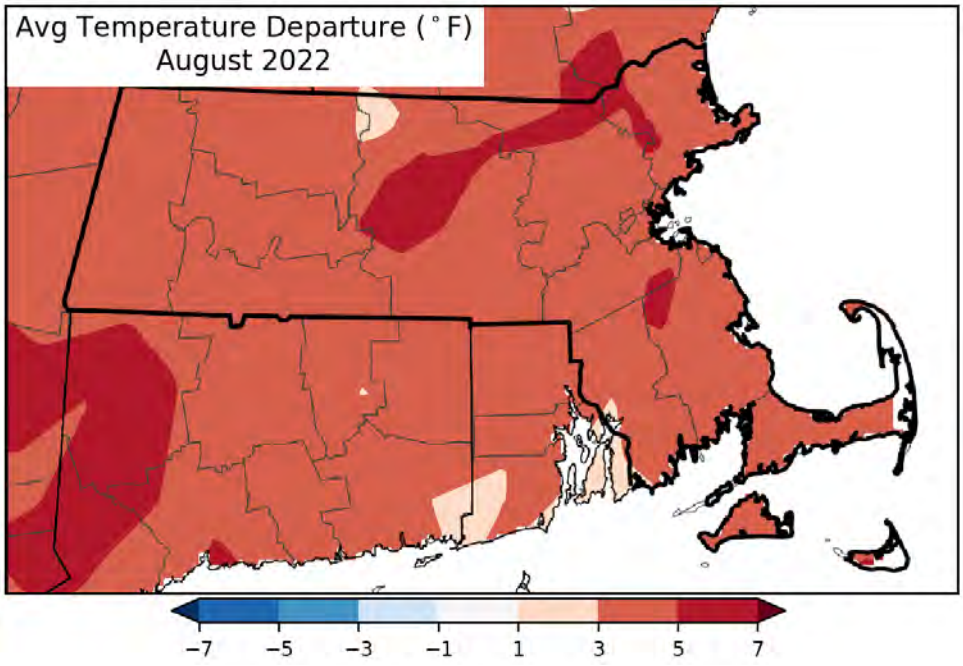
AUGUST 2022 HYDROLOGIC CONDITIONS

SUMMARY OF CONDITIONS

- Monthly average temperatures were above normal.
- Precipitation varied across the state. The Western and Northeast Regions, parts of Cape Cod, and along the northern state border were below normal while parts of the Southeast Region were above normal. Index Severity Levels (ISLs) remain elevated at all look-back periods for all Regions except for the 1-month look-back period for the Southeast Region.
- Streamflow was significantly below normal. This month has the lowest streamflows yet during this drought. All Regions are at ISL 3 or 4.
- Groundwater levels this month were the lowest yet during this drought with most monitored wells in the below-normal range across the state. All Regions are at elevated ISLs ranging from Level 1 to Level 3.
- Lake and impoundment levels varied across the state with most levels below their 30th percentile. All Regions are at an elevated Index Severity Levels.
- The Keetch-Byram Drought Index was elevated across the state with all Regions at an ISL of 2 or 3.
- The Evaporative Demand Drought Index for August was elevated for most of the state.
- NOAA's September outlook shows chances leaning for above-normal temperatures and chances leaning for below-normal precipitation.
- NOAA's 3-month outlook shows likely chances for above-normal temperatures and equal chances for below -normal, normal, or above-normal precipitation.
- Appendix II provides information on the Massachusetts Drought Management Plan (DMP).

TEMPERATURE

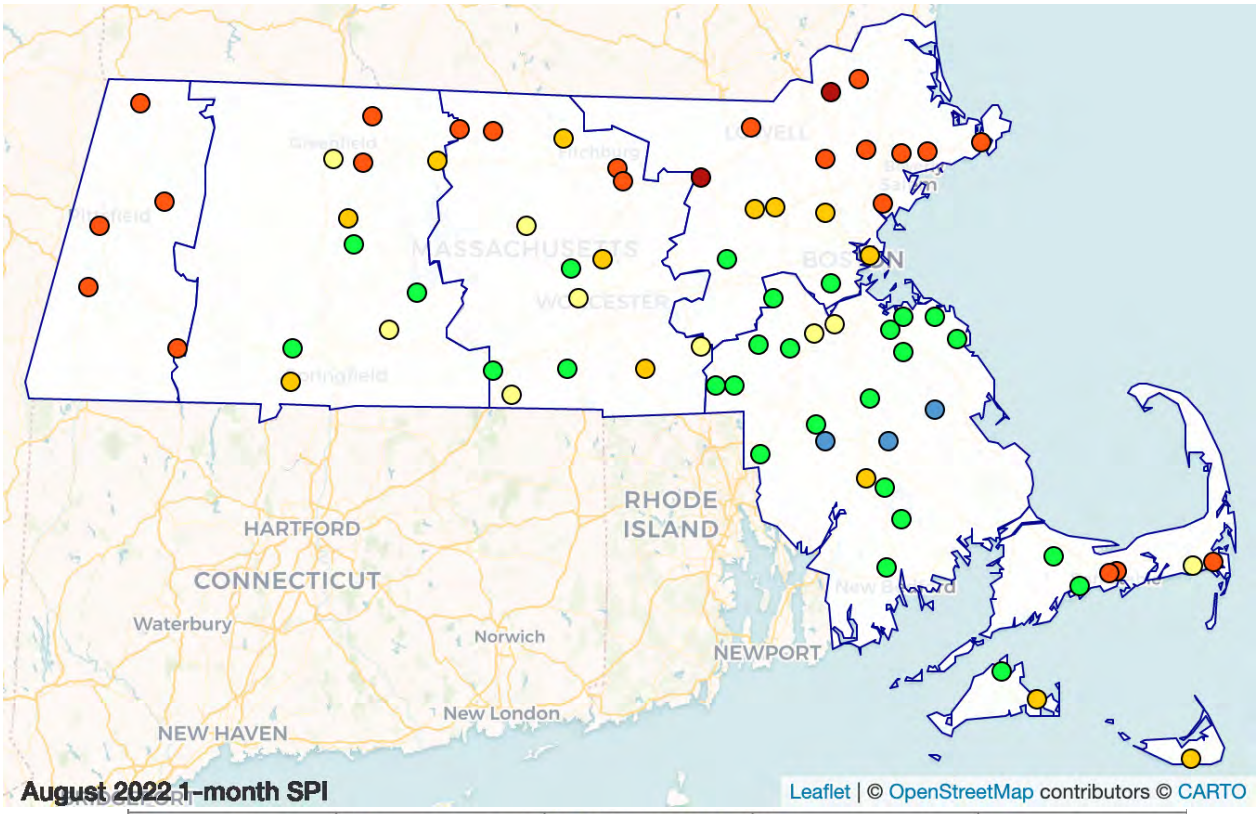
Monthly average temperatures were above normal across most of the state. According to the Northeast Regional Climate Center, the Boston climate site had its 3rd warmest August averaging 4.0°F above normal. The Worcester climate site had its warmest August and 8th warmest month over all months, averaging 4.5°F above normal. Boston had 11 days with a high of 90°F or above, the most for the month of August and 9th overall. Boston had its 4th warmest summer and Worcester had its 6th warmest with June-August average temperatures 2.4°F and 2.5°F above normal respectively. http://www.nrcc.cornell.edu/regional/monthly/monthly.html



PRECIPITATION

August precipitation varied significantly across the state. Most stations in the Western and Northeast Regions, parts of Cape Cod, and along the northern border received rain in the 0-10th percentile range. In contrast, parts of the Southeast Region received rain in the 70-80th percentile range. The remainder of the state was a scattered mix of normal to below normal precipitation. Index Severity Levels remain elevated at all look-back periods for all Regions except for the 1-month look-back period back for the Southeast Region. In addition to the table below, Appendix I provides all look-back periods.

Standardized Precipitation Index (SPI) as a Percentile



≥0 to ≤2	>2 to ≤10	>10 to ≤20	>20 to ≤30	>30 to ≤70
>70 to ≤80	>80 to ≤90	>90 to ≤98	>98 to ≤100	

REGION	NUMBER OF SITES REPORTING	AUGUST MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	5	1.69	-2.56	7	7	17
CTRV	10	2.41	-1.57	21	8	14
CENTRAL	14	2.12	-1.88	20	11	9
NORTHEAST	16	1.45	-2.05	10	6	3
SOUTHEAST	22	3.80	-0.12	53	24	7
CAPE COD	6	1.64	-1.81	18	15	8
ISLANDS	3	2.07	-1.53	20	29	15

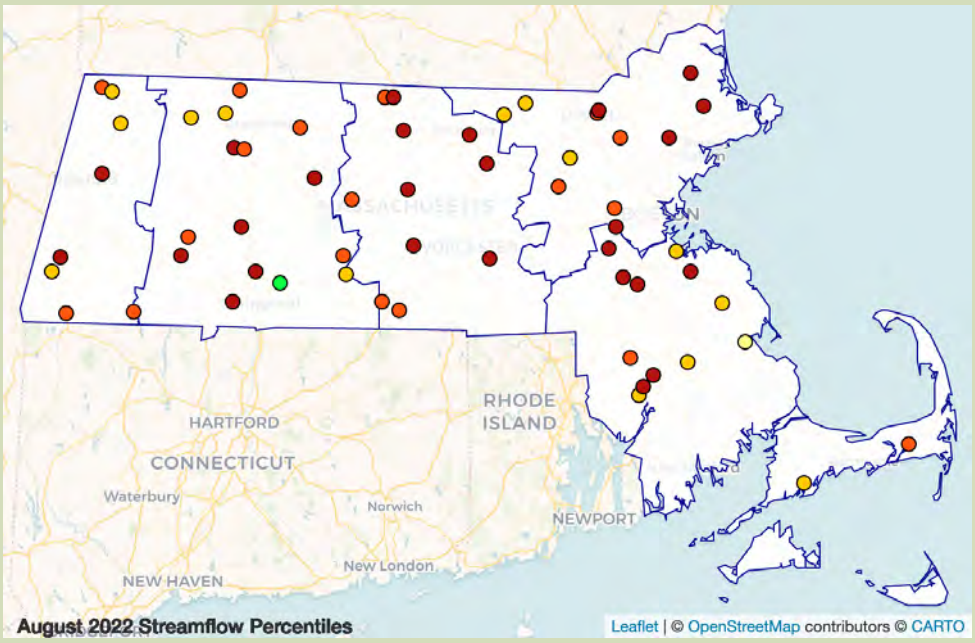
SPI is the Standardized Precipitation Index used in the Drought Management Plan (DMP) expressed here as a percentile and represents the variation, in standard deviations, from long-term precipitation averages.

DMP Index Severity Levels			
1	2	3	4

STREAMFLOW

During August, percentiles of individual streamflow gages were significantly below normal with record low values at numerous gages across the state. This month is the lowest streamflows yet during this drought. For about a week during the second half of August, approximately 30 percent of gages were at record low and over 90 percent of gages below normal. All Regions are at Index Severity Level 3 or 4.

Median Monthly Streamflow Percentiles Compared to Historical Values



≥0 to ≤2	>2 to ≤10	>10 to ≤20	>20 to ≤30	>30 to ≤70
>70 to ≤80	>80 to ≤90	>90 to ≤98	>98 to ≤100	

REGION	NUMBER OF GAGES REPORTING	≥0 TO ≤2 PERCENTILE	>2 TO ≤10 PERCENTILE	>10 TO ≤20 PERCENTILE	>20 TO ≤30 PERCENTILE	>90 PERCENTILE	MEDIAN OF INDIVIDUAL GAGE PERCENTILES
WESTERN	8	2	3	3	0	0	7
CTRV	15	6	5	3	0	0	4
CENTRAL	11	7	4	0	0	0	1
NORTHEAST	12	5	4	3	0	0	4
SOUTHEAST	12	6	1	4	1	0	2
CAPE COD	2	0	1	1	0	0	7

Note: Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to the Islands.

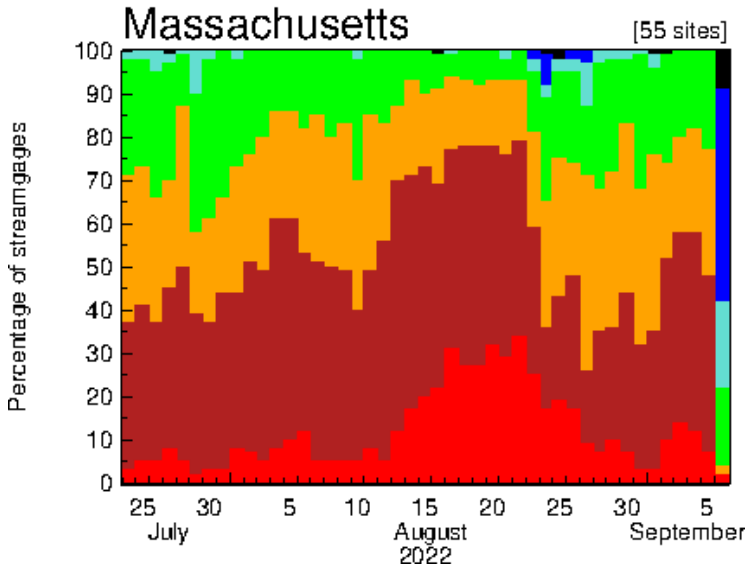
DMP Index Severity Levels			
1	2	3	4

Time Series of the Percent of Gages at Their Respective Percentile Flows for Average Daily Streamflows Compared to Historical Values

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

https://waterdata.usgs.gov/nwis/sw

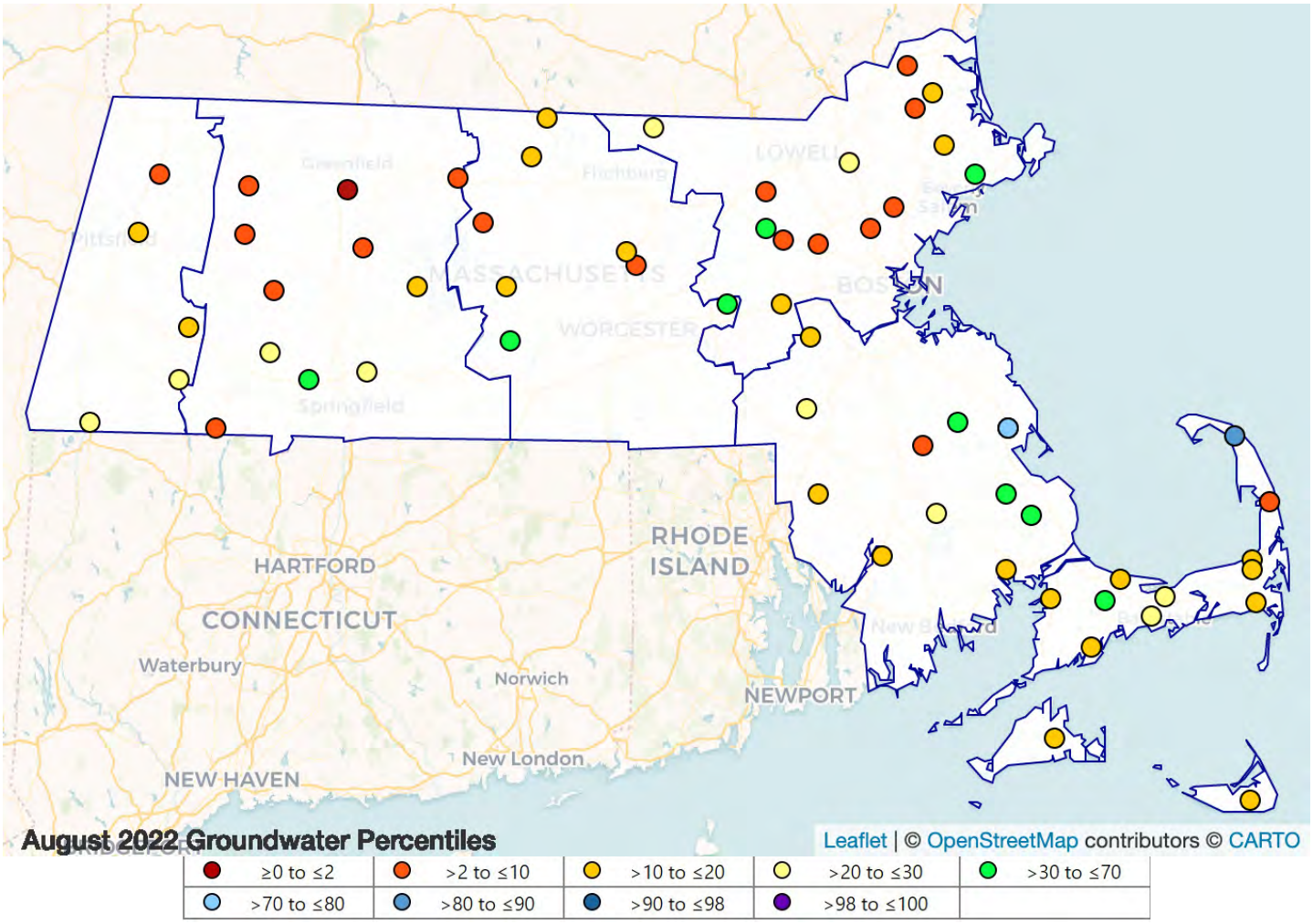
Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		



GROUNDWATER

While August groundwater levels ranged from near record low to above normal, most percentiles of individual groundwater wells were below normal. This month is the lowest groundwater levels yet during this drought. All Regions are at elevated Index Severity Levels ranging from level 1 to level 3.

End of Month Groundwater Compared to Historical in the Climate Response Network



REGION	NUMBER OF WELLS REPORTING	≥0 TO ≤2 PERCENTILE	>2 TO ≤10 PERCENTILE	>10 TO ≤20 PERCENTILE	>20 TO ≤30 PERCENTILE	>90 PERCENTILE	MEDIAN OF INDIVIDUAL WELL PERCENTILES
WESTERN	5	0	1	2	2	0	15
CTRV	11	1	6	1	2	0	5
CENTRAL	8	0	2	4	0	0	15
NORTHEAST	14	0	7	3	2	0	10
SOUTHEAST	12	0	1	4	2	0	27
CAPE COD	11	0	1	6	2	0	19
ISLANDS	2	0	0	2	0	0	16

DMP Index Severity Levels			
1	2	3	4

LAKES AND IMPOUNDMENTS

REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	19th
CTRV	2	16th
CENTRAL	6	24th
NORTHEAST	6	9th
SOUTHEAST	2	22nd
CAPE COD	1	25th

DMP Index Severity Levels do not necessarily reflect water supply status.

At the end of August, lake and impoundment levels varied across the state with most levels below their 30th percentile. All Regions are at an elevated Index Severity Levels.

DMP Index Severity Levels			
1	2	3	4

REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	3	528
CTRV	6	493
CENTRAL	6	692
NORTHEAST	5	692
SOUTHEAST	8	609
CAPE COD	4	561
ISLANDS	2	503

KEETCH-BYRAM DROUGHT INDEX (KBDI)

At the end of August, KBDI values were elevated across the State. All Regions are at an elevated Index Severity Level of either 2 or 3.

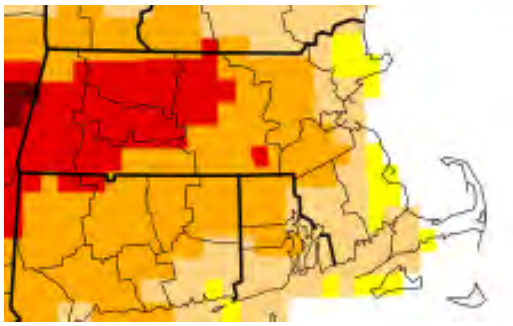
EVAPOTRANSPIRATION (ET) INDEX

Crop Moisture Index (CMI) - 2019 Drought Management Plan

At the end of August CMI values were in the Abnormally Dry range across the state. All Regions are at Index Severity Level 1.
https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

Evaporative Demand Drought Index (EDDI) - proposed 2022 Drought Management Plan

The 1-month EDDI shows elevated ET across most of the state.

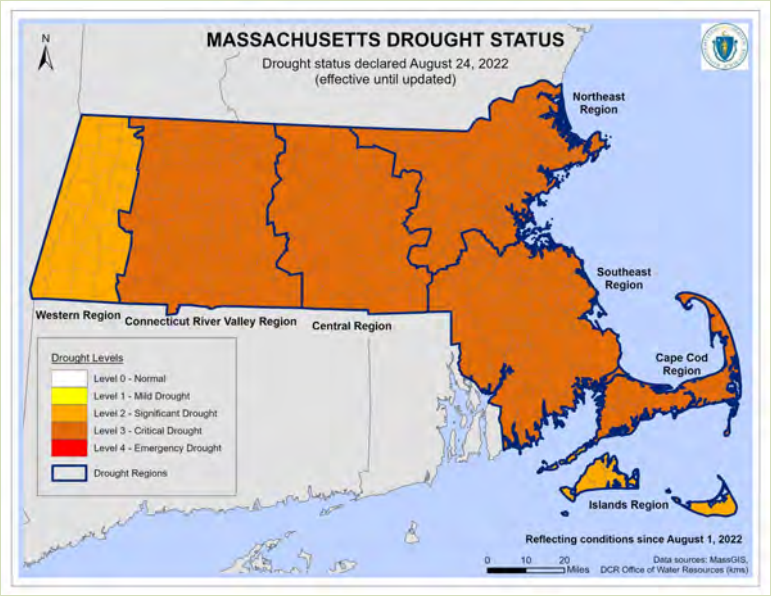


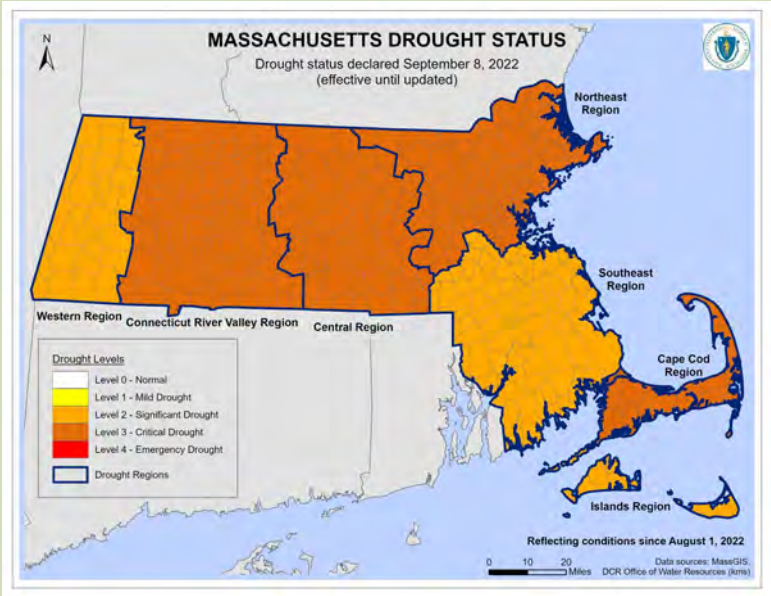
Map dated August 29th

SNOWFALL

Reported seasonally.

DROUGHT CONDITIONS AND FORECASTS





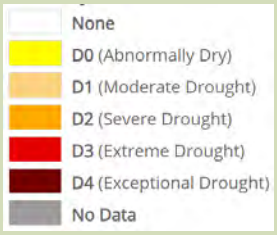
Massachusetts Drought Status

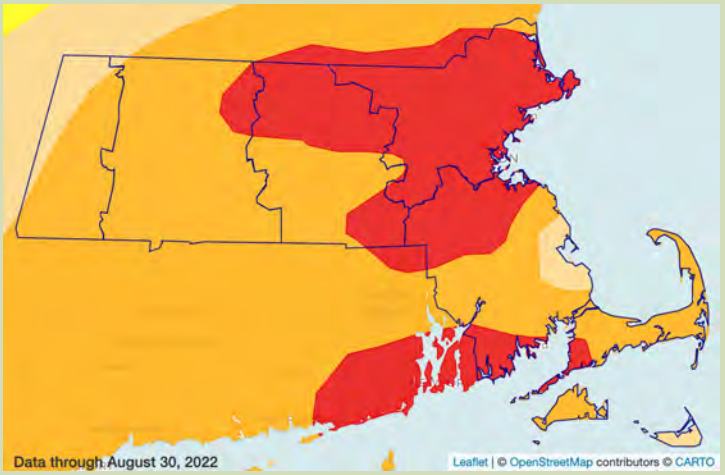
The MA Drought Management Task Force met twice to consider conditions during the month of August. The drought conditions declared by Massachusetts Energy and Environmental Affairs Secretary Bethany A. Card after each meeting are depicted in the maps above. The latest, September 8th, status remains in effect until further updates.

U.S. Drought Monitor (USDM)

At the end of August, the USDM showed areas of D1, D2, and D3 drought conditions in Massachusetts. These are equivalent to Massachusetts Drought Levels 2 and 3.

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





NOAA Climate Prediction Center

Temperature and Precipitation Outlook

September: The outlook issued 8/31 shows a 40-50% chance of above-normal temperatures. For precipitation, there is a 33-40% chance of below-normal precipitation.

September through November: The outlook issued 8/18 shows a 50-60% chance of above-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation. https://www.cpc.ncep.noaa.gov/

Monthly and Seasonal Drought Outlook

The monthly outlook for September released on 8/31 shows drought persisting across the state. The seasonal outlook for September through November issued on 8/31 shows drought persisting across the state.
http://www.cpc.ncep.noaa.gov/products/Drought

NOAA 2022 Hurricane Season Updated Outlook from August 4th forecasts that an above-average season is still likely for the Atlantic.

https://www.cpc.ncep.noaa.gov/products/outlooks/hurricane.shtml
https://www.noaa.gov/news-release/noaa-still-expects-above-normal-atlantic-hurricane-season

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 9/07/2022. Additional information, previous reports, and the Massachusetts Drought Dashboard with weekly updates to the drought indices can be found at: https://www.mass.gov/drought-monitoring

APPENDIX I – ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index—August 2022 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	5	7	14	7	17	21	53	78	69
CTRV	10	21	17	8	14	13	31	71	56
CENTRAL	14	20	21	11	9	20	44	71	69
NORTHEAST	16	10	3	6	3	5	24	73	68
SOUTHEAST	22	53	18	24	7	8	32	61	54
CAPE COD	6	18	2	15	8	11	64	46	26
ISLANDS	3	20	20	29	15	11	17	22	27

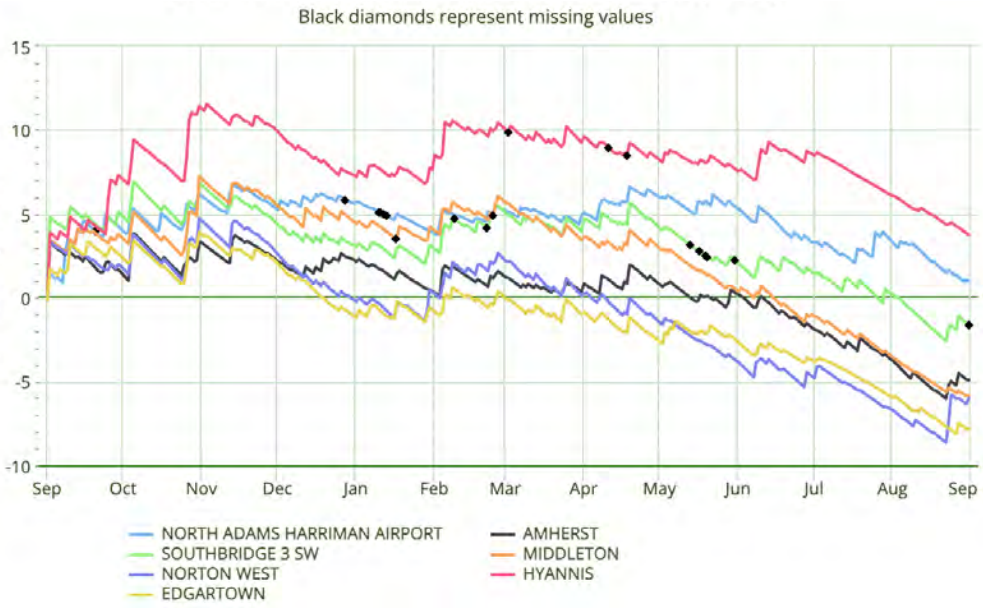
DMP Index Severity Levels			
1	2	3	4

Percent of Average Historical Precipitation—August 2022

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	AUGUST AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	5	4.25	1.69	-2.56	40%
CTRV	10	3.98	2.41	-1.57	61%
CENTRAL	14	4.00	2.12	-1.88	53%
NORTHEAST	16	3.50	1.45	-2.05	41%
SOUTHEAST	22	3.92	3.80	-0.12	97%
CAPE COD	6	3.45	1.64	-1.81	48%
ISLANDS	3	3.60	2.07	-1.53	57%

Accumulated Precipitation Departure from 30-Year Normals in Inches

Graph does not consider starting condition's wetness/dryness; does not show summer heat waves with high evapotranspiration; and shows only one station per Drought Region. https://xmacis.rcc-acis.org/



APPENDIX II – DROUGHT MANAGEMENT PLAN INFORMATION

The Massachusetts Drought Management Plan (DMP) can be found at https://www.mass.gov/doc/massachusetts-drought-management-plan/download. The document provides details on the Drought Indices, how Drought Levels are determined, and actions associated with each drought level.

Drought Levels (Section 3.1 of the DMP)

Level 0 Normal

Level 1 Mild Drought

Level 2 Significant Drought

Level 3 Critical Drought

Level 4 Emergency Drought

Index Severity Levels (Section 3.4 of the DMP)

SEVERITY LEVEL	STANDARDIZED PRECIPITATION INDEX (SPI)	STREAMFLOW	LAKES AND IMPOUNDMENTS	GROUNDWATER	KEETCH-BRYAM DROUGHT INDEX (KBDI)	CROP MOISTURE INDEX
0	> 30th percentile				< 200	> -1.0
1	≤ 30 and > 20				200-400	≤ -1.0 and > -2.0
2	≤ 20 and > 10				400-600	≤ -2.0 and > -3.0
3	≤ 10 and > 2				600-700	≤ -3.0 and > -4.0
4	≤ 2				700-800	≤ -4.0